Original Research Article

Causal Linkage amongst Public Expenditure on Health, Health Status and Growth: New Empirical Evidence from Toda-Yamamoto Approach for Nigeria.

Abstract

This study investigates the causal linkages amongst public expenditure on health, health status and economic growth in Nigeria using the Toda-Yamamoto technique. The choice of the Toda-Yamamoto approach is predicated on its simplicity and the ability to overcome the shortcomings inherent in the conventional causality procedures by producing more robust results through the estimation of the augmented VAR that guarantees the asymptotic distribution of the Wald statistic. To this end, the study collected annual time series data from the Central Bank of Nigeria's Statistical bulletin and the World Development Indicator on public expenditure on health, life expectancy, infant mortality and real gross domestic product spanning 38 years from 1981 to 2018. The result of the study's empirical analysis based on the co-integration test indicates that public health expenditure, health status and economic growth have long-run association. Further, the Toda-Yamamoto causality test result reveals the absence of causality between health expenditure and health status. Similarly, health status and economic growth are not causally interdependent. On the basis of the findings, the paper vehemently concluded that efforts to stimulate economic growth by targeting health outcomes improvement through public expenditure will be futile. As such, the need to develop better national health policy and programmes that are capable of resolving the fundamental problems in the sector and integrate it into the mainstream of the Nigerian economy cannot be overemphasized.

1. Introduction

The role of health in economic growth and its relationship with public expenditure on health has continued to pre-occupy the minds of researchers and policymakers in developed and emerging market economies alike. However, less attention is paid to health related issues in the latter because of poor knowledge of the importance of health not only for personal welfare but for sustained national prosperity. Health is said to be wealth to both individuals and nationals at large. This stems from the fact that healthy persons are more efficient in contributing to labour productivity which cumulatively forms the national output. However, unhealthy persons are identified to constitute clogs in the wheels of national prosperity

through inefficiencies in production, increase dependency ratio, and crowding out public expenditure from developmental to non-developmental supports services for their welfare.

In furtherance to the importance of health for national growth and development, the developed economies expend more resources on health than their developing counterparts, thus, over 50 percent of their prosperity differentials in terms of economic growth and development is attributed to higher health expenditure by the World Health Organisation (Maduka, Madichie & Ekesiobi, 2016). The mechanism through which health expenditure impacts on growth flows from higher public health expenditure resulting in better healthcare services, increased demand for healthcare due to affordability, high life expectancy, improved productivity, better skills, education and in sum, human capital development which translates into higher income earning, rising consumption and investment, thus, culminating in higher aggregate demand (economic growth). The truism of the pass-through-channels of health expenditure on growth has continued to attract scholarly debates from both empirical and theoretical angles. The flurry of empirical literature on these phenomena of investigation has left policymakers with more doubtful than clarified based on high level of inconsistency and disagreements in empirical evidences.

In Nigeria, where public expenditure on health is grossly inadequate; 3.95 percent of total budget in 2018 (NBS, 2018), poor health outcomes are crystal obvious. For instance, health facilities are inappropriate and deficient, health workers are limited and unmotivated, the sector is bedeviled by incessant industrial actions, healthcare accessibility constrained by high cost, and quality of healthcare service compromised through corruption and lack of professionalism. The consequences of these are high infant mortality rate of 66.12 per 1000 in 2018 (WDI, 2018), increasing cases of life style related illnesses like cancer, hepatitis and HIV/AIDS, life expectancy of 54 years which unfortunately is the lowest amongst West African countries (WDI, 2018), reduction in health sector contribution to national output of less 1 percent in 2018 (NBS, 2018), high illiteracy rate of 40.4 percent in 2018, which is one of the highest in Africa (WDI, 2018) and crawling economic growth rate of 0.8 percent in 2018 which is less than impressive when compared with Senegal's 6.8 percent and 10.2 percent economic growth rate in Ethiopia. The above vital statistics reveals the level of health destitution in Nigeria.

However, in the face of these enormous problems stated above, and despite the plethora of studies on health expenditure, health outcomes and growth in Nigeria, a preponderance of these studies (Amakom, 2016; Edeme, Emecheta, & Omeje, 2017; Matthew, Adegboye, & Fasina, 2015; Nwani, Kelani, Ozegbe, & Babatunde, 2018; Nwanosike, Orji, Okafor, & Umesiobi, 2015) focused on impacts rather than causality. Again, a few studies (Chaabouni, Zghidi, & Mbarek, 2016) that investigated the causal links amongst these constructs employed the traditional causality tests with obvious shortcomings such as lack

of robust results when applied to differently integrated series. However, only Maduka et al., (2016) employed the Toda-Yamamoto approach in analyzing health expenditure, health outcomes and economic growth in Nigeria, but their work which covers 1970 – 2013 is of little or no relevance from policy options in current times due to the limited scope. The findings of their study call for new empirical investigation with updated scope. Thus, this study re-examines the nexus amongst public expenditure on health, health status and economic growth in Nigeria between 1981 and 2018 using the Toda-Yamamoto causality approach with the objective of ascertaining the direction of causality amongst the phenomena of interest and further determines if public health expenditure and health status are capable of stimulating economic growth. This article further departs from the study of Maduka et al. (2016) in these other ways; incorporating infant mortality rate as one of the indicators of health status: estimating both causality and effects: adopting the variance decomposition, AR inverse root stability test and Impulse response analysis. These enhance the uniqueness, robustness and scholarly contribution to existing knowledge in the nascent field of Health Economics. It also adds to the paucity of literature by enormously contributing to the debates in this research space and there is no gain saying that the findings of this study produce policy options relevant to government and international health agencies.

Following this introductory section, section 2 contains stylized facts; section 3 is literature review, and section 4 details out the methodology of the study. Empirical analysis and discussion of results are the focal points of section 5, while the study is concluded in section 6 with policy options and future research needs.

2. Stylized Facts

Healthcare services in Nigeria fit into the category of merit good due to the fact that these services are produced and supplied by private and public participants. The private participants include NGOs, private profit oriented healthcare providers, community-based organization and religious and traditional healthcare suppliers, while public sector participants include the federal, state and local government. There three levels of public health care provision in Nigeria. Following Nwani et al. (2018), the first is at primary level. This entails healthcare services produced at the health centres and clinics basically established by local government. Their services are the closest to the people and focuses on preventive, curative, primitive and pre-referral cases. Medical personnel that provide such services are nurses, community health officers, community health extension workers. At secondary level, we have general hospitals to provide medical, laboratory and specialized health services, such as, surgery, obstetrics, pediatrics, and gynecology (Nwani et al., 2018) usually established by the federal and state governments. At this level, we have doctors, nurses, midwives, laboratory scientists and pharmacists who man

specialized services and render higher quality healthcare services. Relatively, their services are less affordable when compared to those of the primary healthcare. The third category is the tertiary level of healthcare supply which is the height of healthcare production in the country. The specialist hospitals such as the National Orthopedic hospitals, Teaching hospitals, and Federal medical centres dominate the tertiary level of health provision. Though their services are more professional, accessibility is limited due to high cost of services.

Table 1
Contribution of Health Sector to RGDP in Nigeria

Year	HS	RGDP	HS:GDP
1981	110.6977	15258	0.725505
1982	110.6977	14985.08	0.738719
1991	110.6977	19199.06	0.576579
2001	110.6977	25267.54	0.438102
2017	110.6977	68490.98	0.161624
2018	110.6977	69810	0.15857

Source: Central Bank of Nigeria, 2018

The contribution of health sector in Nigeria is summarized in Table 1. The figures obtained from the Central Bank of Nigeria indicate a static health sector for Nigeria. This is evidenced in its constant absolute value in GDP that stood at ₦110.69 billion over time. As RGDP increases, the health sector's contribution declines asymptotically, thus, indicating inadequate attention to the sector. The trend in the proportion of health sector in GDP for Nigeria is presented in Figure 1 from 1981 to 2018. Obviously, there is s downward sloping trend, which implies declining relevance of health in Nigerian economy.

Figure 1: Trend in Nigerian Health Sector contribution to the economy

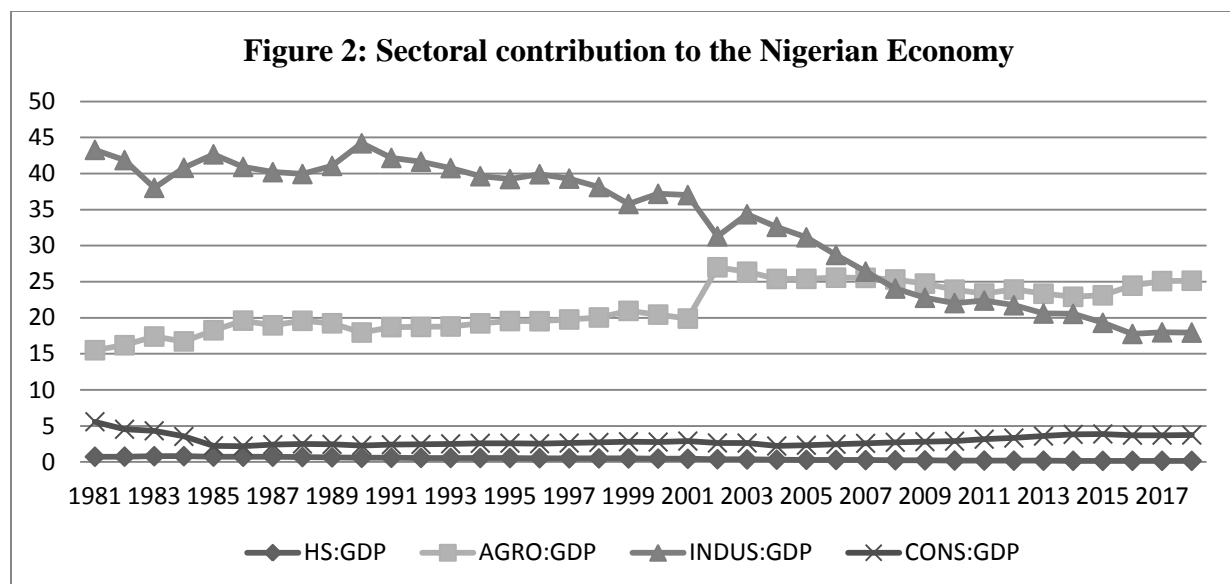**Figure 2: Sectoral contribution to the Nigerian Economy**
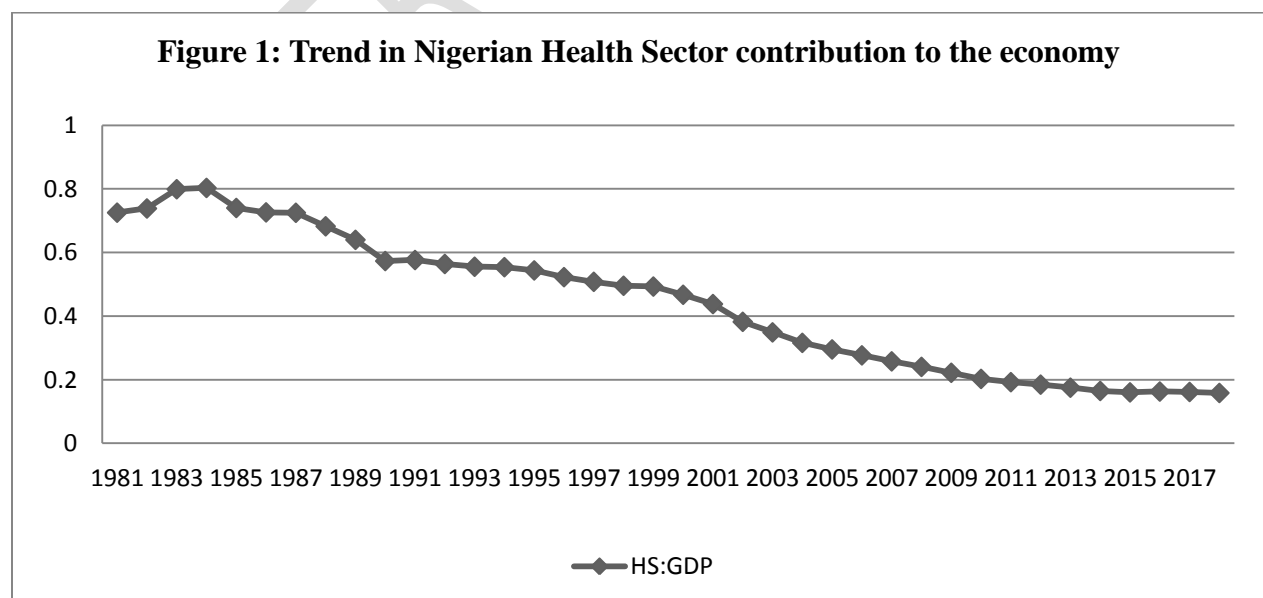
Figure 2 reveals interesting facts about the relevance of health in the country. For instance, it could deduce that at all times, the health sector has been the least performing sector in terms of its size in Nigerian economy. Its annual contribution to GDP has been less than 1 percent. The highest it recorded was 0.8 percent in 1984; thereafter its woeful performance has been consistent. Further, the construction sector which is still at its infancy performed better than the health sector, also, the industrial and agricultural sectors performed better health sector. The forgoing simply connotes that the Nigerian government has little or no value for human development. Rather, all policy emphasis is on physical infrastructure at the expense of the omnibus human development via healthcare provision.

To further harp on this assertion, the proportion of public expenditure allotted to the health sector vis-à-vis other sectors of the economy lend credence as displayed in Figure 3.

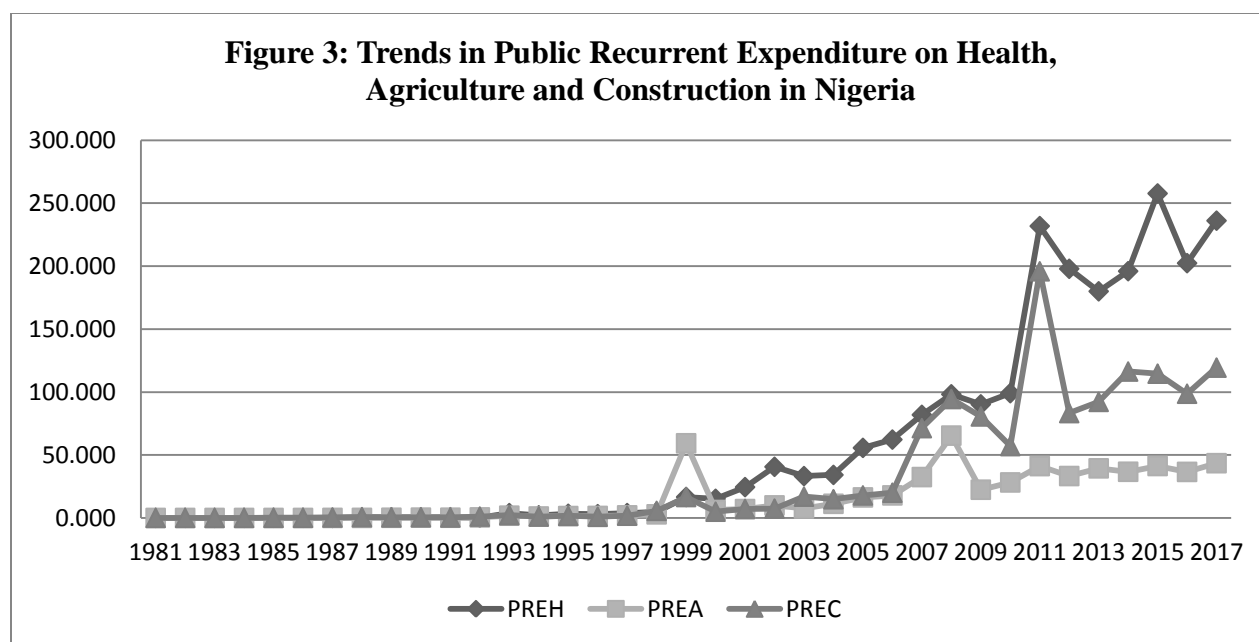**Figure 3: Trends in Public Recurrent Expenditure on Health, Agriculture and Construction in Nigeria**

Figure 3 shows stable narrow disparity in resources allocation to health, agriculture and construction sectors between 1981 and 1998 in terms of recurrent expenditures. From 1999 till date, the health sector has had more allocation in terms of its recurrent expenditure than agriculture and construction sectors. Yet, enormous fluctuations are noticeable features which are attributable to macroeconomic instability resulting from oil price volatility and exchange rate variation. Its effect feeds back on key health indices; high level of infant mortality which is among the poorest in West Africa and low life expectancy rate which is the lowest in the region, this is indeed very unfortunate!

Table 2 below shows the destitution of the phenomena examined in this study. When compared with other African countries, Nigerian health indicators ranks better than only three other nations in the continent, this implies that country is one of the worst places to live in the World (Nwani, Ozegbe & Onochie, 2019). The safety of both infants and adult is not guaranteed. This could also be linked to high poverty level and insecurity (Nwani et al., 2019).

Table 2
Summary of Health Indicators, Expenditure and Growth

Year	LEXP	INFM	PHE	RGDP
1981	46.9	125.4	1383.5	15258.0
1985	47.4	124.5	1286.0	14953.9
1990	47.2	126.2	2596.7	19305.6
1995	47.0	123.6	12536.3	20353.2
2000	47.2	112.3	21787.3	23688.3
2005	49.0	96.5	76832.6	37474.9

2010	51.6	81.1	115860.7	54612.3
2015	53.8	69.0	230995.3	69023.9
2016	53.8	66.9	257000.0	67931.2
2017	53.0	66.9	304330.0	68491.0
2018	54.0	66.1	315000.0	69810.0

*Source: CBN & WDI (2018). Note: **lexp**-life expectancy, **infm**- infant mortality rate, **phe**-public expenditure on health, **rgdp**- real gross domestic product.*

Table 3

Nigeria's standing amongst other African Countries in Health Related Matters

Indicators	Ethiopia	Ghana	Nigeria	South Africa
Percentage of health sector budget ratio GDP	2.87	2.13	0.92	4.24
Life Expectancy (per 1,000)	66.26	63.4	54.4	66.20
Infant Mortality (per 1,000)	64.89	40.14	66.12	36.4
RGDP growth rate (%)	7.7	7.4	1.90	2.20
Literacy rate (%)	50	76.6	59.6	86.3

Sources: WDI, 2018, Index Mundi, 2018

3. Empirical Review

Flurry of studies exist on the relationship between health, health spending of the government and economic growth in developed and emerging economies. However, while empirical evidence from the developed economies reveal that health and public expenditure on health amplify growth, same cannot be said of empirical results in developing economies where studies have consistently shown mixed outcomes. In this section, the paper carried out a review of previous studies in this research space and identified gaps that formed the kernel of this article.

In recent analysis of health and growth nexus, Kelani, Odundayo, Ozegbe & Nwani (2019) examine the impact health status and labour productivity on economic growth for Nigeria using annual time series data collected from the CBN bulletin and WDI of the World Bank between 1981 and 2017. The data were analysed using the ARDL bounds test to Co-integration methodology, the empirical result indicated the existence of long run equilibrium amongst health status, labour productivity and economic growth. The result from the parsimonious model show that health status and labour productivity bear positive impact on economic growth in both short run and long run. In review of this study, health expenditure as a potent health production input was neglected, again, the study focused on impact rather than causality. The deficiency in impact analysis stems from the fact that a variable may show impact on another but in

reality; it does actually causes or leads it. Thus, to ensure that policy options achieve desired results, causality test is of great importance.

Nwani et al. (2018) investigate the role of public health expenditure, environmental pollution and health outcomes in Nigeria from 1981 to 2017 using the ARDL estimation technique. Their study found that health outcome is driven by public expenditure on health, while pollution deteriorates health status of Nigerians. Incorporating the growth factor, the study reports that economic growth does not play a significant role in enhancing health outcome of life expectancy in the country. Though their study made significant contribution to knowledge by considering the roles of economic growth and environmental pollution in determining health outcomes in Nigeria, its major deficiency lies on its inability to estimate the causal linkages amongst the variables. This would have enhanced the robustness of their empirical findings.

Maduka et al (2016) employed the Toda-Yamamoto causality approach in estimating the nexus amongst health outcomes, health expenditure and growth in Nigeria between 1970 and 2013. The study reveals the existence of long run relationship amongst the variables investigated. Based on the Toda-Yamamoto causality test, it was ascertained that public health expenditure does not lead economic growth directly, but affects it through health outcomes. The need to update the scope of their study is one of the motivating factors for our study. Thus, this article extends the scope of Maduka et al. (2016) to capture recent economic phenomena up to 2018.

Further, Onisanwa (2014) assesses the impact of health on economic growth in Nigeria using the Co-integration and the traditional granger causality techniques on quarterly time series data for Nigeria between 1995 and 2009. The study found that there is a long run relationship between health indicators and economic growth in Nigeria. Based on the traditional causality test, the study submitted the existence of a lead-lag relationship between growth and health indices. His result contradicts the findings of Ayuba (2014) that reports a unidirectional causality that runs from economic growth to health outcomes for Nigeria. Both studies are deficient based on the fact that they neglected the Toda-Yamamoto causality to adopt the traditional granger and pairwise causality tests. Yet, Ogundipe & Lawal (2011) in their earlier analysis on the effects of health expenditure on economic growth using econometric approaches on secondary data between 1985 and 2009, their study posits that health expenditure bears a direct effect on economic growth.

Evidence from Algeria reported by Boussalem *et al.* (2014) on their investigation of a possible causal and long run equilibrium relationships between public spending on health and economic growth from 1974-

2014 show that public spending on health causes economic growth in the long run while in the short run public expenditure on health does not cause economic growth.

Examining health expenditure and national productivity nexus in Nigeria, Eneji *et al.* (2013) reports that health expenditure does not significantly account for growth of real GDP in Nigeria. Contrarily, **ODUBUNMI *et al.* (2012)** examine the co-integrating relationship between health expenditure, health outcomes and economic growth in Nigeria. Their study intelligently incorporated other variables such as population growth rate and foreign aids as mediating variables. Their empirical result supports the existence of a significant negative relationship between economic growth and health expenditure in Nigeria.

In summary, from empirical evidence, studies on health expenditure, health outcomes and economic growth are sparse in terms of causality. Again, the few studies on causality but Maduka et al. (2016) employed the conventional causality techniques instead of the robust Toda-Yamamoto approach. This study therefore improves on previous studies from methodological and scope perspectives.

4. Methodology

4.1 Theoretical Framework

4.1.1 Wagner's Theory of Public Expenditure

Wagner's Law is named after the German political economist Adolph Wagner (1835-1917), who developed the "law of increasing state activities" after empirical analysis on Western Europe at the end of the 19th century. He posited that increase in the size of government expenditure depends on industrialization and economic development. Wagner stated that during the industrialization process, as the real income per capita of a nation increases, the share of public expenditure in total expenditure rises. The law stated that "the advent of modern industrial society will result in increasing political pressure for social progress and increased allowance for social consideration by industry."

Wagner (1893) designed three focal bases for the increase in state expenditure. Firstly, during industrialization process, public sector activity will replace private sector activity. State functions like administrative and protective functions will increase. Secondly, governments needed to provide cultural and welfare services like health, education, old age pension or retirement insurance, food subsidy, natural disaster aid, environmental protection and other welfare functions. Thirdly, industrialization promotes technological advancement that could be monopolized by large firms at the expense of smaller firms,

thus, creating market failure. To correct this, the government indulges in the production of the monopolized products through public spending. This ultimately causes public expenditure to rise.

Further, following this publications; Finanzwissenschaft (1883) and Grundlegung der politischen Wissenschaft (1893), Wagner pointed out that public spending is an endogenous factor, which is determined by the growth of national income. Hence, it is national income that causes public expenditure. The Wagner's Law tends to be a long-run phenomenon; the longer the time-series, the better the economic interpretations and statistical inferences.

Wagner's contention is applicable to the Nigerian economy in several ways. First; Nigerians, demand are the reasons for an increase in government expenditure being greater than the increase in output of economy. Firstly, Nigerians demand for services such as health and education at a rate faster than the growth of per capita income due to the population explosion. Second, the private sector demands favourable business operating environment that requires huge investment in safety and security, administration, and incorruptible justice system. Third, the Nigerian government has intervenes through in various sectors by either subsidizing or direct production, price roofing or price flooring policies to correct market failure emerging from monopoly, economies of scales and other sources that are capable of bearing negative impact on the welfare of Nigerians.

4.2 Data

This article utilizes annual secondary time series data extracted from two major sources: World Development Indicator and CBN statistical bulletin between 1981 and 2018. The variables on which data were collected include: Public Expenditure on Health (PHE), Real Gross Domestic Product (RGDP), and on two indicators of health outcomes; life expectancy (LEXP) and Infant Mortality Rate (INFM).

4.3 Model Specification and Method of Analysis

The earlier work of Maduka et al. (2016) that employed the Toda-Yamamoto approach to causality determination was adapted in the model specification of this paper. As such, as earlier noted in section one, the point of departure ranges from the scope, the use of infant mortality instead of general mortality rate and the fact that our study goes a step further to considering both effects and causality simultaneously. The study does these using the unique Toda-Yamamoto causality test, the Trace and Maximum likelihood co-integration tests all based on the standard vector autoregressive models specified hereafter.

The general VAR model is expressed as follows:

$$y_{1t} = \phi_1 + \phi_{11}y_{1t-1} + \phi_{12}y_{2t-1} + \Omega_{11}y_{1t-2} + \Omega_{12}y_{2t-2} + \epsilon_{1t} \qquad (1)$$

$$y_{2t} = \Omega_1 + \phi_{21}y_{1t-1} + \phi_{22}y_{2t-1} + \Omega_{21}y_{1t-2} + \Omega_{12}y_{2t-2} + \epsilon_{2t} \qquad (2)$$

The compact form of the above VAR equations is expressed in the equation below.

$$y_t = \Omega + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \mu_t \qquad (3)$$

Where

Ω depicts an n x 1 Column vector

$\phi_{j's}$ are the n x n square metrics

μ_t is an n x 1 column vector of serially uncorrelated vector of innovations variable which is independently, identically and normally distributed with zero mean and constant variance $\{\mu_t \sim iidn(0, \sigma^2)\}$.

If y_t is a column vector (n x 1) matrix which encompasses all the logged variables in the model, the VAR model establishes a link between the current y_t, its lags (y_{t-i}) and the white noise variable (μ_t).

Furthermore, the Granger causality test is employed to estimate equations 4 to 11 in an attempt to determine causal linkages amongst PHE, LEXP, INFM and RGDP and other sectors of the economy.

$$lnRGDP_t = \Omega_0 + \sum_{t-1}^{n} \Omega_1 \, lnRGDP_{t-1} + \sum_{t-1}^{n} \Omega_2 \, lnPHE_{t-1} + \mu_t \qquad (4)$$

$$lnPHE_t = \phi_0 + \sum_{t-1}^{n} \phi_1 \, lnPHE_{t-1} + \sum_{t-1}^{n} \phi_2 \, lnRGDP_{t-1} + \varepsilon_t \qquad (5)$$

$$lnRGDP_t = \Omega_0 + \sum_{t-1}^{n} \Omega_1 \, lnRGDP_{t-1} + \sum_{t-1}^{n} \Omega_2 \, LEXP_{t-1} + \mu_t \qquad (6)$$

$$LEXP_t = \phi_0 + \sum_{t-1}^{n} \phi_1 \, LEXP_{t-1} + \sum_{t-1}^{n} \phi_2 \, lnRGDP_{t-1} + \varepsilon_t \qquad (7)$$

$$lnRGDP_t = \Omega_0 + \sum_{t-1}^{n} \Omega_1 \, lnRGDP_{t-1} + \sum_{t-1}^{n} \Omega_2 \, INFM_{t-1} + \mu_t \qquad (8)$$

$$INFM_t = \phi_0 + \sum_{t-1}^{n} \phi_1 \, INFM_{t-1} + \sum_{t-1}^{n} \phi_2 \, lnRGDP_{t-1} + \varepsilon_t \qquad (9)$$

$$lnPHE_t = \Omega_0 + \sum_{t-1}^{n} \Omega_1 \, lnPHE_{t-1} + \sum_{t-1}^{n} \Omega_2 \, LEXP_{t-1} + \mu_t \qquad (10)$$

$$LEXP_t = \phi_0 + \sum_{t-1}^{n} \phi_1 \, LEXP_{t-1} + \sum_{t-1}^{n} \phi_2 \, lnPHE_{t-1} + \varepsilon_t \qquad (11)$$

$$lnPHE_t = \Omega_0 + \sum_{t-1}^{n} \Omega_1 \, lnPHE_{t-1} + \sum_{t-1}^{n} \Omega_2 \, INFM_{t-1} + \mu_t \qquad (12)$$

$$INFM_t = \phi_0 + \sum_{t-1}^{n} \phi_1 \, INFM_{t-1} + \sum_{t-1}^{n} \phi_2 \, lnPHE_{t-1} + \varepsilon_t \qquad (13)$$

$$LEXP_t = \Omega_0 + \sum_{t-1}^{n} \Omega_1\, LEXP_{t-1} + \sum_{t-1}^{n} \Omega_2\, INFM_{t-1} + \mu_t \qquad (14)$$

$$INFM_t = \phi_0 + \sum_{t-1}^{n} \phi_1\, INFM_{t-1} + \sum_{t-1}^{n} \phi_2\, LEXP_{t-1} + \varepsilon_t \qquad (15)$$

From equations 4 through 15, we drew the statement of hypotheses below

Null hypotheses:

$H_0 = \sum_{t-1}^{n} \Omega_i = 0$, and $\sum_{t-1}^{n} \phi_i = 0$ \qquad\qquad (16)

$H_1 = \sum_{t-1}^{n} \Omega_i \neq 0$, and $\sum_{t-1}^{n} \phi_i \neq 0$ \qquad\qquad (17)

From equations 4 to 15, if the estimates Ω_2 and ϕ_2 are statistically significant, a bi-directional causation is said exist. But if Ω_2 is statistically significant and ϕ_2 is insignificant, it connotes the existence of a unidirectional causal relationship running from the dependent to the independent variable. However, should ϕ_2 is statistically significant and Ω_2 is otherwise, the unidirectional relationship flows from the independent variable to the explained variable in the causality models.

5. Empirical Analyses and Discussion of Results

5.1 Pre-Estimation Test

Table 4
Descriptive Statistics

	INFM	PHE	RGDP	LEXP
Mean	104.7684	68862.95	33725.21	49.00526
Median	113.7500	27321.70	23068.85	47.40000
Maximum	126.2000	315000.0	69810.00	54.00000
Minimum	66.10000	339.2000	13779.30	46.90000
Std. Dev.	22.17396	88169.64	19578.10	2.491819
Skewness	-0.549505	1.444587	0.734406	0.904599
Kurtosis	1.714232	4.222402	1.996529	2.187928
Jarque-Bera	4.529951	15.58252	5.010243	6.226709
Probability	0.103833	0.000413	0.081666	0.044452
Sum	3981.200	2616792.	1281558.	1862.200
Sum Sq. Dev.	18192.32	2.88E+11	1.42E+10	229.7389
Observations	38	38	38	38

Source: Author's computation using eviews 10

5.1.1 Descriptive Statistics

The descriptive statistics results presented in Table 4 reveal that INFM, RGDP and LEXP are narrowly spread with their respective mean value greater than the associated standard deviation. However, only PHE possesses wide degree of spread as its standard deviation value is greater than its associated mean

value. The skeweness results implies that the series have skewness ranges between -0.549 and 1.44 with all other variables having long tails to the right except for Infant mortality rate with longer tail to the left. The Jarque-Bera statistic tests it normality property of the observations. The result shows that at 10% level of significance, PHE, RGDP and LEXP are significant while INFM is not significantly normally distributed. Thus, to enhance clarity on the stationarity property of the variables, the series were further subjected to the unit root test.

5.1.2 Tests for Stationarity

In Table 5, the results of the unit root tests are presented. The stationarity test conducted in this study follows the Phillips-Perron (PP) approach. The choice of PP unit root test over other stationarity tests including Dickey Fuller and Augmented Dickey Fuller (ADF) stems from the fact that the PP is a non-parametric test that does not require selection of the level of autocorrelation and it automatically corrects the series for heteroscedasticity.

The stationarity test results on the series presented in Table 5 indicate that the variables are not stationarity in their level form, however, after the first difference, all the series but INFM are stationary but in second difference, INFM became stationary. We further embarked on the Trace and Maximum likelihood co-integration test using the Johansen approach based on VAR optimal lag criterion selection. This is to enable the researcher establish the existence or otherwise of a long run equilibrium relationship amongst the variables in the Model.

Table 5
Unit root tests: Nigerian annual data (1981 – 2018)

	PP test			
Series	Critical Value	t- statistic	Probability	Order of Integration
lnRGDP	-3.202445*	-3.205965	0.0993	I(1)
lnPHE	-4.234972***	-9.669564	0.0000	I(1)
INFM	-4.243644***	-6.237815	0.0001	I(2)
LEXP	-4.234972***	-4.625912	0.0037	I(1)

Source: Author's computation using eviews 10. Note: *, **, *** respectively indicates the rejection of the null hypothesis of unit root at 10%, 5% and 1%.

5.1.3 Optimal Lag Selection Criteria

Table 6
VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	24.63228	NA	3.24e-06	-1.289518	-1.106301	-1.228786
1	55.95121	52.85069	1.26e-06	-2.246951	-1.330866	-1.943294
2	87.98362	46.04659*	4.85e-07*	-3.248976*	-1.60002*	-2.702395*
3	95.43843	8.852585	9.49e-07	-2.714902	-0.333081	-1.925396
4	113.0827	16.54151	1.14e-06	-2.817669	0.297020	-1.785238

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Author's computation using eviews 10

From Table 6, the various criteria support the suitability of 2 lags as the optimal for further empirical estimation and analysis. Thus, we proceed to the estimation of the co-integrating relationship amongst the variables.

5.1.4 Co-integration Test

The con-integration test is used to determine whether or not an equilibrium relationship exists amongst PHE, INFM, LEXP and RGDP in the long-run. The Johansen approach of the Vector Autoregression procedure is employed in this study and the result from the trace statistics and the maximum eigenvalue interestingly reveals the existence of co-movement amongst the variables in the long-run as presented in Table 7 and Table 8 respectively.

Table 7
Unrestricted Co-integration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.597218	62.14125	47.85613	0.0013
At most 1 *	0.427446	32.13238	29.79707	0.0264
At most 2	0.261970	13.72997	15.49471	0.0906
At most 3	0.106214	3.705524	3.841466	0.0542

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: Author's computation using eviews 10

Table 8
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.597218	30.00887	27.58434	0.0239
At most 1	0.427446	18.40241	21.13162	0.1155
At most 2	0.261970	10.02445	14.26460	0.2103
At most 3	0.106214	3.705524	3.841466	0.0542

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

Source: Author's computation using eviews 10

5.2 Toda-Yamamoto Causality Test

The existence of co-integration amongst the series does not automatically imply causality. However, Econometricians have suggested that the existence of co-integration between two or more series should connote at least uni-directional causality. To ascertain the existence or otherwise of causal linkages amongst the health expenditure, health status and growth, which forms the kernel of this article, the causality test based on Toda & Yamamoto (1995) technique is presented in Table 9. The outcome of the causality test follows a Chi-square distribution with 2 degree of freedom based on the estimated optimal lag length and their various P-values.

Table 9

Toda-Yamamoto Causality Test (Modified WALD Result)

Null Hypotheses	Chi-Sqaure	Probability	Decisions	Remarks
lnPHE does not granger cause lnRGDP	0.690078	0.7082	Accept Ho	No Causality
lnRGDP does not granger cause lnPHE	1.131013	0.5681	Accept Ho	
LEXP does not granger cause lnRGDP	0.560211	0.7557	Accept Ho	No Causality
lnRGDP does not granger cause LEXP	4.211649	0.1217	Accept Ho	
INFM does not granger cause lnRGDP	0.333919	0.8462	Accept Ho	No Causality
lnRGDP does not granger cause INFM	0.264108	0.8763	Accept Ho	
lnPHE does not granger cause LEXP	1.752755	0.4163	Accept Ho	No Causality
LEXP does not granger cause lnPHE	0.742970	0.6897	Accept Ho	
lnPHE does not granger cause INFM	1.724055	0.4223	Accept Ho	No Causality

INFM does not granger cause lnPHE	1.045972	0.5927	Accept Ho	
LEXP does not granger cause INFM	12.795***	0.0017	Reject Ho	Bi-directional
INFM does not granger cause LEXP	6.47683**	0.0392	Reject Ho	Causality

Source: Author's computation using eviews 10. *Note: *** and ** imply 1% and 5% significance level*
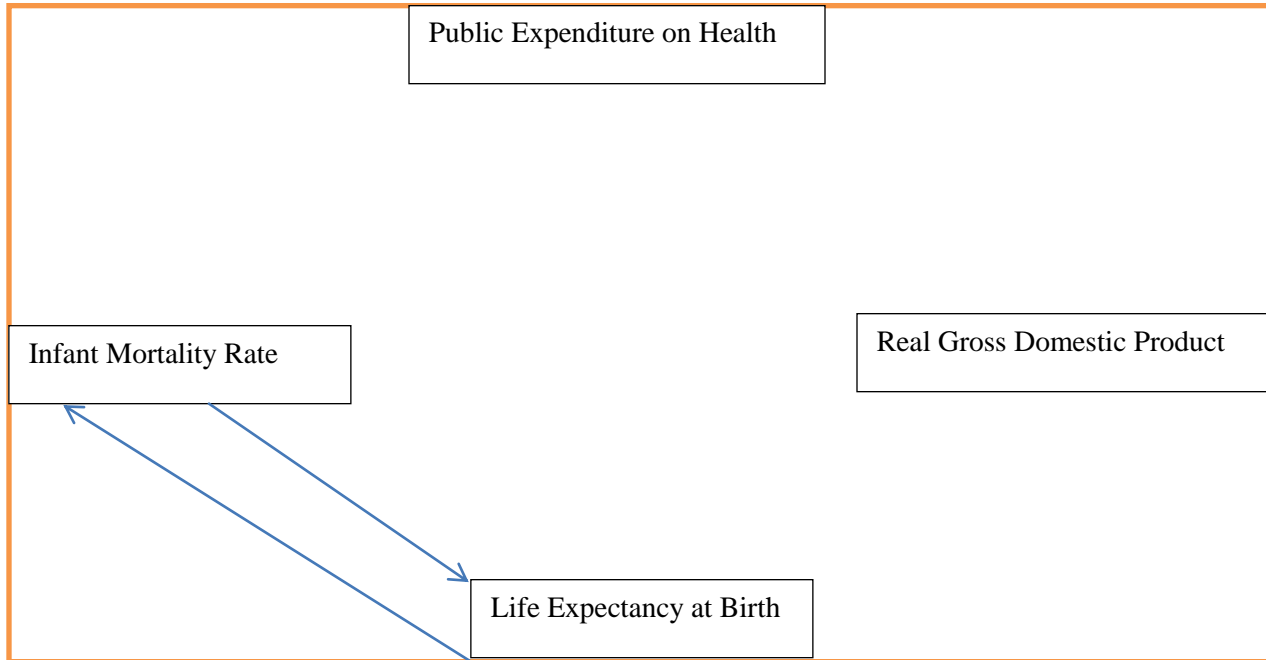

Figure 4: Summary of causal relationship amongst PHE, INFM, LEXP and RGDP in Nigeria.

5.3 Discussion of Findings

The result of the Toda-Yamamoto causality test presented in Table 9 reveals poor empirical support for casual relationship between public expenditure on health and economic growth in Nigeria. This finding upholds the position of Eneji *et al*. (2013) and Maduka *et al.* (2016). Surprisingly, there is no evidence of causality between health expenditure and health status/outcomes of infant mortality and life expectancy in Nigeria and health outcomes of infant mortality and life expectancy have no causal relationship with economic growth in the country. These latter findings significantly depart from earlier reports by Boussalem *et al*. (2014), Maduka *et al.* (2016) and Onisanwa (2014) that affirm the existence of causal and significant nexus between health outcomes and growth on one hand and health expenditure and health outcomes on the other hand.

To rationalize this study's empirical findings requires a proper articulation of its real-world implications. First, the study's empirical result implies that public health expenditure is not driven by the quest for improving health outcomes or its multiplier effect through labour productivity and economic growth. Thus, Nigeria's public expenditure on health does not result in better health for Nigerians because the little amount allocated to the health sector mostly ends up in the private pockets of the political class through inflation of healthcare contracts, supply of sub-standard healthcare equipment, and diversion of subventions by top health practitioners for building of personal healthcare facilities at the peril of the public healthcare system.

Furthermore, the empirical results connote that the current national health policies in Nigeria are poorly interlinked with the national objectives and aspirations of the country. This is deduced from the fact that health sector indices are unrelated to national indicators and the infinitesimal contribution of the sector to national output over the years. This further reveals that national health policies are not dynamically drawn to incorporate ideas from other disciplines but the medical profession.

The ultimate implication of the study's empirical findings is such that attempts by government to improve the health sector through expenditure on health is not expected to amplify economic growth, because, the channels (life expectancy and infant mortality) through which health expenditure influences growth does not respond to health expenditure due to unhealthy and corrupt practices both in the government and the health industry.

6. Summary of Findings, Conclusion and Policy Suggestions

This article presented new empirical evidence on the causal linkages amongst public expenditure on health, health status and economic growth in Nigeria between 1981 and 2018. The study departed from previous studies by employing the Toda-Yamamoto causality methodology against the conventional granger causality approach utilized by earlier works on these phenomena. The stationary test follows the Phillips-Perron approach, and the result reveals that the variables are integrated of different order. Specifically, lnRGDP, lnPHE and LEXP were stationary in their first difference, I (1), while infant mortality rate became stationary in second difference, I (2). However, further empirical inquest using the Johansen co-integration test showed that the variables have long-run association. Though this could have suggested causality from the primal facial evidence, surprisingly, the result from the Toda-Yamamoto modified

Wald test implied that public health expenditure is poorly interlinked with health sector indices and economic growth in Nigeria.

Thus, this paper strongly submits that government expenditure on health does not lead-feed on economic growth and health outcomes in Nigeria. Again, health outcomes do not have forward-back relationship with economic growth. However, both health outcomes of life expectancy and infant mortality rate are highly interlinked with the existence of bi-directional causality between both variables. Thus, unveiling the quest for future research needs on the determinants of health outcomes in Nigeria.

Essentially, on the based on the study's empirical findings, it is imperative for Nigeria to overhaul the entire sector and system through the formulation of modern national health policy that can integrate the health sector into the mainstream of the Nigerian economy. This could achieved by incorporating experts from other fields such as Economics and Statistics, Public Administration, Sociology among others in the management of public healthcare facilities in Nigeria. The anti-graft war should be extended to the health sector irrespective of the resistance and public outcry that would greet it. These fundamental clogs in the wheels of health sector growth and development, if not addressed with sincerity and urgency, further increases in public expenditure on health will continue to promote allocative-inefficiency and economic deadweight loss.

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