HEALTH EXPENDITURE AND ECONOMIC GROWTH NEXUS: 
AN ARDL APPROACH FOR THE CASE OF NIGERIA

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Abstract
In this paper, the dynamic relationship between health expenditure and economic growth from 1980-2010 in Nigeria is examined — using the newly developed ARDL Bounds testing procedure and Granger causality test. The results suggest that there is a long-run relationship between health expenditure and economic growth, indicating that there is causality relationship in at least one direction. However, it does not indicate the direction of causality. Therefore, the Granger causality test indicates a strong bidirectional relationship between health expenditure and economic growth. It is therefore important for the Nigerian government to include investment in health as a tool of macroeconomic policy, due to the fact that differences in economic growth rates between countries have been significantly explained by health differences, showing that investment in health improves economic growth.

Keywords: Health expenditure, economic growth, cointegration, causality test

Introduction
Health is not only a priority goal in its own right but also an indispensable factor input into sustained economic growth and development. The importance of expenditure on health has been greatly underestimated, not only by policy analysts but also by Sub-Saharan African countries government. The role of health in influencing economic outcomes has been well understood more especially at the micro level. For instance, healthier workers are likely to be able to work longer, be generally more productive than their relatively less healthy counterparts, and consequently able to secure higher earnings than the latter, all else being the same; illness and disease shorten the working lives of people, thereby reducing their lifetime earnings ( Mehrara and Musai, 2011).

Although there are many empirical studies on the relationship between health expenditures and economic growth conducted in Nigeria (Adeniyi and Abiodun 2011, Bakare and Sanmi 2011, Dauda 2011, and Odior 2011). The results are at best mixed.

The objective of this study is to add to this group of studies by considering the health expenditure—economic growth nexus for Nigeria. The uniqueness of this work is twofold. First, this is the first study to the best of the authors’ knowledge that considers only health expenditure and economic growth for a test of the causal relationship. Second, our modelling approach is novel as it uses Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration proposed by Pesaran et al. (2001) to analyse long-run relationships between the variables of interest. This procedure is adopted because it has better small sample properties than alternative methods. Moreover, it can be used irrespective of the order of integration of the regressors as applied in Inuwa (2012).

Literature review
The relationship between health and economic growth has been empirically investigated intensely, although, the evidence is mixed. Moreover, most of empirical studies have focused on either time series or panel data.

For example, on the basis of time series data, Sulku and Cancer (2011) examined the relationship among per capita gross domestic product (GDP), per capita health expenditures and population growth in Turkey over the period 1984-2006. Using the methodology of multivariate cointegration techniques, the authors find that income elasticity of total health expenditures is less than one which implies that a 10% increase in total per capita leads to 8.7%
increase in total per capita health expenditures. Similarly, income elasticity of public health expenditures was less than one. However, private health care expenditure is greater than one implying that private health care is more of luxury than necessity in Turkey. Another study by Mehrare and Musai (2011a) examines the relationship between health expenditure and economic growth for Iran over period 1979-2008 by employing Gregory-Hansen (1996) cointegration techniques which allows the presence of potential structural breaks in data. The authors find the presence of a long run relationship between health expenditure and the income elasticity for health care spending is greater than one during the period under study. The results also suggest one-way causality relationship running from GDP to health expenditure, thereby concluding that health expenditure does not granger caused economic growth.

Similarly, Mehrara and Musai (2011b) re-examines the relationship between health expenditure and economic growth for the period 1970-2007 via the application of autoregressive distributed lag (ARDL) bounds test approach to cointegration for Iran. The authors suggest a cointegration relationship among real GDP, health expenditure, capital stock, oil revenues and education. The results further suggest that health expenditures are among most important factors in the lowering of infant mortality even though their contribution to economic growth are negligible. Also, a similar hypothesis is tested by Mehdi et al. (2011). They study the relationship for Iran but using five variables ( gross domestic product growth rate, the ratio of health expenditure to GDP, the ratio of investment to GDP, population growth, growth rate of graduates and also their influences). They employ vector autoregressive model (VAR) and Johansen cointegration technique over the period 1973-2008 and find that the ratio of health expenditure to GDP, ratio of investment to GDP and Growth rate of graduates have positive effect on growth rate. In contrary, population growth has negative effect on growth rate.

Furthermore, Aurangzeb (2001) investigates the relationship between health expenditure and economic growth within an augmented Solow Growth model for Pakistan during the period 1973-2003, Johansen cointegration technique and error correction model (ECM) are applied. The author find a significant and positive relationship between GDP and health expenditure in both short- and long-run.

Moreover, some empirical evidence were also emerged from Nigeria. For example, Odior (2011) conducts a study on the relationship between health and economic growth by using an integrated sequential dynamic computable general equilibrium (CGE) model over the period 2004-2015 to investigates the impact of government expenditure on health on economic growth. The findings suggest that the re-allocation of government expenditure to health sector is significant in explaining economic growth in Nigeria. Similarly, Dauda (2011) examines the relationship between health expenditure and economic growth for Nigeria spanning from 1970-2009 by employing descriptive statistics, Johansen cointegration technique and error correction model (ECM), the author suggest that health expenditure is positive and statistically significant but the coefficients of the second and third lags are negative and statistically significant. The results of error correction model is statistically significant and has expected negative sign with the coefficient of 40% implying that the speed of adjustment to is 40%.

In addition, Adeniyi and Abiodun (2011) used ordinary least square (OLS) to examine the impact of health expenditure on economic growth over the period 1985-2009. The authors suggest that if funds are properly channeled and appropriate expended to both the recurrent and capital projects in health, the existence of a positive relationship between economic growth and health will be more widened. Arguing in same line, Bakare and Sanmi (2011) also used ordinary least square (OLS) multiple regression for annual time series data for Nigeria covering 1974-2008, the results show a significant and positive relationship between health expenditure and economic growth. Therefore, the study recommends that policy makers should place more priority to the health expenditure by increasing its yearly budgetary allocation to the sector.

However, on the basis of panel data, David et al. (2004) examines relationship between health and economic growth for 104 countries over the period 1960-1990 by applying non-linear two-stage least squares estimates (2SLS), the authors find that good health has positive and statistically significant effect on economic growth, even though, life expectancy
effect in growth regressions appears to be a real labour productivity effect other than life expectancy proxied for workers experience. Another study by Aguayo-Rico and Iris (2005) examines the impact of health on economic growth for 13 European countries, 12 African countries, 16 American countries, and 11 Asian countries over the period 1970-80 and 1980-90 using ordinary least square (OLS), the authors find that health capital has a significant effect on economic growth, especially with a variable that captures all the determinants of health. Similarly, Dreger and Reimers (2005) investigates the relationship between health care expenditures and GDP for a sample of 21 OECD countries over the period 1975-2001 using the recent panel cointegration techniques. The authors find the existence of a long run relationship among health expenditures, GDP per capita and proxied for medical progress which implies that health care is by no means a luxury.

Recent study by Baltagi and Moscone (2010) estimates a regression equation for health care expenditure as a function of GDP and other control variables using data on 20 OECD countries over the period 1971-2004 by using maximum likelihood estimation (spatial MLE) techniques to estimate and test fixed effects and spatially correlated errors. The authors find that health care expenditure is a necessity rather than a luxury with an elasticity much smaller than that estimated in previous studies. Also, Hartwig (2010) conducts causality testing for a panel of 21 OECD countries using panel Granger causality test over the period 1970-2005, the author find that health capital formation fosters long term economic growth in all the OECD countries under study. A more recent study by Mehrara and Musai (2011) examines the Granger causality tests between health expenditure and economic growth among 11 oil exporting countries during the period 1971-2007 by using panel unit root tests and panel cointegration techniques. The results suggest strong causality running from revenues and economic growth to health expenditure in the oil exporting states. Also, health expenditure does not have any significant effects on GDP in both short- and long-run.

**Methodology**

The data for the study are time series data spanning the time period 1980-2010. They were gathered from the Central Bank of Nigeria Statistical Bulletin. The variable $LRGDP_t$, represents real GDP (proxy variable for economic growth) and $HEXP_t$, represents health recurrent expenditure (proxy variable for health expenditure). This study applied the ARDL bounds testing approach to cointegration based on ARDL framework and pair wise approach for causality analysis.

To check the stationarity of the series variables as well as the order of integration, unit root test was conducted using Phillips-Perron, PP (Phillips and Perron, 1988), the optimal lag length was chosen based on the lowest AIC value. To empirically analyse the long-run relationship and dynamic interactions between the variables of interest, the model will be estimated by using the bounds testing (or autoregressive distributed lag (ARDL) cointegration procedure, developed by Pesaran et al. (2001). The procedure is adopted for three reasons. Firstly, the bounds test procedure is simple. As opposed to other multivariate cointegration techniques such as Johansen and Juselius (1990). Secondly, the bounds testing procedure does not require the pre-testing of the variables included in the model for unit roots unlike other techniques such as the Johansen approach. It is applicable irrespective of whether the regressors in the model are purely I(0), purely I(1) or mutually cointegrated. Thirdly, the test is relatively more efficient in small or finite sample data sizes as is the case in this study. The procedure will however crash in the presence of I(2) series. The bounds testing approach to cointegration involves investigating the presence of a long-run equilibrium relationship using the following UECM frameworks:

\[
\Delta \ln RGD_{t} = \alpha_{0} + \alpha_{1}\Delta \ln RGD_{t-1} + \alpha_{2}\Delta \ln HEXP_{t-1} + \sum_{i=1}^{q} \alpha_{3}\Delta \ln RGD_{t-1} + \sum_{i=1}^{p} \alpha_{4}\Delta \ln HEXP_{t-1} + \mu_{1} - - - - (1)
\]

\[
\Delta \ln HEXP_{t} = \beta_{0} + \beta_{1}\Delta \ln HEXP_{t-1} + \beta_{2}\Delta \ln RGD_{t-1} + \sum_{i=1}^{q} \beta_{3}\Delta \ln HEXP_{t-1} + \sum_{i=1}^{p} \beta_{4}\Delta \ln RGD_{t-1} + \mu_{2} - - - - (2)
\]
From equation (1) and (2), Δ represents the difference notation, while lnRGDP and lnHEXP represent the natural logarithms of RGDP and HEXP. The null hypothesis for each of the equation is: 

\[ H_0: \alpha_1 = \alpha_2 = 0, \quad H_1: \beta_1 \neq \beta_2 \neq 0 \]

From Eqs. (1)–(2), the F-test can be used to examine whether a long-run equilibrium relationship exists between the variables, by testing the significance of the lagged level variable. The computed F-statistics for cointegration are denoted as \( F_{RGDP}(RGDP/HEXP) \) and \( F_{HEXP}(HEXP/RGDP) \) for each equation, respectively.

Cointegration implies the existence of causality. However, it does indicate the direction of the causality relationship. Therefore, the pair-wise Granger causality is employed to detect the direction of causality through the following equations:

\[
RGDP_t = a + \sum_{i=1}^{p} \mu_i RGDP_{t-i} + \sum_{j=1}^{q} \rho_j HEXP_{t-j} + v_t \tag{3}
\]

\[
HEXP_t = b + \sum_{i=1}^{m} \gamma_i HEXP_{t-i} + \sum_{j=1}^{n} \delta_j RGDP_{t-j} + \varepsilon_t \tag{4}
\]

where RGDP\(_t\) and HEXP\(_t\) are defined as RGDP and HEXP observed over \( t \) time periods; \( p \) and \( q \) represents the number of lags; \( \mu, \rho, \gamma, \) and \( \delta \) are parameters to be estimated; \( v_t \) and \( \varepsilon_t \) represents the serially uncorrelated error term.

### Analytic Result

**Table 1: Unit Root Test**

<table>
<thead>
<tr>
<th>Variable</th>
<th>PP test at Level</th>
<th>PP test at first Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGDP</td>
<td>1.688737</td>
<td>-5.161585***</td>
</tr>
<tr>
<td>HEXP</td>
<td>-0.606454</td>
<td>-11.78003***</td>
</tr>
</tbody>
</table>

*Source: authors’ calculation using EVIEWS software, ***indicates level of significance at 1%*

The results, reported in Table 1, indicate that RGDP growth and HEXP are non-stationary in their respective levels. Then again, after first differencing the variables, the null hypothesis of a unit root in the PP tests were rejected at the 5% significance level for both series. Thus, the two variables are integrated of order one, I(1).

**Table 2: Bounds Test Results**

<table>
<thead>
<tr>
<th>F-Statistic</th>
<th>Critical Values at 5%</th>
<th>Lower bound</th>
<th>Upper bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>( F_{RGDP}(RGDP/HEXP) = 12.0378 )</td>
<td>3.3937</td>
<td>4.4704</td>
<td></td>
</tr>
<tr>
<td>( F_{HEXP}(HEXP/RGDP) = 1.7767 )</td>
<td>3.3937</td>
<td>4.4704</td>
<td></td>
</tr>
</tbody>
</table>

*Source: authors’ calculation using MICROFIT software.*

The cointegration results show that null hypothesis of no cointegration is rejected at the 5 percent level in model 1. However, in the second equation, the null hypothesis of no cointegration is accepted same level of percentage. As is seen from Table 2, the computed F-statistics exceed the 5% upper bounds critical values in \( F_{RGDP}(RGDP/HEXP) \) equation. Therefore, these variables are co-moved in the long run.
Table 3: Pair Wise Granger causality test

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Obs</th>
<th>Number of Lags</th>
<th>F-Statistic</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEXP does not Granger Cause RGDP</td>
<td>30</td>
<td></td>
<td>3.36082</td>
<td>0.07781</td>
</tr>
<tr>
<td>RGDP does not Granger Cause HEXP</td>
<td>30</td>
<td></td>
<td>5.29976</td>
<td>0.02927</td>
</tr>
</tbody>
</table>

Source: authors’ calculation using EVIEWS

The presence of cointegration does not imply the direction of causality because the Granger Representation Theorem only documented that there must be causation if the variables are cointegrated. Therefore, pair wise Granger causality test result shows that there is a bi-directional causality between the health expenditure and economic growth in Nigeria. This suggest that both the variables granger cause one another, meaning that there is two-way relationship between them.

Conclusion
This study analyzed empirically the relationship between health expenditure and economic growth in Nigerian economy from 1980-2010 period using the newly developed autoregressive distributed lag (ARDL) bound test approach to cointegration and Pair wise Granger causality test. The cointegration results provide evidence of a unique cointegrating relationship between health expenditure and economic growth exist. That means health expenditure and economic growth move together in the long run. The results of Granger causality test indicate that there is bidirectional causality between health expenditure and economic growth in Nigeria. Therefore, the study concludes that a higher awareness of the health of the people is necessary if sustainable growth is pursued. It is therefore, important for the Nigerian government to include investment in health as a tool of macroeconomic policy, due to the fact that differences in economic growth rates between countries have been significantly explained by health differences, showing that investment in health improves economic growth and is one of the few feasible options to destroy poverty traps as demonstrated in Aguayo and Irish (2005).

References


