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An empirical investigation of health care expenditure and national income in Togo

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Abstract
This empirical study examined the health care expenditure and national income in Togo, more unambiguously, the study investigated the determinants of health expenditure and national income in Togo economy. The results from the ordinary least squares (OLS) method revealed that the proportion of population aged between 0-14, GDP per capita and total fertility rate are significant in explaining the changes in real health care expenditure per capita in Togo. More conceivably, the empirical outputs showed that healthcare expenditure is a luxury good, because the coefficient of the natural log of GDP per capita variable was greater than one in the studied area. The findings of the study exhibited considerably perverse relationship between health care expenditure and national income in Togo health industry.

Keywords: Ordinary least squares (OLS), health care expenditure, national income, Togo

1. Introduction

The continuous innovation in technology and science brought adequate solutions to most of health disease. However, those solutions didn't come without cost. Increasing in health expenditure has become a huge challenge worldwide mostly because of economic recession and rising in healthcare costs. In economics, an important question is how health expenditure is financed and what the part of national income involved is. To answer that question, one must know the structure of healthcare system in the countries under study. Togo which is a Low-income country literally rely more heavily on private funding especially household out-of-pocket payments (Sandra Hopkins, 2010). The little public healthcare spending that happens in Togo is mainly financed with insufficient tax revenues, internal and external loans and restricted foreign grants, other healthcare funding sources available are either private or out-of-pocket payments, fee-for-service and private health insurance schemes (poullier. JP 2002).

In Togo, investing in human capital in order to reduce effective poverty and improve the health care system is one of the highest priorities of the Government.

The healthcare system in Togo is organized a pyramid of three levels. At the first level, we have the Minister's cabinet and its central directorates, teaching hospitals, the blood transfusion centre, the psychiatric hospital. At the second level, we have the six regional healthcare offices and a representation in each region with the Regional Hospital Centres. At the third level, we have the district hospitals, the public peripheral care units and the private care units. The country is divided into six healthcare regions; Lomé district, the maritime region, the plateau region, the central region, the Kara region and savannah region. They are subdivided into 40 districts in total. Since 2010, the national approach of the country on healthcare system planning has evolved. The regional initiatives such as Harmonization for health in Africa (HHA) and the International Health Partnership (IHP+) have shaped the new reforms. But still almost half of all health spending is out of households' pockets; essentially cost recovery, user fees and purchase of medicine. The healthcare system often suffers from socio-political instability. Between 1990 and 2005 the socio-political instability has led to 62% in official development assistance and a reduction in the share of external assistance in gross domestic product from 13.8% to 3.3%. The USAID states in one report (February 2016) that: "nearly 12% of the population in urban and rural zones cannot access health care services for financial reasons. This rate ranges from 4.8% to13.8% across regions. More than 15% of women have no access to health care services due to financial reasons, compared

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with 10% of men". Around 6% of the population is covered by health insurance mostly in old age pension, disability, family allocations and health insurance for workers in the public sector. In 2011, a legislation calling for a scheme of national health insurance targeting civil servants, central administration staff, local collectivities, Para-public agencies and retired public service workers was called. The fees for caesarian sections were also canceled the same year. In 2012, the national health insurance started with INAM (Institut National d' Assurance Maladie); mostly with public sector workers.

Recent empirical studies on healthcare expenditure in Togo and conceivably some African countries largely focused their studies on how Government can improve the health sector (Saleh K 2012, Pillinger J. 2011) [12, 9]. Some of these studies are also based on theoretical investigations largely on selected few characteristics in the health industry (Yoshida S, Martines J, Lawn JE, Wall S, Souza JP, Rudan I, *et al* 2016, Nolte E, McKee M 2004, Aboagye E, Agyemang OS, Sidney K 2014 etc.) [14, 8, 2]. Based on these seemly distortions in the existing literature, this study seeks to examine the relationship between health care expenditure and national income in Togo by using annual data configuration from the standpoint or perspective of pull and push side factors. This study will contribute to the existing literature by showing the financing status of health care as a form of necessity or luxury in the context of Togo.

2. Literature Review
The connections between health care expenditure and national income portray equivocal and debatable setups. Numerous studies were found using different types of data and different methods to get the empirical outputs. These researchers used mixed approaches in their individual studies, some were basically cross-sectional studies, whiles some are panel. Its consequently, imperative to take a retrospective look at these studies.

Abasimi Ignatius *et al* (2018) [1] carried out an empirical study on health care expenditure and national income in Ghana using the OLS method. The results revealed that the proportion of population aged 65 and above, proportion of population aged between 0-14, GDP per capita and literacy rate are significant in explaining the changes in real health care expenditure per capita in Ghana. Moreover, the empirical outputs showed that healthcare expenditure is a necessity good in the Ghana.

N. lien *et al* (2009) [7] used panel data of the year 1993 to 2004 and two-stage estimation procedure to examine the determinants of health care expenditure in a decentralized health care system as a case study in Finland. The authors concluded that the differences in municipal total health expenditure were mainly explained by shares of elderly, the employment-to-population ratio, the rate of disability pensions, the municipal tax rate, the NHI reimbursements of prescription medicines and private dental care, income and population density. The measures of income elasticity were small, indicating the public health care is a major necessity in Finland.

K Gyimah- Brempong *et al* (2004) [5] used data from 21 Sub-Saharan African countries over the period of 1975 to 1994 and 22 OECD countries over the period of 1961 to 1965 to test on the effects of human capital on the growth

rate of per capita income. They found the marginal effect of positive relationship between health human capital and the growth rate per capita income eventually diminishes. Health human capital investment yields positive correlation with per capita income growth for both Sub-Saharan African countries and OECD countries.

Akinkugbe and Mohanoe (2009) [3] performed time series analysis using the error correction model (ECM) and found that in addition to public health care expenditure, the availability of physicians, female literacy and child immunization significantly influenced health outcomes in Lesotho.

Filmer and Pretchett (1999) [4] provided evidence to show that while health care spending impact on child mortality, it is not the dominant driver of this health outcome. Factors such as education, technological change, income and cultural differences have been identified by some researchers as major drivers of health outcomes rather than health care spending.

R.R. Rao (2008) [11] performed a study to identify the link between health care expenditure to GDP and quality of Life (QoL) on five ASEAN countries namely; Malaysia, Singapore, Thailand, Philippines and Indonesia from 1981 to 2005. The authors used GDP and health care expenditure to measure the quality of life and applied the Granger causality test to the direction of causality between GDP and health care expenditure. The results found that there was existence of unidirectional Granger causality running from GDP to government health care expenditure for in Malaysia and Singapore. On the other hand, Thailand and Indonesia showed a bidirectional Granger causality of GDP and health care expenditure. It concluded that economy performance is important in determining quality of life.

K. M. Wang (2011) [6] noted that the influence of health care expenditure growth was significantly different on countries with low level of economic growth when the economic growth was quantile. Countries with medium and high levels of economic growth, exceeding 5 percent would have positive influence of health care expenditure growth on economic growth. The panel quantile regression applied in this study had an advantage of providing estimated results of various quantiles under a change in economic growth. However, Baumol (1993) believes that health care is "an industry whose costs are driven by technological imperatives to rapid rise".

V. N. R. Murthy, A. A. Okunade (2009) [13] examined the determinants of health care expenditure in 44 African countries. They studied on the cross-sectional data for the year 2001 using Ordinary Least Square (OLS) and Two-Staged Least Square (TSLS) method. They concluded that per capita real GDP and per capita real foreign aid were the two major determinants of health care expenditure. The non-income factors in this study were like persons per physician, percentage of population over 65 years and mortality per 1000 persons played a small role as determinants in health spending.

3. Methodology and Data Source
This section highlights and describes the econometric methodology and the data that were used to established and analyzed the underlining topic of discussing.
The study employed annual data from 1995-2015 which is

sourced from the website of world Bank databases (https://data.worldbank.org/) and Gapminder databases (https://www.gapminder.org/data/). The variables extracted from this database includes; health care expenditure per capita (HCE), which comprises of healthcare goods and services consumed during each year. Total fertility rate (TFR), total fertility rate represents the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with age-specific fertility rates of the specified year. Proportion of population aged 65 and above (POP65). Proportion of population aged 0-14 (POP14). Crude death rate per 1000 person (CDR), 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. Literacy rate (LTR) which is proxied as educational level. Literacy rate in this study refers to the number of secondary students enrolled in technical and vocational education programs, including teacher training and finally GDP per capita (GDP).

The study adopted the ordinary least square (OLS) method for the empirical econometrics' analyses. The justification for utilization of this method is that it minimizes the sum of the square's errors of the differences between the observed regress and (dependent) and the predicted regressors (independent). The OLS estimator is consistent when the regressors are exogenous, and optimal in the class of linear unbiased estimators when the errors are homoscedastic and serially uncorrelated. Under these conditions, the method of OLS provides minimum-variance, mean-unbiased estimation, when the errors have finite variances. The model can empirically be expressed in matrix notations as fellows;

$$Y = X\beta + \varepsilon \qquad (1)$$

$$HCE = \begin{Bmatrix} TFR & POP65 & POP14 & \vdots \\ CDR & GDP & LTR & \vdots \end{Bmatrix}$$

Where Y and ε are $N\times 1$ vectors of the values of the observed or response variable (the regress and: health care expenditure per capita) and unobserved scalar random variables (the errors) for the various observations. β is a $p\times 1$ vector of unknown parameters; regressors.
Equation (1) can further be expressed as;

$$Y_i = \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots \beta_w X_{iw} + \varepsilon_i \qquad (2)$$

Where Y_i (regress and) is a linear function of the regressors $X_{i1} \ldots X_{iw}$ and $\beta_1 \ldots \beta_w$ are unknown parameters and ε_i is the 'noise' or error term.
Equation (2) is further extended to include the study variables as follows;

$$HCE = \beta_0 + \beta_1 TFR + \beta_2 POP65 + \beta_3 POP14 + \beta_4 CDR + \beta_5 GDP + \beta_6 LTR + \varepsilon \qquad (3)$$

Where:
The regress and
HCE_t = Health care expenditure per capita time t
The regressors are;
TFR_t = Total fertility rate at time t
$POP65_t$ = Proportion of population aged 65 and above at time t
$POP14_t$ = Proportion of population aged 0-14 at time t
CDR_t = Crude death rate per 1000 person at time t
GDP_t = GDP per capita at time t
LTR_t = Literacy rate at time t
β = coefficients of the regressors
ε = Represents the random error term.

4. Data analysis and discussions

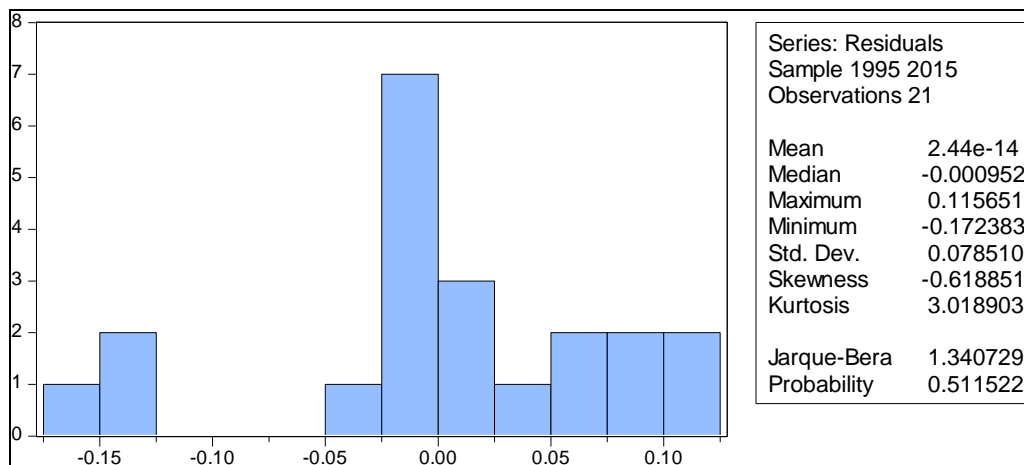| Series: Residuals	
Sample 1995 2015	
Observations 21	
Mean	2.44e-14
Median	-0.000952
Maximum	0.115651
Minimum	-0.172383
Std. Dev.	0.078510
Skewness	-0.618851
Kurtosis	3.018903
Jarque-Bera	1.340729
Probability	0.511522

Fig 4.1: Residual diagnostics test (normality test)

The results from the normality test (figure 4.1) suggests that the data is normality distributed. The probability value of the Jarque-Bera test is greater than 5% significance level which in this case, we fail to reject the null hypothesis and conclude that the data is asymptotically normally distributed.

Stability Diagnostic Test
Figure 4.2 shows the CUSUM tests and CUSUM of squares test of stability for the variables considered in the study. The figure reveals no structural breaks in the CUSUM tests, however, there is a slight digression from CUSUM of squares test. In general, the study parameters are quite stable and somewhat robust.
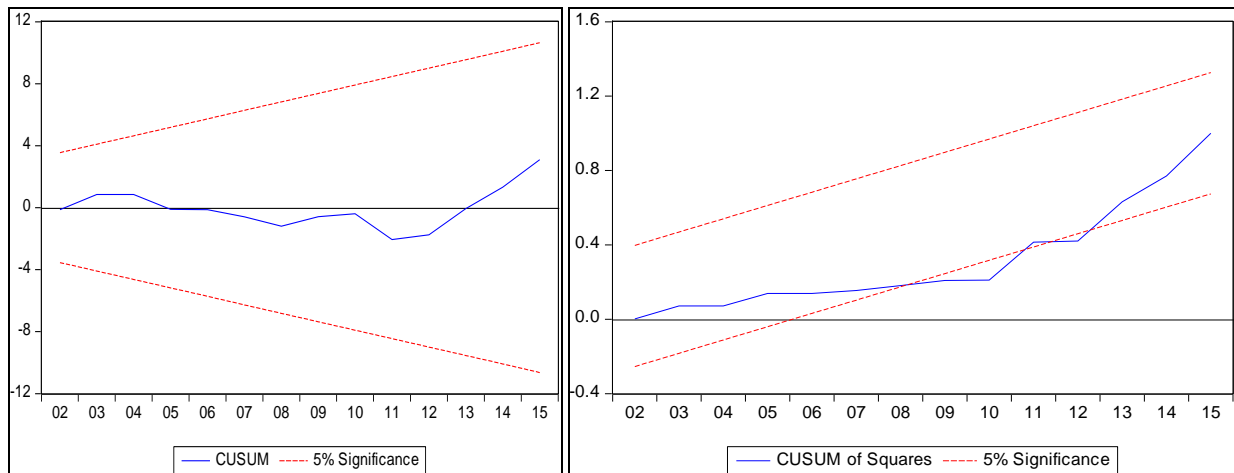
Fig 4.2: CUSUM tests and CUSUM of squares test

4.1 Ols Estimates
Dependent Variable: LNHCE
Method: Least Squares

Sample: 1995 2015
Included observations: 21

Variables	Coefficient	Std. Error	T-Statistic	Prob.
LNTFR	15.36134	5.380553	2.854973	0.0115**
LNPOP65	0.666129	2.126426	0.313262	0.7581
LNPOP14	7.848560	3.057566	2.566930	0.0207**
LNCDR	-0.059516	1.879516	-0.031665	0.9752
LNGDP	1.023457	0.216047	4.737207	0.0002***
LNLTR	-0.026566	0.154226	-0.172252	0.8657
C	-142.8054	54.64568	-2.613298	0.0188

Asterisk *** and * indicates 1% and 15% significance

R-squared	0.962858	Mean dependent var	3.202007
Adjusted R-squared	0.953572	S.D. dependent var	0.407894
S.E. of regression	0.087890	Akaike info criterion	-1.821213
Sum squared resid	0.123593	Schwarz criterion	-1.572517
Log likelihood	24.12274	Hannan-Quinn criter	-1.767240
F-statistic	103.6935	Durbin-Watson stat	1.550583
Prob(F-statistic)	0.000000		

Justifications and Discussion

From table 4.3, the estimated p-values for population aged; 65 and above, crude death rate per 1000 persons and literacy rate were greater than the significant levels (1%, 5% and 10%), perhaps, they are not significant in explaining changes in health care expenditure per capita in Togo. However, the estimated p-values for proportion of population aged between 0-14, GDP per capita and total fertility rate were within the significant levels, specifically within 1% and 10% levels. These parameters are therefore decisive, vital and significant in explaining the changes in real health care expenditure per capita in Togo.

The coefficient of the natural log of GDP per capita variable in the model can be elucidated as an estimate of the income elasticity of health care expenditure per capita. Income elasticity of a good between zero and 1 is a necessity good whereas income elasticity of a good greater than 1 is a luxury good. Therefore, a value of 1.023457 implies that a substantial spending on health is due to a marginal increase in income. Consequently, health care expenditure is seen as a luxury good in Togo. This effect might not be exactly what is trendy on the grounds but conceivably, can be extrapolated as the value the citizenry place on health. The positive relationship of proportion of population aged 65 and above and health care expenditure per capita is in support of the popular notion of ageing population leads to increase in health care expenditure, unfortunately, its coefficient was not significant. Again, the positive and significant sign of the proportion of population aged between 0-14 is considerably vital as it raise the health care expenditure by its coefficient value. This is so because these group of individuals needed more health attention such as vaccination and immunization. The positive coefficient sign of total fertility rate also suggest that the more people are fertile, the higher the chance they will fulfill their biological destiny of child bearing. This may require channeling more resources into the health sector which consequently increases the total health expenditure per capita.

5. Conclusion Remarks

This empirical study looks at health care expenditure and national income in Togo, more specifically, the study investigated the determinants of health care expenditure in Togo. The results revealed that total fertility rate, proportion of population aged between 0-14 and GDP per capita are significant in explaining the changes in real health care expenditure per capita in Togo. Moreover, the empirical output demonstrated that healthcare expenditure is a luxury good in the studied area. The findings of this study exhibit somewhat pervasive and vigorous relationship between

health care expenditure and national income in Togo economy, this relationship further supported "The Income View"; of national income determines health care expenditure.

In order to obtain more effective result, a longer data set should be employed in future, it would be better that the supply side factors of health care expenditure such as technological and medical progresses and human capital should be incorporated into the study to capture the determinants of health care expenditure wholly from both the demand and supply side effects as to ensure a more complete analysis.

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