



Does Life Expectancy, Death Rate and Public Health Expenditure matter in sustaining Economic growth under COVID-19: Empirical Evidence from Nigeria?

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Abstract

The current health pandemic that has plagued the global of which the global south-Nigeria is not insulated from is the premise for this empirical investigation. The present study relies on recent annual time-series data to conceptualize the hypothesized claim via Pesaran's Autoregressive distributed lag techniques. Empirical findings from the bounds test traces the long-run relationship between public health expenditure and economic growth over the study span. However, unlike previous studies, we introduce life expectancy and death rates in the model framework. Although health expenditure is not significant, empirical results show that a 1% increase in life expectancy and death rate increases and decreases economic growth by 3.85% and 1.84% respectively. This suggests the need for Health Policymakers in Nigeria to implement active strategies that reduce the death rate, which is a blueprint for active engagement in the face of a global pandemic such as COVID-19.

Keywords: Life Expectancy; Death rate; Health Expenditure; Economic Growth; Nigeria

1. Introduction

Good Health care and quality of life is said to be a life asset globally and affiliated to each other, that is, health and economic growth are correlated making it a fundamental factor of sustainable economic growth. The country's economy is propelled by building a healthy population, to understand the future generations income, the life cycle model explains the affiliation between the citizen's health status, wealth and expenditure (*Interalia* Lilliard & Weiss 1997; Smith, 1999). On the other hand, diminishing and unsustainable economic is seen when the quality of life and health status is poor but if otherwise then a fueled upswing of the economy is developed (see World Health Organization, 1999). For a stable economy, the united nation layout a vision for 2030 which is known as the “17 Sustainable Development Goals (SDGs)” which part includes Good healthcare services that reduce mortality at all level and engender sustainable economic growth, Economic growth, sustainability, education, and partnership to achieve the goal. These life-changing goals signify that a healthy population is proportional to the economic growth of the country. Several quality studies have proven that building a healthy population is a lifetime asset concerning building undiminishing economic and strong economic development¹ (Yaqub et al,2012;Fernandes, 2020)

According to the WHO world health report, an agreement was made by Africa rulers in 2001 to focus on health expenditure to achieve the health Millennium Development Goals (MDGs) to raise the economics of Africa. Furthermore, 15% of the government's expenditure is to be allocated to the health sector to attain this goal but by 2013 only 5 countries accomplished this target, namely Botswana, Rwanda, Zambia, Madagascar, and Togo. Nigeria as a country couldn't meet up, nevertheless, enrolment of strategy and plans for an increase in Health capital expenditure and economic growth was implemented by the governments, according to the study carried out by Oni (2014), health expenditure and labor force productivity are paramount to the economic development of Nigeria and positive outcome in health expenditure was recorded from 1970-2010, but the results were inconsistent yearly according to AFDB (2011); World Bank (2013) and UNECA (2012), the health expenditure budgetary are as follows respectively for each year from 2008 to 2014. 9.19%, 7.63%, 7.63%, 7.42%, 7.43%, 6.48% and 8.17%. These results revealed the importance of good quality

¹ For brevity, more insights into UNSDG's see https://www.sightsavers.org/policy-and-advocacy/global-goals/?gclid=EAIaIQobChMI8SI8Y-76AIVk08YCh3KGAVDEAAAYAiAAEgI-1fD_BwE

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3 of life and its relationship with economic growth, and so the Nigerian government is encouraged to
4 priorities building a healthy population (Yaqub et al. 2012).
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10 In late 2019 a virus caused a disaster in Wuhan, Hubei province China named "Novel
11 Pneumonia Coronavirus Disease-2019 (COVID- 19)" and was declared as a global pandemic
12 (Andersen et al., (2020). The virus outbreak was disturbing due to its fast-spreading ability and
13 contagious, The world health organization daily record list for the virus cases keeps emerging globally,
14 however, a decline was seen from China infected cases where it was first prominent as of when this
15 article was drafted, meanwhile, a drastic increase in infected cases emerged in Europe, America, and
16 Africa. Emergency action was taken by the WHO to protect human life due to the risk prevalent of
17 the virus. The global pandemic of COVID-19 has increased mortality rate and beyond that, a severe
18 diminish is seen on the global economy due to the decrease in production, consumption,
19 unemployment, and decrease in quality of life. Even thou the global economic diminish seems
20 unavoidable the governments are putting more effort to sustain the economic development during
21 and after the pandemic. Fernandes (2020).
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31 Based on the highlighted position, the current study seeks to explore to what extent public
32 health expenditure impede/engender sustainable economic growth for the case of global south-
33 Nigeria. In a nutshell, the present study aims to find solution to the question? Looking at the severe
34 outbreak of (COVID-19), Will economic growth be sustainable or crash amidst the global health
35 pandemic crises? This study aims to use Nigeria as a case study for the global south blocs for more
36 insightful and policy constructions in the country and region at large to attain the "vision 2030" of the
37 UN and much more the goal-3 of UNSDG's
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43 The remainder of this study is structured as: Section 2 presents the review of related literature.
44 Section 3 renders the data and methodological sequences while empirical results and discussion. The
45 conclusion and policy blueprint are highlighted in section 5.
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51 **2. Literature Review**

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53 Various studies have been conducted for the past years similar to this by different scholars,
54 aiming to draw the attention of government, public and private sector to how health care,
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environment, and health status has a significant impact on economic growth and also to investigate if the government can establish sustainable growth in economic especially for the period of health crises. Piabuo and Tieguhong (2017) conducted an analytical research study on 5 African countries that achieved the MDGs goal from 2001-2013 and countries in the CEMAC sub-region. Econometric technics analysis was used which results indicate an increase in GDP per capita by 0.38 unit for five African countries that meet the target of allocating 15% of their government expenditure on health and 0.3unit for CEMAC, signifying that significant change in GDP per capital can only be prominent if there's a positive change in health expenditure. Ibikunle (2019) supported this, indicating a positive increase in GDP using the Ordinary Least Square (OLS) and the Granger causality test techniques to analyze the impact of health on economic growth, which was concluded that an increase in government expenditure on health should be considered so to achieve the goal of economic growth. On contrary to this, Olisakwe (2019) argued that an increase in budgetary allocation for health has negative outcomes on economic growth this was proven by extracting data from 1981-2017 in Nigeria using a classical linear regression technique to conduct the investigation. Nwani and Kelikume (2019) deducted the same conclusion as Olisakwe (2019) using the Toda-Yamamoto technique to investigate the causal relationship between health expenditure, health status and economic growth in Nigeria from the period of 1981-2018. The investigation results indicate a negative non-interdependent between government health expenditure and economic development of the country and thereby suggests that focusing on the link between these two is pointless.

Investigating more proves either positive or negative impact of health status, environmental economic growth, and expenditure on health care respectively. Nwani et al. (2018) explored a study to investigate the influence of the environment on health status and the effect of health expenditure on Nigeria health status from 1981-2017 by ARDL estimation technique, the result points out a significant negative effect of environmental pollution in Nigerians Focusing on the bad effect of capita CO2 emission on human health. According to the finding, a positive outcome was prominent on health expenditure outcomes for the past 37 years. The government should allocate more budgetary to the health care sector as well as monitor environmental pollution to maintain good wellbeing. Eneji et al. (2013) also reported a similar outcome by supporting the positive interrelationship between health expenditure, health status, and economic development, focusing on applied economics in public healthcare expenditure between 1999 and 2012 in Nigeria. The result of the investigation implied that good health is a country's big asset, so people's health status portrays the country's

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3 economic growth. The investigation by Edeme et al. (2017) validates Eneji et al. (2013) result
4 outcomes.
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7 Ahmad and Hasan (2016) conducted a study in Malaysia between 1984 and 2009. The result
8 based on Autoregressive Distributed Lag (ARDL) cointegration framework classified that health
9 status outcomes, public health expenditure, and governance have a stable long-run relationship making
10 them correlated. Sharma (2018) validates the result outcomes by Ahmad and Hasan (2016). Similarly,
11 with the same method Erçelik (2018) examined turkey health output and economic growth for the
12 period of 1980-2015, bound test results revealed that co-integration shows a positive variable
13 connection between Turkey's government health output and economic growth. It can be deduced that
14 health expenditure has a positive impact on economic development in the long run.
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21 Yuksel and Dinçer (2019) used the Pedroni panel cointegration method and Dumitrescu
22 Hurlin panel causality analysis to evaluate the total, public, and private health expenditure and
23 economic growth of E7 countries between the period of 1996 and 2016. The result discovers two
24 important aspects, an obvious long-run relationship between total/public health expenditure with
25 Economic growth and Negative economic growth contribution in private health care expenditure.
26 The impact of the private health sector on economic growth is quite low, the private sector should
27 improve and be re-evaluated.
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34 Kim and Lane (2013) studied the 17 OECD countries with a mixed-effect model to critically
35 evaluate the link connecting Public health output, national health outcomes, and impact of recent
36 changes in healthcare policy in the United States. The study focused on infant mortality rate and life
37 expectancy at birth, the finding indicated negative and positive result accordingly, no link between
38 government health expenditure and infant mortality rate meanwhile and an obvious link between
39 government health expenditure and life expectancy at birth was seen. Doğan et al. (2014) also used
40 OECD countries to analyze the health expenditure for the period of 1995-2011 by ARDL
41 methodology. The result proved positivity in the age Dependency Ratio on health care expenditures
42 but unexpected influence in a decrease in expenditure is seen in the increased population among young
43 workers.
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54 **3. Data, Model and Method**

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3.1 Data and Variables

This section presents the data, variables description and methodological procedures applied to address the hypothesized study claim for the case of Nigeria². Subsequently the materials and method accordingly

(INSERT TABLE 1 HERE)

3.3 Model and Method

To carry out the empirical assessment necessary to achieve the aim of this study, we present a standard growth equation with labour, capital, trade and foreign direct investment as the required control variable. However, as a novelty, we introduced three different measures for the health sector. First is the standard health expenditure as a percentage of GDP. Results from this are compared with other health sector proxies such as life expectancy and death rate. Given that COVID-19 has significantly influenced the death rate across many countries, the death rate and its impact on real GDP will provide valuable insights in times of pandemic such as this. Hence, our model is shown in the following equations below:

$$LRGDP = f(LCAP, LLAB, LTOT, LFDI, LHEA) \quad (1)$$

$$LRGDP = f(LCAP, LLAB, LTOT, LFDI, LLEXP) \quad (2)$$

$$LRGDP = f(LCAP, LLAB, LTOT, LFDI, LDRT) \quad (3)$$

The autoregressive distributed lag model is used to estimate the models in equations 1 to 3. Before doing this, however, pre-estimation diagnostics are conducted as well as post estimation check after all model diagnostics and main estimations are concluded.

4. Discussion of Results and Implication of Findings

4.1 Pre-estimation Diagnostics

Table 2 gives the descriptive statistics of the variables of interests employed in the study which includes mean value, standard deviation, minimum and maximum. The total number of observations

² The data span is from 1989 to 2018. The selected variables are described in table 1. All data accessed May 2020 from WDI database

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3 is pegged at 30. As shown Table 4, the results of the descriptive statistics are presented in log and
4 variable. When the variables are logged, real GDP is shown to have the highest mean value of \$7.492
5 million with the minimum and maximum values of \$7.207 million and \$7.849 million respectively
6 while the least of the logged variables is the foreign direct investment (FDI) with the mean value of
7 \$0.431 million and with minimum and maximum of \$-0.693 million and \$1.756 million respectively.
8 At level, the same result is found with changes in the values. Lastly, the table also presents the standard
9 deviation which explains the degree at which the data varies from their mean values.
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19 To have a better understanding of the variables, Figure 1 shows the graphical illustrations of
20 the trend of the variables of interest. As shown in Figure 1, capital investment (CAP) is revealed to be
21 the most fluctuating variable followed by the real GDP and health expenditure. This implies the
22 inconsistencies of the variables over time.
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29 Table 3 presents the results of the correlation analysis between the variables of interest. The
30 result of the association between real GDP and health expenditure as well as life expectancy reveals
31 that there is a strong and significant positive association that supports the theoretical construct in the
32 literature while a strong and significant negative relationship is discovered between real GDP and
33 death rate. The association between real GDP and terms of trade as well as labour force is found to
34 be strong, positive and significant, whereas, a weak and significant negative relationship is found
35 between real GDP and foreign direct investment. Capital investment is shown to have a strong and
36 significant negative relationship with real GDP.
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49 **4.2 Model Diagnostics**

50 We confirm the validity of the estimated model using analytical tests presented in Table 4 and
51 Figure 2. The model validity tests carried out in this study include normality test using Lagrange
52 Multiplier Jarque-Bera technique, heteroscedasticity test using Breusch-Pagan / Cook-Weisberg
53 approach, functional misspecification using Ramsey RESET test, multicollinearity test employing
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3 Variance inflation factor, IM-test and CUSUM using Cameron & Trivedi's decomposition technique
4 and lastly, stability test using CUSUMSQ graphical illustration.
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9 Subsequently, after exploring the summary statistics and correlation matrix, it is also
10 imperative to examine the stationary properties of the variables of interest. Table 5 presents the
11 Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) unit root tests employed in the study to
12 examine the order of integration of the variables. The estimates from the Dickey-Fuller unit-roots
13 confirm that all the variables are non-stationary at level but stationary at first difference except for the
14 FDI that is stationary at both level and first difference. Also, the results obtained from Philip-Perron
15 unit root test reveals that all the variables of interest are stationary at first difference while only TOT
16 and FDI are found to be stationary at level.
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29 **4.3 Estimation Results**

30 After conducting the tests for the unit roots, the next step is to examine if at all there is the
31 existence of long run equilibrium between the variables. Therefore, ARDL bound test technique
32 coined by Pesaran et al (2001) is employed in this current study to test for cointegration as shown in
33 Table 7. The results of ARDL bound test approach shows that, in most cases, the F-statistics is valued
34 above at least the 10% upper bound which is an avenue to establish long run equilibrium between the
35 variables of interest.
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41 Since the ARDL bound test approach has confirmed that that the variables of interest to this
42 study are cointegrated, the long run and short run equilibrium can then be estimated. Table 8 shows
43 the empirical findings of the short run and long run equilibrium nexus using the ARDL modelling
44 approach and the analysis covers three models with real GDP as the sole dependent variable.
45 Accordingly, the result of the impact of health expenditure on real GDP is found to be negative and
46 insignificant both in the short run and the long run. Specifically, a 1 percent increase in health
47 expenditure will lead to an insignificant 0.09 percent reduction in the real GDP. This result is partially
48 consistent with the empirical findings of Bakare & Sanmi (2011) who discovered a positive and
49 significant impact of health expenditure on the Nigerian economy. This result has shown the triviality
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3 of the effect of health expenditure on the advancement of the Nigerian economy and this can be best
4 explained from the low budgetary allocation for healthcare in the country.
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7 Life expectancy in the contrary exhibits a significant positive impact on the real GDP in both
8 the short run and the long run. This result validates the empirical findings of Mahyer (2016) for Iran
9 and Ngague & Manfred (2015) for 141 developing countries. The findings show that a 1 percent
10 increase in life expectancy will directly cause a significant increase in GDP by 3.16 and 3.85 in the
11 short run and long run respectively. The implication of this is that having a high life expectancy will
12 provide the Nigerian economy with the necessary labour force to improve the productivity of the
13 country in terms of her GDP.
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19 As expected, death rate is found to pose a significant threat to the economic advancement of
20 the country. The findings reveal that a 1 percent increase in the number of death cases recorded in the
21 country will directly cause a significant reduction in the GDP by about 1.84 percent in the long term
22 and by about 1.54 percent in the short run. This result implies that high death rate in a country could
23 render the country with lesser manpower to efficiently carry out her productive activities which in
24 turn influence the economic advancement of the country.
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30 For the control variables, the estimated coefficients of capital investments show that both in
31 the short run and long run, capital investment has negative and insignificant effects on the dependent
32 variable. Specifically, a 1percent increase in capital investment will cause the GDP to reduce by 0.03,
33 0.002 and 0.05 percent respectively in the short run and by 0.1, 0.002 and 0.05 percent in the long run
34 across the three models. However, the results are not significant. The empirical findings of Obialor,
35 (2017) for three Sub-Saharan African countries including Nigeria. This implies that more capital
36 accumulation tends to cause the Nigerian economy to experience a downturn due to ways through
37 which the capital is channeled. The results obtained from the analysis also indicate that labour force
38 across the three models has negative but insignificant impact on health expenditure both in short run
39 and long run in such a way that a 1 percent increase in results 28.26 percent reduction in GDP for the
40 first model. Meanwhile, the results of analyses modelled for life expectancy and death rate reveal a
41 negative and significant effect of labour force on GDP both in the short run and long run such that a
42 percent increase in labour force will reduce the GDP by 7.05 and 9.04 percent respectively in the short
43 run and by 8.58 percent and 10.83 percent respectively in the long run. This implies that labour force
44 has neutrally disrupted the advancement of the economy of Nigeria.
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3 The coefficients of terms of trade are positive and insignificant across all the three models
4 exemplified in the study both in the short run and long run. Specifically, the results indicate that 1
5 percent increase in terms of trade will cause the GDP to increase by 0.16 percent in the first model,
6 to increase by 0.02 percent in the second model and increase by 0.01percent for the third model in
7 the long run while the short run coefficients of the GDP for the first model is 0.04 percent rise, rises
8 by 0.02 percent and 0.01 percent rise in GDP when terms of trade increases by 1%. The result obtained
9 is in contrary to the study conducted by Jebran et al (2018) for Pakistan. However, the effect of terms
10 of trade tends to be insignificant to the Nigerian economy owing to the excessive reliance of the
11 economy on importation.
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19 In contrast, foreign direct investment is found to influence the GDP negatively and
20 insignificantly across the three models. For instance, 1 percent increase in foreign direct investment
21 will inversely cause GDP by 0.02, 0.01, 0.01percent respectively across the three models in the
22 short run while the long run estimations show a negative and insignificantly such that a 1 percent
23 increase in FDI leads to 0.07, 0.01 and 0.01 percent in the long run across the three models. The
24 result of the analysis is partially consistent with the study conducted by Alvarado & Ponce (2017) for
25 lower-middle-income countries. This shows that FDI has neutral effect on the economic growth in
26 Nigeria.
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41 While table 6 indicates that all the tests carried out in the study are well behaved and align with
42 expectations attached to the estimated results, the stability of the estimated model is also confirmed
43 with Figure 2 that presents the CUSUM and CUSUMSQ plotted within 95% degree of confidence.
44 Therefore, there is a possibility of making unbiased statistical derivations, interpretations and policy
45 recommendations.
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52 4.4 Granger Causality Tests

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54 The presence of cointegration between the variables of interest has provided the evidence for
55 the existence of at least one causality nexus between the variables though could not provide the
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3 direction of the causality. Thus, we employ the popular Granger causality test in this study to examine
4 which variable serves as a causative agent to the other. The Granger causality test results are presented
5 in Table 8. Empirical evidence shows that, there exists a one-way directional relationship moving from
6 the health expenditure to productivity growth while no causal relationship is found between economic
7 growth and life expectancy and also between economic growth and death rate.
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12 The empirical results obtained from the causality tests reveal the validity of feedback
13 hypothesis such that bi-directional causal relationship is discovered between economic growth and
14 capital investment, unidirectional relationship separately running from labour force and terms of trade
15 to economic growth. Meanwhile, no causality is discovered between foreign direct investment (FDI)
16 and productivity growth.
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21 Efforts to compare the results of the current study to the previous show that one-way
22 directional causal relationship exists moving from expenditure on healthcare to productivity growth
23 found in this current study is contrary to the empirical study of Dincer & Serhat (2018) and Mehrara
24 & Musai (2011) who also found a one-way directional causal relationship running from economic
25 growth to health expenditure for E7 countries and Iran respectively. Another conflicting result is that
26 of Ecevit (2013) who found a one-way directional causal relationship moving from life expectancy to
27 productivity growth.
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40 **5. Conclusion and Policy Implications**

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42 This study employs the ARDL model and Granger causality to investigate the relevance of life
43 expectancy, death rate and public health expenditure to the sustainability of economic growth in
44 Nigeria amidst the Nobel Coronavirus Disease-2019 (COVID- 19).
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48 The empirical findings from the ARDL approach reveal that health expenditure has negative
49 impact on economic growth. However, the impact is found to be insignificant. As regards the Granger
50 causality tests, unidirectional causal relationship is found running from health expenditure to
51 economic growth. These findings show that health expenditure is a core factor that can be undertaken
52 to improve the economic growth and development of the Nigerian economy. It indicates that Nigeria
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3 could gain from the agility of her labour force if more investments are directed towards improving the
4 healthcare system.
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7 The empirical results also show the significant positive effect of life expectancy on economic
8 growth. Surprisingly, the results obtained from the Granger causality tests reveal that there is no causal
9 relationship between the two variables. The results indicate the influence of high life expectancy span
10 on the promotion of economic growth in Nigeria given the fact that there is no evidence to support
11 the existence of a causal relationship between the variables in question.
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16 The expected empirical result is found for the impact of death rate on economic growth and
17 of which is negative and significant. Regarding the causality test, no causal relationship is found
18 between economic growth between death rate as duly expected theoretically. This result suggests that
19 if death rate becomes consistent in the country, it could hinder the economic growth and development
20 of the country through labour force channel.
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25 From the findings stated above, it is therefore recommended that the Nigerian government to
26 prioritize investment in human capital development through the provision of healthcare facilities,
27 personnel training, monitoring and evaluation, and making the access to the healthcare facilities
28 affordable. Embarking on these will not only assure the provision of the quality labour force but also
29 translate to an increase in the productive capacity of the country and an increase in economic growth.
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34 Furthermore, since it is clear that the health sector in Nigeria is underfunded and
35 underdeveloped, this is a call on the government to increase the investment in the health sector in the
36 country and such investments should be directed towards fighting off leading death-causing diseases
37 such as tuberculosis, pneumonia and influenza that tend to cut the life expectancy in the country short.
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42 Lastly, the Nigerian government should strongly consider the provision of an economically
43 friendly environment as well as a secured environment for business to grow and this should be the
44 ultimate responsibility of people in power and managers of the economy. Facts have been duly
45 established in this current study that unemployment increases mortality and negatively affects life
46 expectancy and increased unemployed youths tend to increase the number of dependents in the
47 country, increase the inequality gap and make medical access care burdensome. Thus, it is
48 recommended in this study that the government should focus on making policies that increase
49 employment opportunities and productive capacities of the citizens.
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LIST OF TABLES

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47 *Table 1. Description of variables*

Variable symbol	Description	Source
RGDP = GDP per capita, constant 2010 dollars	GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars.	The World Bank

CAP = Capital investment as a percent of GDP	Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress." According to the 1993 SNA, net acquisitions of valuables are also considered capital formation.	The World Bank
LAB = Labor force, million people	Labor force comprises people ages 15 and older who supply labor for the production of goods and services during a specified period. It includes people who are currently employed and people who are unemployed but seeking work as well as first-time jobseekers. Not everyone who works is included, however. Unpaid workers, family workers, and students are often omitted, and some countries do not count members of the armed forces. Labor force size tends to vary during the year as seasonal workers enter and leave.	The World Bank
TOT = Terms of trade, base year = 2000	Net barter terms of trade index is calculated as the percentage ratio of the export unit value indexes to the import unit value indexes, measured relative to the base year 2000. Unit value indexes are based on data reported by countries that demonstrate consistency under UNCTAD quality controls, supplemented by UNCTAD's estimates using the previous year's trade values at the Standard International Trade Classification three-digit level as weights. To improve data coverage, especially for the latest periods, UNCTAD constructs a set of average prices indexes at the three-digit product classification of the Standard International Trade Classification revision 3 using UNCTAD's Commodity Price Statistics, international and national sources, and UNCTAD secretariat estimates and calculates unit value indexes at the country level using the current year's trade values as weights.	The United Nations
FDI = Foreign Direct Investment, percent of GDP	Foreign direct investment is the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors and is divided by GDP.	The World Bank
HEA = Health spending per capita	Current expenditures on health per capita in current US dollars. Estimates of current health expenditures include healthcare goods and services consumed during each year.	The World Bank
LEXP = Life expectancy, in years	Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.	The World Bank
DRT = Death rate, per 1000 people	Crude death rate indicates the number of deaths occurring during the year, per 1,000 population estimated at midyear. Subtracting the crude death rate from the crude birth rate provides the rate of natural increase, which is equal to the rate of population change in the absence of migration.	The World Bank

Table 2. Summary Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Variables at log					
LRGDP	30	7.492	0.242	7.207	7.849
LCAP	30	3.302	0.426	2.701	3.974
LLAB	30	3.724	0.225	3.367	4.106
LTOT	30	4.712	0.497	3.781	5.415
LFDI	30	0.431	0.610	-0.693	1.756
LHEA	19	4.074	0.582	2.875	4.681
LLEXP	30	3.883	0.060	3.825	3.988

LDRT	30	2.769	0.154	2.473	2.923
Variables at level					
RGDP	30	1845.52	452.05	1348.68	2563.90
CAP	30	29.59	12.18	14.90	53.19
LAB	30	42.46	9.57	28.98	60.70
TOT	30	124.72	58.73	43.88	224.77
FDI	30	1.85	1.25	0.50	5.79
HEA	19	66.73	27.84	17.72	107.87
LEXP	30	48.65	2.95	45.84	53.95
DRT	30	16.12	2.37	11.86	18.60

Table 3. Pairwise Correlation

	LRGDP	LCAP	LLAB	LTOT	LFDI	LHEA	LLEXP	LDRT
LRGDP	1							
	--							
LCAP	-0.9371*	1						
	0.0000	--						
LLAB	0.9200*	-0.9635*	1					
	0.0000	0.0000	--					
LTOT	0.8750*	-0.8482*	0.7967*	1				
	0.0000	0.0000	0.0000	--				
LFDI	-0.2385	0.2726	-0.3587	-0.0553	1			
	0.2043	0.145	0.0516	0.7716	--			
LHEA	0.9365*	-0.8460*	0.7938*	0.8405*	-0.2929	1		
	0.0000	0.0000	0.0000	0.0000	0.2236	--		
LLEXP	0.9725*	-0.9381*	0.9552*	0.8059*	-0.3298	0.8381*	1	
	0.0000	0.0000	0.0000	0.0000	0.0751	0.0000	--	
LDRT	-0.9603*	0.9314*	-0.9612*	-0.7864*	0.3594	-0.8034*	-0.9980*	1
	0.0000	0.0000	0.0000	0.0000	0.0511	0.0000	0.0000	--

Table 4. Model verification and validation

Lagrange Multiplier Jarque-Bera Normality Test			
Lags (p)	Chi ²	df	Prob > chi ²
1	2.01776	2	0.36463
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity			
Chi ² (1)	0.33	Prob > chi ²	0.5634
Ramsey RESET test			
F (3, 20)	4.75	Prob > F	0.0116
Variance inflation factor			
Variable	VIF	1/VIF	
LLAB	1.17	0.854413	
LFDI	1.14	0.879885	
LLEXP	1.11	0.899184	
LCAP	1.11	0.901391	
LTOT	1.09	0.92134	
Mean VIF	1.12		

Cameron & Trivedi's decomposition of IM-test			
Source	chi2	df	P value
Heteroskedasticity	14.11	20	0.825
Skewness	2.56	5	0.767
Kurtosis	1.3	1	0.2538
Total	17.97	26	0.8768

Table 5. Unit Root Test

Variable	Dickey-Fuller Test				Philip-Perron			
	Level	Prob	1st diff.	Prob	Level	Prob	1st diff.	Prob
LRGDP	-0.211	0.9373	-3.370	0.0120	-0.464	0.8989	-3.564	0.0065
LCAP	-1.398	0.5830	-4.726	0.0001	-1.414	0.5754	-4.683	0.0001
LLAB	2.669	0.9991	-9.122	0.0000	2.515	0.9991	-7.467	0.0000
LTOT	-1.203	0.6722	-4.925	0.0000	-1.074	0.7252	-4.947	0.0000
LFDI	-3.184	0.0209	-6.675	0.0000	-3.307	0.0146	-7.063	0.0000
LHEA	-2.455	0.1269	-3.502	0.0079	-2.609	0.0911	-3.537	0.0071
LLEXP	2.427	0.9990	-0.891	0.7909	1.265	0.9964	-7.877	0.0000
LDRT	6.067	1.0000	-7.446	0.0000	3.104	1.0000	-7.101	0.0000

Table 6. ARDL regression with short-run and long-run equilibrium relationship. Dependent variable: LRGDP

Variables	Model 1 with Health Expenditure per capita	Model 2 with Life Expectancy in years	Model 3 with Death Rate per 1000 people
EC (-1)	-0.244 (0.462)	-0.822*** (0.195)	-0.835*** (0.194)
Long run			
LCAP	-0.103 (0.285)	-0.00235 (0.0716)	-0.0542 (0.0680)
LLAB	-28.26 (51.90)	-8.576* (4.314)	-10.83** (4.179)
LTOT	0.157 (0.464)	0.0247 (0.0337)	0.0139 (0.0330)
LFDI	-0.0691 (0.189)	-0.0134 (0.0134)	-0.00932 (0.0130)
LHEA	-0.356 (0.956)		
LLEXP		3.847** (1.513)	
LDRT			-1.839** (0.683)
Short run			
D.LCAP	-0.0252 (0.0685)	-0.00193 (0.0588)	-0.0453 (0.0565)
D.LLAB	-6.888 (4.369)	-7.047* (3.845)	-9.043** (3.998)

D.LTOT	0.0384 (0.0542)	0.0203 (0.0260)	0.0117 (0.0266)
D.LFDI	-0.0169 (0.0222)	-0.0110 (0.0101)	-0.00778 (0.0102)
D.LHEA	-0.0867 (0.0777)		
D.LLEXP		3.161** (1.476)	
D.LDRT			-1.536** (0.680)
Constant	0.189 (0.119)	0.178* (0.101)	0.222** (0.103)
Observations	18	28	28
R-squared	0.474	0.557	0.566

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 7. Pesaran, Shin, and Smith (2001) ARDL bounds test

Bound	10%		5%		1%		P value		F/t Statistic
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	
F	2.634	3.923	3.221	4.704	4.672	6.63	0.013	0.065	4.404
t	-2.559	-3.856	-2.934	-4.315	-3.718	-5.275	0.003	0.059	-4.208

Table 8. Granger Causality Tests

Causality Test (H_0)	Statistics	P value	Direction of Causality
LCAP does not Granger-cause LRGDP	3.25*	0.0818	Bi-directional
LRGDP does not Granger-cause LCAP	3.67*	0.0636	
LLAB does not Granger-cause LRGDP	0.38	0.7709	Unidirectional
LRGDP does not Granger-cause LLAB	11.04**	0.0032	
LTOT does not Granger-cause LRGDP	3.05*	0.0922	Unidirectional
LRGDP does not Granger-cause LTOT	2.05	0.1792	
LFDI does not Granger-cause LRGDP	2.01	0.2128	No causality
LRGDP does not Granger-cause LFDI	2.37	0.1650	
LHEA does not Granger-cause LRGDP	0.13	0.7227	Unidirectional
LRGDP does not Granger-cause LHEA	29.55***	0.0002	
LLEXP does not Granger-cause LRGDP	1.50	0.2480	No causality
LRGDP does not Granger-cause LLEXP	2.36	0.1214	
LDRT does not Granger-cause LRGDP	1.31	0.3173	No causality
LRGDP does not Granger-cause LDRT	1.85	0.1790	

*, ** and *** represent significance at 10%, 5% and 1% respectively.

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5 *Fig. 1. Trend of variables*

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7 *Fig. 2. Recursive cusum*
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Fig. 1. Trend of variables

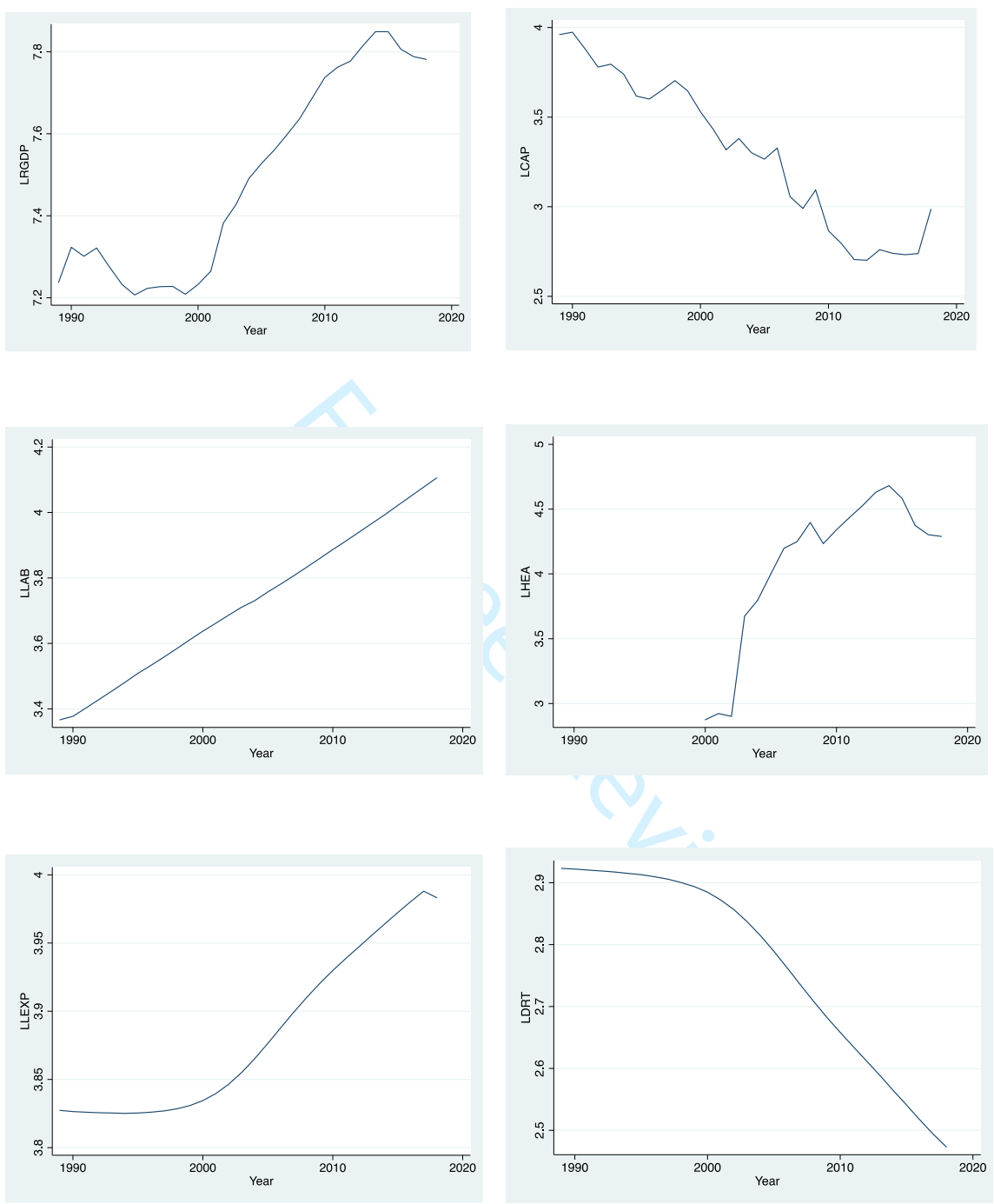


Fig. 2. Recursive cusum

