



Inflation and Life Expectancy in Nigeria: A Granger Causality Approach

Nurudeen Abiodun Lawal¹, Kunle Bankole Osinusi²,
Sodiq Olaide Bisiriyu³

Abstract: This study focused on the examination of inflation and life expectancy in Nigeria using causality analysis from 1980 to 2019. The study acknowledges literature on the determinants of life expectancy and overview of life expectancy in Nigeria over the years as well as the overview in some selected developed and Sub-Saharan Africa countries. The study gathered secondary data from World Bank World Development Indicators Dataset for empirical analysis by adopting the ADF unit root test, VAR autoregressive lag order, and Granger Causality test. The result revealed that all the incorporated data are stationary justifying their inclusion for analysis. The Granger causality result affirmed no causality between life expectancy and inflation rate in Nigeria over the years of analysis while there is uni-directional causality in the other variable (exchange rate) and life expectancy over the period of analysis in Nigeria. This means the inflationary trend in Nigeria was not significant in influencing life expectancy in the country while the exchange rate does. The study thus recommends that government agencies and monetary authority of countries should carefully provide frameworks that will ensure stability in exchange rate having known its significance on life expectancy; while health policymakers, practitioners, and government health ministry across the world should develop plans and strategies for increasing life expectancy rate mostly among Sub-Saharan Africa countries as the figure stood low in this region compare to other regions of the world.

Keywords: Exchange Rate; Granger Causality; Inflation; Life expectancy

JEL Classification: E31; F31; I12

¹ PhD, Department of Economics, Tai Solarin University of Education, Nigeria, Address: Ijagun Road, 120101, Ijebu Ode, Nigeria, E-mail: naf_lawal@yahoo.com.

² Ph.D., Department of Economics, Tai Solarin University of Education, Nigeria, Address: Ijagun Road, 120101, Ijebu Ode, Nigeria, E-mail: bank_kunle77@yahoo.com

³ Department of Economics, Tai Solarin University of Education, Nigeria, Address: Ijagun Road, 120101, Ijebu Ode, Nigeria, Corresponding author: bisiriyusodiqolaide@gmail.com.

1. Introduction

Life expectancy is an important health variable to economies of the world, most especially the developing ones like Nigeria who are on the track of achieving sustainable economic growth and development. Life expectancy is associated with the health of individuals; the World Health Organization (WHO) defined health as a state of not being the only absence of disease or illness but having physical, psychological, and social fitness. Results of empirical researches revealed that several variables such as household income, health price, government expenditure, inflation, etc., affect health in Nigeria (Salatin & Bidari, 2014; Ude & Ekesiobi, 2014; Klobodu *et al.*, 2018).

There are various dimensions of the definition of life expectancy in the existing literature. Life expectancy simply means the expected average number of years an individual will live. Sade and Ohemeng (2015) defined life expectancy as a measure of how lengthy an individual is expected to live after birth. However, the Sustainable Development Goals (SDG's) identified the significance of health as a key input factor to economic development. Economic growth and development are spur by individuals of a country and it can only be possible if and only an individual's life span is lengthy coupled with good health in form of an increased level of production.

Notably, the increase in the general price level of goods and services over time has remained one of the burning issues in every economy (especially in developing nations). It is argued that inflation is inevitable in an economy but should not exceed a single digit in order to achieve economic growth and development (*ceteris paribus*). Inflation simply means an overall and persistent increase in prices of goods and services over time, whereas its impact hurts individuals and the economy at large in forms of reduced saving which translates to low investment, fall in the standard of living, low purchasing power, increase government expenditure, balance of payment problem and so on.

Inflation is one of the economic determinants of life expectancy as asserted by Monsef and Mehrjardi (2015), whereas the life expectancy of a country is an indication of how well a nation's health care has developed and also presents its overall health position. Having established the significance of inflation on life expectancy and health in general, this study seeks to explore the causality between inflation and life expectancy in Nigeria. The guiding hypothesis of the study is that inflation does not granger cause life expectancy in Nigeria. To our knowledge, the review of the existing literature on this topic revealed that no paper has attempted to analyze or examine the relationship or analyze the causal relationship between inflation and life expectancy in Nigeria. Similar to this study is the work of Sade and Ohemeng (2015) who looked at the socioeconomic determinants of life expectancy in Nigeria while in Sub-Saharan Africa are the study of Monsef and Mehrjardi (2015) and Abubakari, Nketial-Amponsah & Owoo (2019).

2. Overview of Nigeria Life Expectancy

Despite the increase in life expectancy in Nigeria for the past two decades, it still lag far behind that of developed countries of the world like Japan, the United States of America, China, etc., and some countries in Sub-Saharan Africa e.g. Ghana, Kenya, and so on (Sede & Ohemeng, 2015). The figure was given as 45.6 years in 1981, 46.1 years in 1985 which indicates an increase of about a year. It declined to 45.8 years in 1993 but later increase in the successive year 1994 to 48.2years. However, the figure had since 1995 maintained an upward shift getting to 50.8years in 2010 and 53.4years in 2016 (CBNSB, 2017 & WDI, 2018). The figure rose by 0.84% in 2017 which put the figure at 53.73years and later increased to 54.18years and 54.81years in 2018 and 2019 respectively representing 0.83% and 0.58% increase in each year. However, according to United Nations (2020) World Population Prospects, the figure was given as 54.81years.

The table below presents the life expectancy figure in some selected developed countries and Sub-Saharan Africa countries from 1999-2018.

Table 1. Average Life Expectancy in Some Selected Countries from 1999-2018

Countries	1999-2002	2003-2006	2007-2010	2011-2014	2015-2018
Nigeria	46.43	48.01	50.15	52.01	53.73
South Africa	55.65	53.31	55.99	60.51	63.30
Ghana	57.14	58.49	60.41	61.90	63.29
U.S.A.	76.75	77.43	78.24	78.74	78.58
China	71.56	72.83	73.98	75.17	76.33
Japan	81.16	82.01	82.72	83.15	84.02

Source: World Development Indicator (2020)

The above table shows that life expectancy has increased over the years in developed and developing countries like Nigeria. However, from the analysis, Nigeria's figure is very far behind those of developed countries as evidenced in the Japan, U.S.A, and China with average life expectancy above 80, 76, and 71years respectively for the past two decades. In addition, Nigeria's life expectancy figure is also below that of Ghana, Kenya, and South Africa who belong to the same Sub-Saharan Africa like Nigeria. The analysis also reveals that the country's life expectancy has always been below the United Nations (UN) average global estimates. This indicates there is an apt need for the Nigerian government through its agencies to improve and develop the health care system in order to reduce the imbalance and health care deficit of the country among other nations in Sub-Saharan Africa and the rest of the world.

3. Review of Related Literature

The theoretical justification of this study was traced to Grossman (1972) who in his analysis postulated that the economic propensity of an individual is an important factor to affordability in the consumption of health. A review of the existing empirical literature on this subject under examination reveals that most existing studies focus on the socio-economic and environmental factors or determinants of life expectancy.

Abubakari, Nketiah-Amponsah, and Owoo (2019) found GDP per capita, health expenditure per capita, and education to be positively related and have a significant impact on life expectancy in Sub-Saharan African countries. The result of Garcia, Rabago, and Ocat (2019) investigation among 120 selected countries showed that the inflation rate of a country significantly predicts its life expectancy outcomes. The analysis further reveals that an inverse relationship exists between life expectancy and inflation rate.

Somayeh *et. al.* (2016) who examined life expectancy and its socio-economic determinants in Iran found GDP per capita, population, number of doctors, food availability, and literacy rate to be positively related and statistically significant on life expectancy at nascence. Similarly, in the study of Hassan *et. al.* (2016) among some selected developing countries over the period of 2006 to 2010, it was revealed that a significant relationship exists between life expectancy, gross domestic product, and education index and it further established the existence of bidirectional causality between life expectancy and income in the long run.

Sede and Ohemeng (2015) in their study found education, per capita income, and government expenditure on health not to be significant factors determining life expectancy in Nigeria. Monsef and Mehrjardi (2015) analyzed the determinants of life expectancy among 136 selected countries between 2002 and 2010 and the result from the analysis suggests that inflation and unemployment are the most economic determining factors causing a decline in life expectancy.

Salatin and Bidari (2014) using the Generalized Moment Method (GMM) in their study on some selected middle-income countries from 1997 to 2011 found inflation to have a negative and significant impact on women's life expectancy and a positive significant impact on female's death rate in the group of selected middle-income countries.

4. Methodology and Data Analysis

Sims (1998) and Todd (1990) posit that if there is true simultaneity amidst a group of variables, the distinction between explanatory and explained variables is not required. This background forms their basis for developing the vector autocorrelation

model (VAR) based on the Granger causality test. The Granger causality test assumes that relevant information is available to forecast each variable, LE and InF, is contained mainly in the time series data on these variables. The test involves evaluating the following set of regressions:

$$LE_t = \sum_{i=1}^n a_i \text{InF}_{t-i} + \sum_{j=1}^n b_j LE_{t-j} + u_{1t} \dots \dots \dots (1)$$

$$\text{InF}_t = \sum_{i=1}^n \lambda_i LE_{t-i} + \sum_{j=1}^n \delta_j \text{InF}_{t-j} + u_{2t} \dots \dots \dots (2)$$

where: LE = Life Expectancy and InF = Inflation Rate

The time series annual data from 1980 to 2019 were gotten from World Development Indicator; World Bank Data, 2019. For robust analysis, the study included exchange rate in the granger causality analysis procedure.

Granger and Newbold (1974) found that the regression results from the VAR models of the Granger Causal tests using transient variables will be incorrect. To avert this, we test the stationarity of the variables of the model based on the Augmented Dickey-Fuller unit root test.

Data Description

a. Unit Root Test

To verify the stationary of the datasets employed, the variables were subjected to a unit root by adopting the Augmented Dickey-Fuller statistics. The results are reported in the table below:

Table 2. Summary of ADF Unit Root Test

Variables	ADF Statistics	Critical Values @ 5%	Prob*	Order of Integration	Inference
EXR	-4.203859	-2.941145	0.0021	I(1)	Stationary
INF	-5.834835	-2.941145	0.0000	I(1)	Stationary
LE	-3.01861	-2.945842	0.0952	I(1)	Stationary

Source: Researchers' Computation, 2020

The above results in table 2 indicate that the variables of the model (real exchange rate, inflation rate, and life expectancy) are stationary at the first difference i.e. I(1) order of integration.

b. Vector Autoregression (VAR) Lag Order Selection Criteria

VAR model was fitted to the time series data in order to select a suitable lag structure for the Granger causality test. This need arose due to the sensitivity and connection between lag length structure and Granger causality (Foresti, 2006; Afzal, 2012; Oyibo *et. al.*, 2012). Table 3 below presents the result indicating the optimal lag

length is five based on the value of Likelihood ratio, Final Prediction Error (FPE), Schwarz Information Criterion (SIC), and Hannan Quinn Information Criterion.

Table 3. VAR Lag Order Selection Criteria Result

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-388.5547	NA	4061306.	23.73059	23.86664	23.77637
1	-251.4348	240.9986	1729.711	15.96575	16.50993	16.14885
2	-179.5283	113.3073	38.83099	12.15323	13.10555	12.47366
3	-156.7891	31.69697	17.56413	11.32055	12.68102	11.77831
4	-138.5615	22.09406	10.83482	10.76131	12.52991	11.35639
5	-114.8761	24.40321*	5.075248*	9.871277	12.04801*	10.60368*
6	-103.7355	9.452602	5.528562	9.741545	12.32642	10.61128
7	-93.22291	7.008394	7.131743	9.649873*	12.64289	10.65693

* 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

c. Granger Causality Test

As given in table 3 above, the Granger causality test was conducted using the given five optimal lag lengths. The result is presented in table 3 below:

Table 4. Result of Pairwise Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.	Inference
INF does not Granger Cause LE	35	0.46906	0.7955	No Causality Exist
LE does not Granger Cause INF		1.74857	0.1619	No Causality Exist
EXR does not Granger Cause LE	35	6.56094	0.0006	Causality Exist
LE does not Granger Cause EXR		1.74725	0.1622	No Causality Exist
EXR does not Granger Cause INF	35	0.48810	0.7818	No Causality Exist
INF does not Granger Cause EXR		1.09163	0.3904	No Causality Exist

The result from the Granger causality test reveals that there is no causal relationship between inflation and life expectancy in Nigeria; it also reveals that there is bi-directional causality from exchange rate to life expectancy which invalidates the hypothesis of no causal relationship between exchange rate and life expectancy.

Finally, the causal analysis showed that there was no causality between exchange rate and inflation over the years on analysis in Nigeria.

The result of the study that inflation does not granger cause life expectancy is in contrast with the finding of Garcia, Rabago, and Ocat (2019) who found that the inflation rate of a country significantly predicts the resultant of its life expectancy. In the same vein, the result of this Granger causality analysis disagrees with the result of Monsef and Mehrjardi (2015) whose analysis suggests that inflation and unemployment are the most economic determining factor influencing life expectancy negatively.

5. Conclusion and Recommendation

In an attempt to examine the causal link between inflation and life expectancy in Nigeria over the period of 40 years (1980 - 2019), the study was able to establish through the Granger causality test that there is no causality between inflation and life expectancy in Nigeria and it also establishes that there is a uni-directional causal link from exchange rate to life expectancy in Nigeria of the period of under analysis consideration. Based on these findings, it is thus recommended among others that:

- i. Government agencies and monetary authorities of countries especially in Nigeria should carefully provide frameworks that will ensure stability in exchange rate having known its significance on life expectancy.
- ii. Health policymakers, practitioners, and government health ministries across the world should develop plans and strategies for increasing the life expectancy rate mostly among Sub-Saharan Africa countries as the figure stood low in this region compared to other regions of the world.
- iii. Government should invest and allocate more resources to the health sector in order to achieve desirable health outcomes.

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