Economic Performance and Life Expectancy in Nigeria

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Certification

This is to certify that Adebayo John JULIUS with Matric No. LCU/PG/001759 carried out this research work titled "Economic Performance and Life Expectancy in Nigeria" in the Department of Economics, Faculty of Management and Social Sciences. Lead City University, Ibadan, Oyo State, for the award of Master Degree in Economics and this has not been previously submitted.

…… ……

Dr. O. Y. Alimi Date

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Dedication

This Thesis is dedicated to the Almighty God, the giver of knowledge.

Acknowledgement

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Abstract

This study investigated the relationship between economic performance and average life expectancy (LEXP), male life expectancy (LEXPM), and female life expectancy (LEXPF) in Nigeria between 1981 and 2020. The economic performance indicators adopted for this research include income per capita, unemployment rate, inflation rate, external debt, foreign exchange rate, and government health expenditure. The relationship between economic performance indicators (EPIs) and life expectancy in Nigeria was studied based on neoclassical and endogenous growth theories. Data were analyzed using descriptive statistics, and the co-integration technique (ARDL Bound test). The response of life expectancy to shocks in EPIs was examined using impulse response function and variance decomposition analysis, The short-run causal link between EPIs and life expectancy was examined using Granger causality based on TYDL procedure and VECM while the long-run causality was based on TYDL procedure and VAR. The test result revealed a co-integration of all the variables at the first difference I(1) except inflation rate I(0). The error correction term (ECT) implied that the short-run models of LEXP, LEXPM, LEXPF respectively adjusted their disequilibrium by 31.85%, 34.68%, and 29.0% speed of adjustment to return to the long-run equilibrium. The response of life expectancy to a Cholesky one standard deviation shock exerted on each EPI translated into a different form of reaction. A uni-causality was revealed in the short-run between the EPIs and life expectancy but in the long-run, there was feedback from life expectancy to external debt and inflation rate. The Government was advised to reduce external debts and cultivate the culture of using the borrowed funds for its cause.

Also, the stability of EPIs should be prioritized, and a true development plan should be introduced at all levels of government for inclusive growth and long life expectancy in Nigeria.

Keywords: Economic performance indicators, Life expectancy, Relationship, Shocks, Causality, Nigeria

Word Count: 289

Chapter One

Introduction

1.1 Background to the Study

Among the critical indicators that described the level of development of a country is life expectancy. The average number of years that human lived in Nigeria is extremely low compared to some parts of the world. Life expectancy in Nigeria was 54.02 years in 2020[1], while countries like the United Kingdom (82 years), Japan (85 years), Hong Kong (85 years), South Korea (84 years), Australia (84 years), and Canada (83 years), among others almost double the Nigeria in terms of Life expectancy. In the same continent of Africa, countries similar to Nigeria have been observed to have higher life expectancies; among such countries are Mauritius (75 years), Kenya (67 years) and Ghana (64 years) among others. For decades, life expectancy in these countries has surpassed that of the Nigeria even though the causes of such disparities have not been robustly explored.

Majority of the African countries, especially the sub-saharan shared the same climatic conditions with Nigeria also, the economic and political system does not differ yet, life expectancy among these countries differs significantly[2]. Life expectancy to a greater extent described how a country is faring economically; it reflects the standard of living, health outcome, and the quality of lives of the people. Economic performance and economic agent (human) are inseparable from birth to death (the entire agent life cycle).

Correspondingly, the essence of any economy is to improve standards of living, provides affordable quality health care, nutritious foods, among others that contributes to longevity and quality of life. To achieve these, there is a need to strengthen and stabilize the macroeconomic indicators, in addition, the mechanism with which to attain higher life expectancy in Nigeria has been described to include full employment, interest and exchange

rate stability, low inflationary rate, improved healthcare, efficiency in government spending, equity, among others which are goals generally desired by society and pursued by governments through economic policies[3,].

The neoclassical and endogenous growth theories have posited that economic growth is a function of capital and labour where a unit increase in these production inputs will increase the output by the same unit[4]. Aligning these theories to this study means that capital could reflect in the form of investments in all sectors enabling improvement in per capita income of a country and reduce government borrowing (external debt). Labour and innovation according to the model is expected to bring about full employment and increased productivity, this equally contributes to increased domestic production and reduced dependence on importation thereby bring about from exchange stability[5].

Through the perspective of these theorists, life expectancy shall be set to be the output of the model while the economic performance indicators shall be the input of this model. Further, the impact of economic performance indicators shall be assessed on life expectancy to determine whether a unit increase in the economic performance indicators also translates to a unit increase in life expectancy. Also, shocks in economic perforce indicator shall be captured looking at the unprecedented events occurred to the economic performance indicators within the duration of the study and to examine the causality in the variables of study, both directions shall be explored, that is, life expectancy shall also be used as independent variable or a predictor of economic performance indicators.

Previously, it was submitted that GDP per capita increases the life expectancy at birth through sustainable economic growth and development[6]. Nevertheless, there has been an oversight regarding several other economic indicators such as unemployment rate, where the people who are capable and willing to work do not get jobs from which to earn incomes and

afford their need hence, constituted burdens and no positive contribution to the economy. This can hinder economic performance and directly or indirectly affect life expectancy.

Another important economic indicator is inflation rate, the general rise in the price level of goods and services, accompanied by a decrease in the purchasing value of money can prevent people of access to needs, wants and the desired quality of life. For instance, if prices fall, your purchasing power increases, indicating that a fall in price of health care can even increase the purchasing power for health thereby bring about quality health outcomes probable of increased life expectancy, same goes for unemployment rate. The inflation rate in the year 2020 as recorded among the emerged economies such as the UK, Australia, Canada, etc are 0.85%, 0.87%, 0.72% respectively while in Nigeria, inflation rate stood at 13.25% indicating a lower purchasing power and direct relationship with low quality of life.

Moreover, an improvement in these macroeconomic variables is to create optimum welfare for the citizenry. Welfare may come in form of improvement in health, happiness, and fortunes of a person or group[7, 8]. For instance, the welfare of a population can come in form of improved standards of living, which can only be achieved when macroeconomic variables are stable. Thus, the welfare of economic agents particularly the household and individuals in an economic setting must be fully prioritized not only that, inflation rate, unemployment rate, and government borrowings must be controlled to the barest minimum[9].

Very critical are exchange rate stability, increased income per capita, output, consumption; including policies among others are expected to translate and respond to providing better and improved living conditions for people[10]. Economically, the most important component of welfare is access and affordability to basic needs of life such as foods, quality health care, and security of lives and properties among others which strongly reflects in the life span of people[11].

To the present, there were no consensus as regards the causes of low life expectancy in Nigeria as debated among researchers, although, some explained their views based on genetic and medical reasons while some approached the issue through environmental perspective and others were of the opinion that it is more of economic concerns[12, 13, 14]. Consequently, the fluctuation of oil price per barrel at the international market has been described as a source of shock to other economic performance indicators in Nigeria with corresponding effects on life expectancy[15]. Similar to this are insecurity, civil unrest, and pandemic among others which suddenly changes the direction of the economy at any point in time. The adverse effects of these problems are not easy to neutralize by the government which ardently affect human life longevity through the shocks it engendered[16].

Apparently, shock which is an unpredictable occurrence to any of the economic performance indicators has been argued by previous studies to have influence on quality of life and health outcomes[17]. Existing studies have also demonstrated how life expectancy impact economic growth in different continents, in which strong and positive relationships were recorded between life expectancy, growth and development, further indicating that life expectancy is a necessity for promoting socio-economic development[18].

There is an agreement that economic development goes hand in hand with improvements in life expectancy[19]. As such, life expectancy is a strong indicator for measuring economic performance of a country among the rest nations; it is very important and necessary to aim high life expectancy as one of the conditions needed to achieve long-term sustainable economic development. Equally, as economic fluctuations and shocks are inevitable and the existing studies have lacked evidence regarding its association with life expectancy in Nigeria, it is essential to study how economic performance indicators affect life expectancy in Nigeria.

1.2 Statement of the Problem

A healthy living is a healthy economy[20]. This cannot be overstated given the related studies that have argued that healthy human life and longevity are important to economic development[21]. Life expectancy is extremely critical to the weighing of economic performance and positioning of a country among the rest in the world[22]**.** On the global scale, Nigeria ranks number 177 out of 178 for current life expectancy at birth, indicating the lowest life expectancy in the world after Lesotho. A major reason for low life expectancy in Nigeria is because of high prevalence of diseases in the country, according to the age-adjusted mortality ranking per 100,000 population in Nigeria, the most common illnesses are tuberculosis (1st), falls (2nd), maternal illness (3rd), whooping cough (4th) and diarrhea[23]. Influenza and pneumonia (15.03%), diarrheal disease (9.16%), tuberculosis (8.62%), HIV / AIDS (8.31%) and malaria (5.53%), stroke (4.10%), birth injury (4.01%), coronary heart disease (3.76%) and maternal condition (3.14%) are at the forefront of the Nigerian cause of death ranking list. All of these provide various explanations and contributions to low life expectancy recorded in Nigeria[24].

Among the key factors responsible for low life expectancy in Nigeria as summarized by the public health analysts are epidemics and global pandemics[25]. In their research, epidemics and pandemics are described as shocks. For instance, the unprecedented outbreaks of these diseases usually bring about changes in the directions of macroeconomic variables movement. Accordingly, the emergence of Ebola virus disease (EVD) between the years 2014 and 2016, that pictured an upward trend of mortality as well as the coronal virus disease (COVID-19) which has paralyzed various sectors of the economy through lockdowns[26, 27]. All these have posed different forms of fluctuations in the movement of macroeconomic variables which may affect human longevity.

Aside epidemic and global pandemic, the contributions of civil unrest, unstable policies, political and economic instability in Nigeria overtime cannot be overemphasized. This civil

war after the long-term colonial rule was described as the shocking human tragedy[28]. The war resulted from political, economic, ethnic, cultural, and religious tensions, and later graduated to dehumanization**.** In addition, during the two and half years of the war, there were about 100,000 overall military casualties, while between 500,000 and 2 million civilians died of starvation and malnutrition, the conflicts have had a profound effect on economic activity[29, 30].

In addition to the causes of low life expectancy in Nigeria, the economic perspective to life expectancy cannot be underestimated, most especially the undesirable fact that a country with an abundance of both human and natural resources, also being the largest producer of oil in Africa and number six in the world, the largest producer of natural gas in Africa, and the most populous, largest and strongest economy in the continent of African will undoubtedly not be among the leading countries with highest life expectancy if not globally but among her cohorts.

Statistically speaking, while Australia has an average of 83.5 years of life expectancy, the people of Sweden, Canada, New Zealand, Netherlands, and the United Kingdom (UK) are living 82.87, 82.5, 82.36, 82.35, 81.52, years of life expectancies respectively[31].

Notably, Nigeria is found at the bottom of life expectancy ranking of developing countries as categorized by the world bank, which indicated that Sri Lanka accounted for 77.22 average years of life expectancy, Morocco average life expectancy is 76.99 years, while Ukrain (76.99), Egypt (72.23), Indonesia (71.96), Philippines (71.41) all ascribed with over 71 years of life expectancy[32]. Even, Kenya (66.98), Ghana (63.45), and Benin (61.09), which are not too far from Nigeria still recorded appreciable years of life expectancy of over 60 years but Nigeria (55.19) wallowing below degrading 60 years of life expectancy which is the least globally after Lesotho (54.13) as reported[33].

In reality, Nigeria has gone through thick and thin and evidently, there are several government plans aimed towards making the country one of the best in the world which could not materialize as projected. From colonialism before independence in 1960 to civil war in 1968 which grossly led to failure of the development plan initiated within this period to bring the improved standard of living and quality of life. Within the periods 1975 - 1985, the second, third and fourth phase of the national development plan was introduced, despite the oil boom and increased government revenue expected to be used for the expansion of social infrastructure, reduction of inequalities and unemployment as well as enhancing the welfare of the citizenry[34]. It was however realized that the achievement of these plans was below expectations in which the reflections of these failures could only be assessed on the quality of life of people.

In recent time, the Vision 20:2020 launched in 2007 to 2011 to position Nigeria among the first 20 most developed nations in the world through rapid economic growth and development, better income distribution, improved welfare of the citizenry, and reduction of poverty has also been observed to work in opposite direction as low income, increased foreign debts, unstable exchange rate, high unemployment rate, high inflation rate, and poverty among others are prevalent in Nigeria[35].

Also, the economic recovery growth (ERG) plan put forward in 2015 to 2020 before the emergence of the coronavirus (COVID-19) pandemic, to reclaim the Nigerian economy by boosting local production for self-reliance, reduced unemployment, poverty, and inflation, and stabilize exchange and interest rates has claimed to perform to the optimal level despite the retrogressions recorded in all sectors of the economy.

It is imperative to note that most studies on life expectancy only focused on how life expectancy improves economic performance indices with less attention on how human life expectancy is been affected by economic performance indicators. To this end, review of

studies has shown that the aspect of economic performance shocks (which refers to undesirable changes in economic variables) and its influence on life expectancy or longevity of people have been unplumbed. Based on this aforementioned information, this study intends to examine the relationship between economic performance and life expectancy in Nigeria.

1.3 Aim and Objectives of the Study

The broad objective of this study is to examine the relationship between economic performance and life expectancy in Nigeria. More so, the specific objectives are to:

i. examine the impact of economic performance on life expectancy in Nigeria.

ii. analyze the response of human life expectancy to shocks in economic performance in Nigeria

iii. investigate the causal relationship between economic performance and life expectancy in Nigeria

1.4 Research Questions

In response to the identified gaps in the statement of the problem as well as finding an optimum solution, this study has come up with the following research questions:

(i) What is the relationship between life expectancy and economic performance in Nigeria?

(ii) How does life expectancy respond to shocks in economic performance?

(iii) What is the causal relationship between economic performance and life expectancy in Nigeria?

1.5 Hypothesis

Based on the research objectives, this study will be directed by the following hypotheses which are stated in null form.

$H_0$1: Economic performance do not have a significant impact on life expectancy in Nigeria

$H_0$2: Shocks in economic performance do not significantly influence life expectancy in Nigeria

$H_0$3: There is no significant causal link between economic performance and life expectancy in Nigeria

1.6 Significance of the Study

Rationally, there cannot be a better time to find out the problems associated with a short lifespan in Nigeria. Nigeria accounts for about half of West Africa's population with approximately 202 million people and one of the largest populations of youth in the world according to World Bank estimation in November 2020. A major player in West Africa, rich in natural resources, it is Africa's largest oil exporter and the largest natural gas reserves on the African continent. The current macroeconomic situation is more difficult than in 2015, when Nigeria experienced its first recession in 25 years as oil prices plummeted. Under the current circumstances, Nigeria has fewer buffers and policy tools to reduce negative impacts. Excess oil accounts have been used up, foreign exchange reserves rely heavily on short-term flows, and policy uncertainty affects investor confidence. Prior to the 2016 recession, the Nigerian economy grew rapidly at a rate of 6.3%. In contrast, before the COVID-19 outbreak, the economic growth rate was 2.2%. In 2014, the inflation rate was in the single digits, while in 2019 it was about 12%. In 2019, the general government budget deficit accounted for 4.4% of GDP, compared with 1.8% in 2014.

Although the current situation in Nigeria seemed controllable which unfortunately it is not, circumstances that cut short lives of people through accidents, suicides, frustration, terminal

diseases, among others may not be controllable. But the underrated volatility in the inflation rate, exchange rate, increased poverty, unemployment and underemployment, lack of access to affordable quality health care, emotional torture, depression, insecurity, fear of the unknown, and uncertainty all take their tolls on longevity. The outcome of research study will offer policy options that would ensure high life expectancy owing to stable economic performance.

Past studies have placed less attention on how life expectancy responds to shocks in economic performance which this study intends to fill the gap in the missing literature. Therefore, this study intends to demonstrate how economic shocks emanating through these exogenous and endogenous economic variables have impacted life expectancy from 1981 to 2020. Also, the study will be proffering policy measures to improve longevity in Nigeria.

1.7 Scope of the Study

This study will investigate the impact of economic performance as well as shocks in the economic performance on longevity in Nigeria between 1981 and 2020. The choice of this study and the period was born out of the curiosity to understand reasons why life expectancy in Nigeria (55.02 years) is the shortest after Lesotho (54.84years). The study has adopted a 40 years period (1981 – 2020) to have a broader perception of the behaviors and interactions between macroeconomic variables, shocks and human longevity with the intention of achieving a holistic outcome. It is believed that from 1980 to date, many unprecedented and unexpected events have happened both politically, socially, and economically in which the impacts seem to be normal or harmless on human existence.

Just like other countries of the world, Nigeria as a country has gone through lots of hurdles, predicaments resulting in the poor physical and mental condition of individuals in the society.

The period of transitioning from the long-sufferings military era to civilian administration will also be covered so as to shed light on how life expectancy responded to the economic conditions within the period. Further to this, the study will also be extending its coverage to the period of structural adjustment programme (SAP) of 1990 to 1999 in Nigeria. Though this time was characterized by austerity, scarcity of food money, as well as a recession in the economy which calls for a systematic estimation of low longevity, has responded to macroeconomic variables.

Also, the era of the nascent democracy equally dedicated to consolidating democracy will be studied. Although, the period of 2011 to 2015 was argued to have a negative transformation rather than the positive transformation as proposed, however, this study will also spread its tentacles to examining the state of macroeconomic variables amidst the Ebola epidemics and insurgency all over the country.

To round it off, this research will also concern itself with the impact of economic recovery and growth (ERG) of 2015 to 2020, putting into consideration the COVID-19 pandemic coupled with the stock market crash, recession, and insecurity all over the country to mirror their inferences on longevity in Nigeria.

1.8 Limitations of the Study

Low life expectancy issue is critical and very sensitive to growth and development, its analysis required quality data and valid tools for analysis to obtain a reliable result. This study investigated economic performance, shock, and causality on life expectancy in Nigeria between 1981 and 2020, and the choice of this research was born out of intrigue to establish facts regarding the problem of low life expectancy currently experienced in Nigeria. The major challenge faced during the study was where to acquire quality data for the research, as we all know that data collection and management system in Nigeria is very poor.

Nevertheless, the data were amassed from different sources such as the Central Bank of Nigeria (CBN) statistical bulletin, Bureau of statistics, World development indicators (WDI), etc. In addition, the data available is a structured data type used is a structured data which is normally characterized by inherent long lags. Based on the nature of the data, the analysis could not adopt modern analytical techniques such as machine learning, artificial intelligence (AI), etc. Hence, the study is limited to employing the traditional econometric tools which may have effects on the precision level. Inclusive is the short time frame to conduct this research in which all these limitations can be addressed in the future research.

1.9 Operational Definitions of Terms

Economic Performance:– Everything about the economy, it include rise in output, expenditure, income, etc.

Epidemic: - A widespread occurrence of an infectious disease in a community at a particular time

Exchange Rate:- This is the price of one currency in terms of another currency

External Debt:– Total money borrowed by the government from foreign countries at a point in time.

Government Health Expenditure:- It is referred to as expenditure on health care incurred by the government

GDP:- This is the standard measure of the value-added created through the production of goods and services in a country during a certain period

Inflation Rate:- A general increase in prices and fall in the purchasing value of money

Income Per Capita:- This is a measure of the amount of money earned per person in a nation or geographic region

Longevity/Life Expectancy/Life Span:- These two terms are used interchangeably, it is the statistical age that a person is expected to live

Pandemic: - Disease prevalence over a whole country or the world

Shocks in Economic Performance:- An economic shock refers to any change to fundamental macroeconomic variables or relationships that has a substantial effect on macroeconomic outcomes and measures of economic performance.

Unemployment Rate:- Unemployment occurs when a person who is actively searching for employment is unable to find work

Volatility: - Liability to change rapidly and unpredictably, especially for the worse

Endnotes

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Chapter Two

Literature Review

The conceptual review of the synergy between life expectancy and macroeconomic variables behavior were presented in section 2.1, while section 2.2 provides the theoretical review and 2.3, review of empirical studies. The conceptual framework and the summary of gaps in the literature were presented in section 2.4 and 2.5 respectively.

2.1 Conceptual Review

2.1.1 Health Care Financing and Life Expectancy

Generally, government expenditure on health is defined as the total government expenditure expended on health care (GHE) in Nigeria which is expressed as a percentage of total government expenditure measured in billions of U.S dollars. This shows the weight of public healthcare costs in the total value of public sector operations. This indicator includes not only resources provided through government budgets, but also health expenditures provided by territorial governments and extra-budgetary entities through government agencies, especially compulsory health insurance. The indicator refers to funds collected and pooled by government agencies, including all income modalities.

Therefore, health expenditure includes all spending for the provision of health care services, birth control activities, food security and nutrition activities, and emergency aid designated for healthcare, but it excludes the provision of water and hygiene. Health financing is a constituent health care systems[35, 35]. National health care accounts provide a large set of index based on expenditure statistics collected within an internationally acknowledged framework. These accounts are a combination of capital flows recorded in the operation of the healthcare system, from sources and agents to the distribution of funds between providers and functions

of the healthcare system. It also reflects the Sustainable Development Goal (SDG) 3. "Ensure improved quality of life (QoL) through healthy living for longevity".

Furthermore, total government expenditure on health care as a percentage of gross domestic products (GDP), where GDP is the value of all final goods and services produced within a nation in a given year. It presents information on the quantity of resources used for health compared to national wealth.

Total Health Expenditure Per-Capita:-This indicator is defined as the total health expenditure per capita, expressed in the average exchange rate of the year, in US dollars, indicating the total health care spending relative to the total expenditure of the economic agent, expressed in US dollars to facilitate international comparison. These indicators reflect the total expenditures of government and health resources, including nutrition, access, and services related to government expenditures, national wealth, and population. The increase in health care costs is associated with better health outcomes, especially in low-income countries, but there is no "recommended" level of health care spending. The higher your per capita income, the higher your health expenditure. However, some countries spend much higher than expected income levels, and some countries spend much less. If the government believes that the proportion of total health expenditure should be low, this may indicate that nutrition and health are not considered a priority.

2.1.2 Gross Domestic Product (GDP) and Life Expectancy

Gross domestic product (GDP) is perhaps the most common indicators used to track the health of a nation's economy. Equally, the most closely watched and important economic indicator for both economists and investors alike because it is a representation of the total monetary value of all goods and services produced by an economy over a time period.

A booming economy is expected to translate to improved welfare and standard of living, thereby affording the government to achieve better health care for the people[35]. Economic development involves the activity of remodeling a simple, low-income national economy into a modern industrial economy. It is a process of ameliorating the economic welfare and quality of life of a nation and individuals, for targeted goals and objectives[35]. The exact definition of economic development has been challenged by various professionals, as economists in the 20th century are of the opinion that development is mainly concerned with economic growth, while sociologists emphasized the holistic process of change and modernization[35]. Development and urban studies scholar summarizes economic development as "a process of producing and employing physical, human, financial, and social assets to foster enhanced and broadly shared economic well-being and quality of life for the populace[35]. This concept has a lingering existence in the West, "Modernization," "Westernization," and especially "industrialization," are other terms frequently used when analyzing economic development. Historically, economic development policy has concentrated on industrialization and infrastructural growth, but since the 1960s it has increasingly enthralled equality and poverty reduction. Therefore, economic development is a policy intervention directed at improving people's well-being[35].

2.1.2.1 Economic Growth Benefits and Implications for Life Expectancy

2.1.2.2 Increased Consumption

A very salient aspect of economic growth is that consumers can benefit from consuming more goods and services. The premise of economics is that consumption is related to utility. Thus, in theory, the higher the level of consumption, the higher the degree of prosperity, ceteris paribus. This corroborated the findings of notable researchers who discovered an increased quality life adjusted years (QALYs) as a result of an increase in consumption

level[35]. Even though, the relevance of consumption to life expectancy was not in their studies considered important.

2.1.2.3 Reduced Unemployment and Poverty

Economic Growth constantly helps reduce unemployment by creating jobs[35]. Of course, this is important because unemployment is a major cause of social problems such as crime and alienation. It is important to consider long-term economic growth. By the turn of the 20th century, poverty had spread among the undernourished working class in the United States and Europe. Since 1945, the level of absolute poverty has dropped dramatically. Even in south east Asia as well, the high economic growth rates of recent decades have significantly reduced absolute poverty. Economic growth will be important for reducing absolute poverty and increasing life expectancy in Africa.

However, despite rapid increases in economic growth in Nigeria since the independence in 1960 and the Civil War (1966), areas of high unemployment and poverty still remain, consequent to this, it is assumed that high unemployment rate and poverty could pose a negative impact on life expectancy as illustrated by notable scholars[35, 35].

2.1.2.4 Increased Crime Rate and Social Problems

It is another paradox that as incomes increase and people are better off the level of crime is also increased. This demonstrates that crime is not induced by poverty but perhaps envy. One argument for increased crime rates is that, there are more things to steal[35]. In the 1930s, car theft and cell phone theft were rare or nonexistent. Economic growth has increased the number of products that can be stolen. However, this relationship is not absolute. For example, crime rates in the United States have fallen from their recent peaks. However, there

is a general link between growth and crime. All of these can cause psychological and emotional imbalances, fear of the unknown and shorten life span.

2.1.3 Climate Change and Human Health

Climate change includes global warming which brings about building up of atmospheric greenhouse gases due to human activities and the resulting large-scale changes in meteorological patterns[35]. Though, the mid-20th century marked the inception of climate change, and since, humans have unprecedentedly affected the Earth's climate system, causing change on a global scale, then the disappearance of flora and fauna experienced cannot be ordinary from US and global macroeconomic aggregates to the price of. The greatest cause of warming is the emission of gaseous elements, of which over 90% are carbon dioxide (CO_2) and methane[35,35]. Burning of fossil fuel (coal, oil, and natural gas) for power consumption is the major cause of these emissions, with contributions from manufacturing, industrialization, agriculture, and deforestation.

Nigeria's climate is changing, and temperatures are drastically rising. These include fluctuations in rainfall and temperatures, rising sea levels and floods, droughts and desertification, land degradation, more frequent extreme weather events in some regions, devastating impacts on freshwater resources, and biodiversity loss. The length and intensities of rainfall have heightened, creating huge erosion and flooding in various parts in Nigeria.

Rainfall variability is forecasted to continue to increase[35]**.** Precipitation in the Southern geographical zone of Nigeria is expected to increase, and rising sea levels are likely to experience flooding and submersion of coastal lands[35]. Droughts have also become a persistent event in Nigeria**,** with the probability to continue in Northern Nigeria. Also,

depicting from a decline in precipitation and rise in temperature, the Lake Chad and other lakes in Nigeria are drying up and at risk of extinctions[35,35].

Global climate change will continue to affect human health at varying degree through different routes, the scale and directness and with timing yet to be ascertained[35]. Though, the impacts would be of varying degree geographically as a function of both of environment and topography and the vulnerability of the local populace[35]. At the same time, these impacts could be both positive and negative (although experts have predicted predominantly negative happenings). This is not unexpected since the climatic condition would disrupt or otherwise transform a vast range of natural ecological and physical systems that are an essential part of Earth's life support system. To summarize, by way of climate change, humans are contributing to a change in the conditions of life on Earth and human populations, as with individuals, it vary in their vulnerability to certain health outcomes.

A population's vulnerability is a collective function of, first, the degree to which a certain health outcome responds to climate change and, second, the population's ability to adjust or acclimatized to new climatic conditions[35]. The vulnerability of a population is dependents on characteristics like population density, level of economic development, food security, income level and distribution, states of local environment, pre-existing health status, and the quality and accessibility of the available public health care[35].

2.1.4 Oil Price and Economic Shocks

As the empirical and theoretical models employed by economists have gradually developed, so has the awareness of the determinants of oil price shocks and the interrelationship of the oil market with the global economy. Traditionally, the real price of oil was thought to be determined typically by political incidents in the Middle East that were outside of the

confines of macroeconomic models and could simply be accepted without any doubt when conducting policy analysis, it is now widely welcomed that the real price of oil is determined endogenously in global markets much like the price of other global commodities. This means that fluctuations in the price of oil can be grasp only with the help of structural models of the global oil market that allow opinions and responses the global macroeconomic aggregates to the oil price[35]. In other words, understanding the effects of oil price shocks on the domestic economy requires global macroeconomic models that explain jointly the determination of the price of oil and macroeconomic aggregates. Moreover, whereas in the past oil price shocks were thought to cause recessions for reasons unrelated to the state of the domestic economy, we are now knowledgeable that sustained upsurge in the real price of oil are often simply features of a booming world economy. This experience became apparent after 2005 but it is by no means new. For instance, the sudden increases in the real price of oil in the early and late 1970s is an example, although distinct in some dimensions, shared many of the attributes of the spill in the real price of oil between 2003 and 2008. It has become unambiguous, that economists for many years have inclined to conflate the recessionary effects of oil price shocks with other causes of those earlier recessions, at several attempts, it has failed to produce meaningful results[35].

Most theoretical models of oil price shocks transmission focused on the effects of external fluctuations in the actual prices of imported crude oil. Whereby, the transmission of such oil price shocks is dependent of two major mechanisms. One, instantaneous effect of an unexpected increase in the price of crude oil imported is a reduction in the purchasing power of local households as income is transferred abroad. This first effect is similar to an unfavorable aggregate demand shock in a macroeconomic model of aggregate demand and aggregate supply[35]. The other instantaneous effect is to give rise to the cost of producing home-based output to the extent that oil is an input of production along with capital and labor,

which is related to an adverse aggregate supply shock. These direct effects of an external rise in the real price of oil imports are regular in oil price increases and decreases[35]. An unexpected increase in the real price of oil engendered aggregate production and income to fall by as much as an unexpected decline in the real price of oil of the same measure causes total income and production to increase. This action is certainly expected to reflect on the well-being of people.

2.1.5 Pandemics, Human Health and Economic Performance

The history of the plague suggests that severe pandemics can have extremely important and potentially permanent asymmetric economic consequences. However, these consequences depend upon the initial conditions and could not be foretold a priori. Pandemics are wide-ranging outburst of communicable diseases that to a great extent increase morbidity and mortality over a wide geographic area and cause a consequential economic, social, and political disruption[35].

Tons of evidence have predicted probable epidemic increase in the last century due to global travel and integration, urbanization, land-use change, and substantial development of the natural environment[35]. These trends have the likelihood to continue and also intensify[35]. Significantly, policy had been directed towards the need to identify and reduce emerging outburst that might lead to pandemics with the aim to amplify and sustain investment to boost quality health care delivery. The severe acute respiratory syndrome (SARS) pandemic of 2003 and the growing disquiet regarding the threat constituted by avian influenza led many countries to come up with pandemic plans. Several outbreaks, in particular the 2014 West Africa Ebola epidemic, have disclosed gaps related to the prompt detection of disease, accessibility to basic care, contact tracing, quarantine and isolation procedures, and readiness

outside the health sector, including global coordination and response mobilization, were all inadequate[35,35]. These gaps are especially evident in under scarce resource settings and have created challenges during relatively localized epidemics, with dreadful implications for what may happen during a full-fledged global pandemic.

- Pandemics exacerbate large and widespread increases in morbidity and mortality, as well as the effects of unreasonably high mortality in low- and middle-income countries (LMICs)[35].
- Pandemics can cause economic damage through multiple channels, including short-term fiscal shocks and longer-term negative shocks to economic growth[35].
- Individual behavioral changes, such as fear-induced aversion to workplaces and other public gathering places are a primary cause of negative shocks to economic growth during pandemics[35].
- Some pandemic mitigation measures can cause significant social and economic disruption[35].
- In countries with weak institutions and legacies of political instability, pandemics can increase political stresses and tensions. In these contexts, outbreak response measures such as quarantines have sparked violence and tension between states and citizens[35].

2.1.6 Exchange Rate Volatility and Increasing Inflation Rate in Nigeria

Since 1986, the Nigerian naira's relationship with the US dollar (and other foreign currencies) has been erratic, unpredictable, violent, and full of heartbreak and tears. The built-in dysfunction has also made a lot of people very rich. This piece seeks to trace the history of how Nigeria's foreign exchange management became what it is to the point where the exchange rate of the naira has become a deeply political matter.

Inflation affects different people or economic agents differently. Broadly, there are two economic groups in every society, the fixed income group, and the flexible income group[35]. During inflation, those in the first group lose while those in the second group gain. The reason is that the price movement of different goods and services is not uniform. During inflation, most prices rise, but the rate of increase of individual prices differ. Prices of some goods and services rise faster than others while some may even remain unchanged.

The poor and the middle classes suffer because their wages and salaries are more or less fixed but the prices of commodities continue to rise. On the other hand, the businessmen, industrialists, traders, real estate holders, speculators, and others with variable incomes gain during rising prices[35]. The latter category of persons becomes rich at the cost of the former group. There is a transfer of income and wealth from the poor to the rich. More generally, which income group of the society gains or losses from inflation depends on who anticipates inflation and who does not. Those who correctly anticipate inflation can adjust their present earnings, buying, borrowing, and lending activities against the loss of income and wealth as a result of inflation.

2.1.7 Civil War, Military Coups, Insecurity, and Corruption in Nigeria

The Nigerian Civil War from 6 July 1967 to 15 January 1970 was described as war's shocking human tragedy. The war resulted from political, economic, ethnic, cultural, and religious tensions which preceded Britain's formal decolonization of Nigeria from 1960 to 1963. Immediate causes of the war in 1966 included ethno-religious violence and anti-Igbo pogroms in Northern Nigeria**,** a military coup, a counter-coup, and persecution of Igbo living in Northern Nigeria[35]. Control over the lucrative oil production in the Niger Delta also played a vital strategic role[35]**.**

During the two and half years of the war, there were about 100,000 overall military casualties, while between 500,000 and 2 million civilians died of starvation and malnutrition, the conflicts have had a profound effect on economic activity, and in turn, have been affected by economic variables[35].

2.1.8 Development, Economic Performance and Life Expectancy: The Nigeria Scenario

Proponents of economic planning for developing countries argue that the uncontrolled market economy can, and often does, subject these nations to economic dualism, unstable markets, low investment in key sectors, and low levels of employment. In particular, it was claimed that the market economy is not geared to the principal operational task of poor countries: mobilizing limited resources in a way that will bring about the structural change necessary to stimulate a sustained and balanced growth of the entire economy[35]. Planning has come to be accepted, therefore, as an essential and pivotal means of guiding and accelerating economic growth in almost all developing countries[35].

The principal economic arguments for planning briefly outlined earlier in this unit-market failure, divergences between private and social valuations, resource mobilization, investment coordination, and the like have often turned out to be weakly supported by the actual planning experience. It is doubtful whether plans have generated more useful signals for the future than would otherwise have been forthcoming; governments have rarely, in practice, reconciled private and social valuations except in a piecemeal manner; because they have seldom become operational documents, plans have probably had only limited impact in mobilizing resources and in coordinating economic policies. To take the specific case of the market failure argument and the presumed role of governments in reconciling the divergence between private and social valuations of benefits and costs, the experience of government

policy in many developing countries has been one of often exacerbating rather than reconciling these divergences—government failure rather than market failure. Government policy often tends to increase rather than reduce the divergences between private and social valuations; the impact of these policies on the well-being of people is far below expectation[35].

The results of development planning have been generally disappointing[35]. The widespread rejection of comprehensive development planning based on poor performance has had several practical outcomes, the most important of which is the adoption in a majority of developing countries of a more market-oriented economic system. Government policy often tends to increase rather than reduce the divergences between private and social valuations. Plans are often overambitious. They try to accomplish too many objectives at once without considering that some of the objectives are competing or even conflicting. They are often grandiose in design but vague on specific policies for achieving stated objectives[35].

The economic value of a development plan depends to a great extent on the quality and reliability of the statistical data on which it is based. When these data are weak, unreliable, or nonexistent, as, in many poor countries, the accuracy and internal consistency of economy-wide quantitative plans are greatly diminished. And when unreliable data are compounded by an inadequate supply of qualified economists, statisticians, and other planning personnel (as is also the situation in most poor nations), the attempt to formulate and carry out a comprehensive and detailed development plan is likely to be frustrated at all levels. Because most developing countries have open economies that are dependent on the vicissitudes of international trade, aid, “hot” speculative capital inflows, and private foreign investment, it becomes exceedingly difficult for them to engage in even short-term forecasting, let alone long-range planning

2.2 Theoretical Review

The under listed theories were aligned to the study of economic performance and life expectancy. According to these theories, output which is the growth dependents on capital, labor and innovation. In this study, life expectancy shall be considered the output while capital (through investment increases money stock, improves government health spending and income per capita, with moderate money supply to stabilize inflation and foreign exchange)[35]. Labor and innovation on the other hand optimizes productivity, promotes full employment and the innovation through increase in knowledge and education plays critical roles in reducing mortality rate and improving life expectancy.

2.2.1 Neoclassical Growth Theory

Neoclassical growth theory developed in the late 1950s and attempted to explain long-run economic growth by looking at capital accumulation, labor or population growth and increases in productivity. This neoclassical methodology has introduced some concepts such as aggregate capital stocks, aggregate production functions and utility functions for representative consumers for modern growth theory later. Vital contributions to the neoclassical theory model came from the work done by Solow and Swan model[35].

The Solow–Swan model is known as exogenous growth model which puts labour as a factor of production and does not assume fixed capital labour ratio. The central point to their growth model is the production function with some key assumptions on it. Furthermore, by acknowledging a constant-saving-rate rule, the production function (Cobb-Douglas) creates a simple general equilibrium model in winch it is impossible to achieve sustained long-run economic growth and the economy can be stagnated at its zero-growth dynamic equilibrium[35].

One important suggestion of the Solow-Swan model is conditional convergence. Their model pointed out that a country with a lower staring level of per capita GDP will have a faster growth rate in the short-run relative to the long-run position. This is due to the assumption of diminishing returns to capital, as economies have the tendency to receive higher output and a higher economic growth rate when they have less short-run capita per worker relative to long-run capital per worker. The reason the convergence is conditional in the Solow-Swan model is that different economies could have a different savings rate, a different growth rate of population and a different position of the production function, which affect the steady-state levels of capital and output per worker. Hence, the concept of conditional convergence in the Solow-Swan model helps explain economic growth across countries and regions[35].

Another important recommendation of the model is identifying the role of technology in the economic growth process where an increased literacy level has been observed to be a mechanism for reduced mortality rate. Increasing the amount of any input quickly does not lead to increased growth in output in the long-run due to diminishing returns in the accumulation of inputs. As adding an additional unit of an input increases output, but by less than the previous unit, then per capital output stops growing and becomes stagnant. By continuing and improvement in technology, the model can allow accumulating production function inputs over time and thus the positive rates of per capita growth can persist for long term and these growth rates have no clear tendency to decline. Technical progress offsets the diminishing returns to capital investment that would otherwise limit growth. However, the obvious limitation in Solow-Swan growth model is that the long-run per capital growth rate depends on exogenous elements – the rate of technological progress and population growth. Moreover, the Solow-Swan model does not explain determinant of long-run per capita growth[35].

2.2.2 Endogenous Growth Theory

Endogenous growth theory maintains that economic growth is primarily the result of internal forces, rather than external ones. It argues that improvements in productivity can be tied directly to faster innovation and more investments in human capital from governments and private sector institutions[35].

Developments in endogenous growth theories have been motivated by theorists dissatisfied with common accounts of exogenous factors determine long-run growth, the initial wave of new research built on the work of past studies. In endogenous growth models, a constant positive rate of steady state growth in possible in the nonexistence of labor and technology growth[35]. In the one-sector models this arises by preventing the private returns to capital from falling toward zero over time, whereas in the two-sector models this is attained through the separate endogenous accumulation of human capital. By introducing human capital as a component of capital goods which does not exhibit diminishing returns, the growth rate of capital and output is prevented from falling to zero. Furthermore, technological change resulting from purposive R&D activity has a significant impact on the growth framework. The growth rate can be positive in the long run if the economy does not tend to reduce innovation. The central tenets of endogenous growth theory include: (i) government policies can raise a country's growth rate if they lead to more intense competition in markets and help to stimulate product and process innovation. (ii) there are increasing returns to scale from capital investment especially in infrastructure and investment in education and health and telecommunications. (iii) private sector investment in research & development is a key source of technological progress. (iv) the protection of property rights and patents is essential to providing incentives for businesses and entrepreneurs to engage in research and development. (v) investment in human capital is a vital component of growth. (vi) government policy

should encourage entrepreneurship as a means of creating new businesses and ultimately as an important source of new jobs, investment, and further innovation[35]

2.3 Review of Empirical Studies

In this section, relevant studies are presented beginning from the developed economies and narrow down to the less developed economies to examine the relationship between macroeconomic shocks and longevity or life expectancy.

2.3.1 Empirical link between Economic Performance and Health Outcomes

Scholars have previously used a time series data collected from 1970 to 2007 to examine macroeconomic shocks in Nigeria using the Augmented Dickey Fuller (ADF) unit root test in which their results revealed that inflation rate, the growth rate of real output and money supply, and real share of Fiscal deficit are stationary at certain levels, while other incorporated variables in the empirical analysis- real share of Import, Exchange rate and Interest rate-are stationary at different levels in which their research classified inflation as an internal economic shock variable, showing significant negative impacts on human well-being and life expectancy[35, 35].

Again, the dynamic and simultaneous inter-relationship between variables studied to determine the most significant causes of economic shocks[35]. However, in this study, the impact of macroeconomics variables behavior or economic shocks on life expectancy was of course not the priority.

The Polish political economist also posited based on the field survey conducted before the 2015 elections in addition to an embedded survey experiment which have all proven that external economic shocks could lead to insecurity exposing individuals to demand

government support and more likely deserts the government and vote against their wish during the electoral process[35]. Further research to elaborate the implication of such decisions on the welfare and the life expectancy of the voters and the populace was neglected.

Seemingly, a prominent researcher also postulated that unemployment, job dissatisfaction, poor wages emanating from economic shocks could be a factor for the poor state of emotion, low quality of life among others which are critical to human longevity[35]. In line with previous scholars, a cross-national data of 20 European countries used to assess the relation between macroeconomic shocks and death rate with a focus on unemployment and suicide also showed a significant direct link between gender equality and suicide rates in either men or women[35]. However, a greater degree of gender equality helped protect against suicidality associated with economic shocks as sighted in their work[35]. Though this research was conducted in more developed countries where unemployment is relatively low, also it focuses more on suicide consequent to economic shocks which differ and could not be classified as non-accidental death. Thus, the restriction of this study to suicide rather than general life expectancy in relation to economic shocks is a major flaw.

Within Africa and beyond, Nigeria has been described as an oil-dependent economy, the prices of oil at the international market is crucial to Nigeria economic sustainability as the decline or boom in oil price not only affects government spending but also have impacts on the Nigeria stock market[35,35]. Empirical evidence revealed that stock market returns exhibit an insignificant positive response to oil price shocks but revert to negative effects after a while depending on the nature of the oil price shocks[35]. Evidence have also revealed a negative effect of oil price shocks which could be short or long-run depending on the nature of the oil price shocks[35, 35]. Although there were no statistical data to support the acclaimed asymmetric effect of oil price shocks on the Nigerian stock returns indices in this study, and importantly,

this is the first study examining the dynamic linkages between stock market behavior and oil price shocks in Nigeria, nevertheless it is imperative to quantitatively research the dynamic linkages between stock market behavior, oil price shocks and life expectancy in Nigeria.

As revealed by previous scholars, aggregate economic shocks, child schooling, and child health research in poorer countries, mostly in Africa have shown pro-cyclical infant mortality rises and school enrollment and nutrition fall during recessions which further corroborated the facts about economic shocks, as a contributing factor to infant mortality, a fall in school enrollment, and fall in nutrition which is a procyclical trend in nature[35,35]. This holistic study covered mainly African countries dissimilar in socio-economic and political activities. For sensitive research aimed at investigating human longevity, in-depth research based on a specific country at a point in time will go a long way in producing a more reliable result.

Contrary to several studies, research carried out to examine the impact of life expectancy on economic development among sub-Saharan Africans using a 3-period over-lapping generation model also revealed a positive relationship between life expectancy and education but a weak relationship between life expectancy and labor force in Sub-Saharan Africa[35, 35, 35]. However, Sub-Saharan countries are characterized with identical circumstances ranging from governance, corruption, unemployment level, income, among others, but several other attributes such as population size, human capital development level, and natural resources endowments were overlooked, therefore, taking cognizance of these attributes it will yield a more reliable result to initiated such research study on a case by case with respect to each country in the sub-region.

In alignment with previous researchers, an overlapping generations economic growth using a simple endogenous growth model, was adopted to examine the effect of an increase in life expectancy on portfolio choices of individuals and, thereby, on in which money is introduced

based on the money-in-the-utility-function approach[35,35]. It is shown that an increase in longevity raises the balanced growth rate and lowers the inflation rate, offsetting the Tobin effect, if spillovers from accumulated capital to labor productivity sufficiently raise wage income and real savings, and, if not, it may retard economic growth and aggravate inflation[35].

In 2015, Scholars initiated research to demonstrate the response of real exchange rates to various economic shocks; five variables are considered to have an influence on the bilateral real exchange rates. These include the world real price of oil, the domestic and U.S. government consumption spending/ GDP ratios, the productivity differential and monetary differential between the two countries[35]. Though, it was revealed that the exchange rate responds to various economic shocks in which if considerable attention was given to oil price as it huge impact on countries with heavy dependence on importation of oil a better living condition and quality of lives might have been recorded[35]. Therefore, a more recent study is suggested both for the U.S and Nigeria to dig into the behavior of exchange rate to macroeconomic shocks in order to determine any association with life expectancy in Nigeria.

In investigating the causality of life expectancy in Nigeria, Economists have also intervened by empirically analyzed the relationships existing among life expectancy, public health spending, and economic growth in Nigeria, using vector autoregressive model, the outcome of this study showed that there is no bi-directional causality between life expectancy and public health spending in Nigeria[35]. This further revealed that there is no bi-directional causality between life expectancy and economic growth in Nigeria over the years, to experience sustainable economic growth, it has become imperative for her to put in place measures that would boost the life expectancy of her citizenry by increasing her public health spending as this will serve as a panacea for her economic backwardness[35].

Data on public health expenditure and governance variables captured by the corruption perception index were regressed on infant mortality, under-five mortality, and life expectancy using both the ordinary least squares and the two-stage least squares[35]. The result of their analysis showed that public health expenditure has a negative effect on infant mortality and under-5 mortalities when the governance indicators are included[35].

Research initiated to investigate the impact of unemployment on health outcomes in Nigeria in which the prevalence of disease (morbidity) was used as a health outcome indicator[35]. Adopting the Classical Linear Regression Model and estimation technique has shown that government health expenditure has a significant negative relationship with the prevalence of morbidity, while a high unemployment rate also contributes to negative health outcomes in Nigeria[35]. Anyway, unemployment and government health expenditure are the two explanatory variables in their study which may be considered not holistic enough to explain the variations in life expectancy in Nigeria compared to other advanced countries.

An empirical estimation of the growth impact of health expenditure in Nigeria using the Solow growth model focusing majorly on how people achieve better health when there is economic growth has shown a consensus that economic growth leads to improved health status while the attention was not given to whether causality exists in the reverse direction, the result further showed that gross capital formation, total health expenditures, and the labour force productivity are important determinants of economic growth in Nigeria while life expectancy rate has a negative impact on growth for the period covered by the study[35,35]. This study also aligned with others to propose increased savings and investments in the economy, increase expenditures on health provisions, induce the level of labour productivity and place priority on the issues of security to lives and properties in Nigeria as a panacea to improving life expectancy.

Poverty and Youth Unemployment in Nigeria from 1987 to 2011 revealed that unemployment, agricultural and services contributions to real GDP as well as a population have a positive influence on the poverty level in Nigeria with only the agricultural sector statistically insignificant[35]. On the other hand, the manufacturing sector contribution to real GDP and inflation rate exhibited a negative relationship on poverty level in Nigeria with only the manufacturing sector appearing significant. The recommendation put forward include government at all levels to create jobs and arrest unemployment[35]. Howbeit, the failure of this study to extend their investigation to how the variables used relates to life expectancy constituted the flaws in this research.

Also, the trends of per capita income, income inequality, government capital expenditure, the human development index, and the rate of unemployment in Nigeria as analyzed by economists using the vector autoregressive model has posited that a reduced unemployment rate improves human development and consequently reduces poverty[35]. More so, growth in public capital expenditure rises, unemployment falls, and the human development index improves. Therefore, infrastructure-based policies, which initially reduce unemployment, will also improve the living conditions of Nigerians in which the likelihood of improved life expectancy may be achieved in the end.

Evidence through empirical research on the interaction among the standard of living, quality of life and per capita GDP based on 1995 to 2011 data has established that there seems to be a significant correlation between human development index (HDI) and government spending on health and education as a percentage of GDP, but there seems to be of no significance to include the variable government spending on health and education as a percentage of total government spending[35]. Nevertheless, some fundamental facts such as how the variables of the study affect life expectancy are missing which is critical and essential. Equally, the trend

analysis of life expectancy and its association with economic development in the Belt and Road (B&R) Countries from 2000 to 2014 has presented that the average life expectancy in all B&R countries was 69.7 years for men and 73.7 years for women, across countries in 2014, life expectancy for men ranged from 58.6 years in Afghanistan to 80.2 years in Israel. Life expectancy for women ranged from 61.3 years in Afghanistan to 85.9 in Singapore. GDP per capita was positively associated with longevity across B&R countries. The unemployment rate was positively associated with life expectancy only for countries in the top life expectancy quintiles. GDP growth rate and Inflation were negatively associated with life expectancy for the countries in the bottom life expectancy quintiles for men, not for women[35]. Though some of the countries sampled shared some similarities with Nigeria that does not suffice to initiate a home-adaptive study that will be based on the real economic values.

Consequently, the study of socio-economic determinants of life expectancy in developing countries in which multiple regression and probit framework was employed has shown that explanatory variables were statistically insignificant, in the same study, further analysis also confirms that relevant socio-economic factors like per capita income, education, health expenditure, safe water, and urbanization cannot always be considered to be influential in determining life expectancy in developing countries[35,35]. Their analysis also professes that public health activities fell by nearly 5% in the average community between 2006 and 2012, with the bottom quintile of communities losing nearly 25% of their activities. Local public health delivery fell most sharply among communities experiencing the largest increases in unemployment and the largest reductions in governmental public health spending. However, social sector policies and programs, physicians' availability, and reduced adult illiteracy, and undernourishment are seen as means of improving life expectancies.

Similarly, the effect of the socio-economic development on life expectancy at birth as an indicator of mortality or longevity using aggregate time-series pool data between 1990 and 2017 in which the dependent variable was the life expectancy at birth, and the background exploratory variables for the socioeconomic development were GDP per capita and infant mortality rate[35]. The main results suggest that higher life expectancy at birth and longevity of people are a function of higher values of GDP per capita and lower values of infant mortality levels[35].

In a submission to the opinion of previous scholars on the relevant economic factors for improved welfare and longevity, the study on the accessibility of people to healthcare facility especially in rural areas of Nigeria also exposed that the available healthcare facilities are grossly inadequate and their distribution depicts serious inequality[35]. Convergence of opinions agreed that lack of basic health care facilities have led to inefficiency in production, declining productivity, reduced life expectance and increased infant mortality rate[35]. The gap in life expectancy between the highest and the lowest income quintiles widened during the study period by 5.1 years among men and 2.9 years among women, and in 2007 it stood at 12.5 years and 6.8 years, respectively; Increasing mortality attributable to alcohol-related diseases and increasing or stagnating mortality for many cancers, as well as a slower decline in mortality due to ischemic heart disease among men in the lowest income quintile, were the most significant factors.

Further, the introduction of health insurance scheme was believed to have a significant positive effect on the population welfare and quality of life, research to investigate the expansion of health insurance to increase health care utilization have shown that urban dweller's decision to choose health care providers are sensitive to the monetary cost of medical care as measured by medical fee but they are not sensitive to distance. For those who

reside in a rural area, they are sensitive to the non-medical component cost of care as measured by travel distance but they are not sensitive to the medical fee[35]. Be as it may, the failure of this study to examine the utility enjoyed by the consumers of the health insurance schemes and also how well the scheme has contributed to their quality of life are major shortcomings.

In 2010, the impact of crude oil price changes on four key macroeconomic variables was examined; results showed that oil prices have a significant impact on real GDP, money supply, and unemployment[35]. Its impact on the fourth variable, the consumer price index is not significant. This implies that three key macroeconomic variables in Nigeria are significantly explained by exogenous and highly volatile variables. Hence, the economy is vulnerable to external shocks.

Conversely, the macroeconomic performance will be volatile and macroeconomic management will become difficult[35]. Having said that, it is important to note that the variables identified in this study are exogenously influenced and are considered highly volatile which further indicated that the economy is consistently prone to external shocks. Moreover, four out of tons of macroeconomic variables were examined and only the crude oil price shocks were used as a determinant. Further, the effect of oil price shock on output, inflation, the real exchange rate, and the money supply in Nigeria was also studied, which was contrary to previous empirical findings in other countries; the oil price shock does not affect output and inflation in Nigeria[35]. However, oil price shocks do significantly influence the real exchange rates. The implication is that a high real oil price may give rise to a wealth effect that appreciates the real exchange rate[35].

An analysis of the impact of oil price shocks on the growth of the Nigerian economy growth with the inclusion of controlling the effects of unrest in the international oil market, exchange

rate, and agriculture output based on the results from time series; ADF unit root tests; structural Vector Autoregression (SVAR) have all shown that all the series at the level are not stationary but stationary at first difference with constant[35]. Moreover, the findings from SVAR using the impulse response functions (IRFs) and variance decompositions (VDCs) indicated that the response of oil price shocks and unrest to (GDP) economic growth depicts both positive and negative impact, i.e. long-run impact on economic growth exists. The study concludes that oil price, exchange rate, agriculture output, and unrest contained some useful information in predicting the future path of economic growth in Nigeria[35]. Even so, the aspect of how economic growth can translate to improved standard of living and high life expectancy was an oversight; this action has failed to differentiate the authors' research perspectives from others.

The asymmetric effects of oil price shocks in Nigeria; for instance, positive as well as negative oil price shocks significantly increase inflation and also directly increases real national income through higher export earnings, though part of this gain is seen to be offset by losses from lower demand for exports generally due to the economic recession suffered by trading partners[35]. The findings recorded a strong positive relationship between positive oil price changes and real government expenditures. Unexpectedly, the result identifies a marginal impact of oil price fluctuations on industrial output growth but the shocks do not in any way measured with respect to life expectancy.

Contrary to these submissions, Scholars have argued in the study initiated in 2011 to evaluate the impact of oil price shocks on selected macroeconomic variables in Nigeria which in their opinion oil price shocks do not have a major impact on most macroeconomic variables in Nigeria[35]. Though, Granger-causality tests were adopted for the estimation in their analysis even though the researchers failed to operate within a theoretical framework to support their

assertions. The omission of life expectancy in the estimated parameters equally justified the weak nature of this study.

The study of the impact of oil production on the human condition in Nigeria between 1980 and 2012 found out following *(i)* oil production of the first period positively impacted environmental degradation, while it was negative in the second period[35]. *(ii)* Its first-period lag has a positive relationship, but second-period lag has a negative relationship with a life expectancy[35]. *(iii)* The variance decomposition analysis showed that oil production worsened environmental degradation and adversely impacted on infant mortality rate, while it positively affected life expectancy[35]. However, this environmental assessment failed to incorporate economic variables into the model, therefore this study is adjudged insufficient to explain the causes of low life expectancy in Nigeria.

In another dimension, Macroeconomists in 2017 engaged a structural vector autoregressive generalized economic growth model, augmented with a debt variable to characterize the dynamic impact of innovations to external public debt to GDP ratio on per capita GDP growth, investment, trade openness, exchange rate, and inflation in Nigeria in the course of examining the impact of external debt shocks on economic growth in Nigeria[35]. Though, the study argued that external debt constituted economic shocks affecting output growth in Nigeria, further posited that external debt shocks have long-lived negative impacts on economic growth and investment. More so, the study revealed that innovations and external debt were found to have short-lived positive impacts on inflation, but negative impacts on trade openness and significant effect on the exchange rate. However, this study was conducted way back in 2017 based on the data between 1970 and 2014; it is observed that the interactions of these variables with welfare and life expectancy were given less attention.

Sequel to the above, the effect of External Debt on Life Expectancy through Foreign Direct investment was equally analyzed to examine the relationship between life expectancy, short-term external debt, and long-term external debt between 1940 and 2017 where a long-run relationship was confirmed between the variables. The causal relationship was found from life expectancy to long-term debt and short-term debt but no causal relationship was found from long-term debt and short-term debt to life expectancy[35]. Though the Turkish population was adopted for the case study but Further studies to investigate the direct relationship between external debt, relevant macroeconomic variables, and life expectancy for developing countries particularly Nigeria could have produced a better and reliable result.

2.3.2 Empirical Review of Life Expectancy amidst Political, Economic Instability, and Civil Unrest

A study of the relationship between civil conflict and income per capita indicated that poor countries have a higher propensity to suffer from civil war[35]. Second, civil war occurs when countries suffer negative income shocks. It showed that mutual fears exacerbate the problem caused by negative income shocks[35]. Though this study may be conducted as far back as 2009 it could be updated to include life expectancy as the dependent variable to make the study more relevant and for valuable contribution to the body of knowledge.

To understand the relationships in the less developed countries (LDCs) between life expectancy, socioeconomic development, and public health measures, a critical evaluation of 95 developing countries was carried out in which the following indicators of modernization were used as a determinant of life expectancy[35]. *(i)* percentage of the population living in urban areas; *(ii)* percentage of the population engaged in agriculture; *(iii)* percentage of the population that is literate; *(iv)* percentage of the population with access to safe water; *(v)* mean daily caloric intake per head; *(vi)* population per physician. This finding revealed that

mortality is primarily influenced by such socioeconomic development measures as urbanization, industrialization, and education, and secondarily by such public health measures as access to safe water, physicians, and adequate nutrition[35]. Apparently, the wide coverage of this study could generate some ambiguity in the results and as such, it may be better to conduct this research based on the countries case-by-case.

The relevance of population welfare and economic agent's longevity cannot be underestimated in the development of a nation[35]. Following this, a panel data analysis of 74 industrialized and developing countries over 1980–2000 was initiated to investigate the effect of population health on gross inflows of foreign direct investment (FDI), the vertical and Cobb-Douglas Model adopted showed that gross inflows of FDI are strongly and positively influenced by population health in low- and middle-income countries. Estimates suggest that raising life expectancy by one year increases gross FDI inflows by 9%, after controlling for other relevant variables[35, 35]. These findings are consistent with the view that health is an integral component of human capital for developing countries. In line with several findings, researchers have collected and analyzed using a multiple regression a twenty years' time series data covering the period (1993-2012) from the Central Bank of Nigeria (CBN), National Bureau of Statistics (NBS), and National Population Commission (NPC) to study the impact of microfinance banks activities on the standard of living and longevity in Nigeria. Interestingly, their result showed that microfinance banks activities do not have a significant positive impact on the standard of living and life longevity of economic agents in Nigeria[35]. The research further highlighted that microfinance banks should be established within the locus of the poor and not the rich, jettisoning of tangible collaterals for microfinance credit but rather relying on social collaterals, and creation of products by the microfinance banks that will be structured to the environment of their clients will go a long way to promoting the welfare of people[35].

Assessment of limited life expectancy, human capital, and health investments has shown not the only improvement in the global life expectancy but has increased by almost 20 years over the past five decades[35]. These increases have contributed hugely to gains in well-being worldwide

Evidence from the study conducted during post-economic reform in India on the role of financial development and economic misery on life expectancy indicated a long-run impact and suggests that financial development, economic growth, and education expenditure have a significant and positive impact on life expectancy while economic misery and rural-urban income inequality have a substantial negative impact, a replicate of this study adapted to Nigeria's macroeconomic environment may be apt in understanding the response of life expectancy to fluctuations in macroeconomic variables[35].

The impact of food production index, inflation, population growth, GDP per capita growth on life expectancy between 1975 and 2013 has not only showed a significant relationship between variables used but has also revealed that food production has a positive and significant relationship with a life expectancy[35]. Inflation and population growth have a negative and insignificant relationship with life expectancy. The growth in per capita income has a positive and significant relationship with life expectancy. The short-run result showed that inflation and population growth has a negative and insignificant relationship with life expectancy. But, contrary to other studies, food production and per capita growth rate has a positive and insignificant relationship with life expectancy.

In another perspective, the evaluation of the effect of fossil fuel and electricity consumption on life expectancy and infant mortality in Nigeria and South Africa between 2018 and 2019 has indicated a negative effect of fossil fuel use on life expectancy and infant mortality rates for both countries[35]. The effect of fossil fuel use on life expectancy is only noticeable in the

short run. In Nigeria, the negative effect of fossil fuel consumption on infant deaths is observed both in the short and long run with indications of stronger long-run effects. Findings for South Africa showed a negative effect of fossil fuel consumption on infant deaths only in the short run with a higher magnitude than short-run effects in Nigeria. Negative effects of electricity consumption on health outcomes were observed for both countries, but in South Africa, the effect was only in the short run[35]. Anyway, the claim in this study was driven by world development index data, and as such a statistical data from the appropriate Nigerian authority may be helpful to substantiate their assertions.

A study of the interactive effect of energy consumption and poverty on life expectancy in Nigeria equally maintained that poverty had a negative and significant impact on life expectancy in the short-run and the long run. Also, energy consumption had a positive and significant impact on life expectancy in the long- run. The coefficient of the interactive effect of poverty and energy consumption is negative and significant on life expectancy in the short run and in the long-run[35]. Correspondingly, the linkage between economic growth and life expectancy by considering the potential role of financial development and energy consumption has adequately confirmed the presence of cointegration between the variables. Further, economic growth is positively associated with life expectancy. Financial development is revealing a negative effect on life expectancy in the scenario of Pakistan. Energy consumption lowers life expectancy via environmental degradation[35]. Regardless of the attributes common to Pakistan and Nigeria, this study may not completely fit in or explain the current situation of Nigeria.

Consequently, a study carried out to examine the impact of household electricity consumption on the standard of living in Nigeria with the level of education, poverty rate, per capita income, and life expectancy as a proxy for standard of living by adopting

autoregressive distributed lag (ARDL) bound test in estimating the long-run and short-run relationship of the variables of the model based on the neoclassical theory of economic growth popularized by Solow in 1974 has yielded positive long-run relationship between household electricity consumption and level of education, poverty rate, per capita income and life expectancy[35]. The study also found a significant short-run relationship between household electricity consumption and level of education, poverty rate, per capita income, and life expectancy.

A cluster of the researcher in 2018 studied the effects of socioeconomic factors such the percentage of Nigeria's government's health expenditure of the Gross Domestic Product (GDP), the percentage of the private health expenditure of the GDP, the percentage of people with access to safe water in the population, and the percentage of people with access to basic sanitation system on the life expectancy at birth. Interestingly, their study concluded that Nigeria's government health expenditure of the Gross Domestic Product (GDP), and the percentage of the private health expenditure of the GDP at a significant level of α=0.05 do not have a significant effect on the life expectancy, but however, access to safe water in the population and basic sanitation system do have a significant effect on the country's life expectancy at birth[35].

Another group of investigators who investigated the implications of food poverty on life expectancy in Nigeria has presented that while total labour force, capital formation, and food items importation had positive effects on life expectancy in Nigeria, food poverty exerted a negative impact on life expectancy in Nigeria within the period under study[35, 35].

An unbalanced panel data used to assess the dynamics between health and economic growth using panel generalized method of moments estimator that takes care of endogeneity issues, which arises due to reverse causality also pointed that population health proxied by life

expectancy exert a positive and significant effect on both real income per capita as well as growth. The observed result was obtained from 17 advanced economies for the period 1870–2013, therefore, a more recent study relating to Africa particularly Nigeria is advised.

The comparative study of the impact of public and private health spending on life expectancy, with the main goal of examining the causal link among public health expenditure, private health expenditure, and life expectancy in which the Toda and Yamamoto causality test has revealed a significant positive relationship among public health expenditure, private health expenditure, and life expectancy[35,35]. The in-depth analysis further showed that private health expenditure has a positive and significant impact on life expectancy while public health expenditure has no significant impact on life expectancy. The results of the causality test show a bi-directional causality between private health expenditure and life expectancy and a unidirectional causality running from life expectancy to public health expenditure[35]. Although, this research coverage was basically on Cameroon which may render their results inapplicable to Nigeria, therefore, a similar study that can encapsulate macroeconomic variables in determining life expectancy in Nigeria may be preferred.

Vulnerability to catastrophic events has been described as a highly significant but unnoticed cause of low life expectancy[35]. The cross-national, time-series data used to establish this claim showed that natural disasters lower the life expectancy of women more than that of men. In other words, natural disasters (and their subsequent impact) on average kill more women than men or kill women at an earlier age than men. Since female life expectancy is generally higher than that of males, for most countries natural disasters narrow the gender gap in life expectancy. Second, the stronger the disaster (as approximated by the number of people killed relative to population size), the stronger this effect on the gender gap in life expectancy. That is, major calamities lead to more severe impacts on female life expectancy

(relative to that of males) than do smaller disasters. Third, the higher women's socioeconomic status, the weaker is this effect on the gender gap in life expectancy. Taken together, results showed that it is the socially constructed gender-specific vulnerability of females built into everyday socioeconomic patterns that lead to the relatively higher female disaster mortality rates[35]. Though this study might have expressed the gravity of collective natural disaster shocks but failed to reveal the relationships between natural disasters, macroeconomic variables, and standard of living or life expectancy as the case may be.

In like manner, the macroeconomic study of the determinants of life expectancy in Nigeria using variables such as income per capita, unemployment, inflation, income inequality, health investment; health system measured by physician per 1,000 population and the environment measured by the carbon dioxide emission index from 1980-2015 has been estimated using the Ordinary Least Squares technique in which the macroeconomic variables included in the model, income inequality was the largest predictor of life expectancy[35]. The other macroeconomic variables significant in explaining life expectancy are income per capita and government capital expenditure on health. Also, carbon dioxide emission and physician per 1,000 population were found to be significant in explaining life expectancy in Nigeria[35]. However, the shocks to macroeconomic variables neglected in this study constituted the major flaws that rendered the research inadequate in explaining the causes of the low life expectancy in Nigeria.

An empirical contribution of rectangularization to the secular increase of life expectancy between has also professed an acceleration of rectangularization in the 1980s, whereas a deceleration occurred among women in the 1960s[35]. These diverging trends are likely to reflect the gender-specific trends in smoking. As for longevity, the extension was steady from 1922 in both genders in almost all countries[35].

2.3.3 Economic Performance, Demographic Transitioning and Life Expectancy: Empirical Evidence from Nigeria

Demographers have equally investigated the causal effect of life expectancy on economic growth by explicitly accounting for the role of the demographic transition, it was gathered that a sufficiently high life expectancy is ultimately the trigger of the transition to sustained income growth[35,35]. Articles on awareness of demographic change by individuals as they project their life expectancy and survival probabilities upon determinants that coincide with the evidence of epidemiological and demographic studies also pointed out that people are living longer than ever in the developed world[35]. The lowered death rate, well below what was being projected a few years ago, has enormous ramifications for the Social Security program, insurance actuaries, employers, politicians, and economists. Evidence from 1980 to 2009 has presented factors affecting life expectancy to include the availability of more health care resources and higher levels of socioeconomic advantages[35]. In contrast, demographic changes are more likely to increase life expectancy by way of health care resources.

In the same vein, the study of life expectancy and labor supply of the elderly among organizations for economic cooperation and development (OECD) countries to determine the effects of an extension of life expectancy (that is to say, a reduction in the probability of dying after the first period of life as defined in the overlapping generation model) on the individuals' motivations to retire, the focus of interest has been the extension of longevity[35]. Their analysis concluded that, as long as the increase in longevity improves the old workers' productivity more than the utility of leisure, the tradeoff between these two forces is solved by workers, on average, by distributing the additional time of life expectancy between work and retirement, so more workers find incentives to leave the labor market later[35]. Though, these studies failed to adopt robust macroeconomic indicators for their assessments as well as

put into consideration the economic activities and economic shocks experienced over the years and how it relates to life expectancy in Nigeria. Not only that, the research is viewing the problem in an opposite direction by estimating life expectancy on economic growth. Therefore, investigating economic shocks on life expectancy in Nigeria will assist in providing up-to-date information and also filled the neglected research gap.

Economic modeling was performed between 1965 and 2005 by adopting bounds testing approach to cointegration to compute the long-run elasticity of longevity with respect to the selected economic, social, and environmental factors[35]. Apparently, this result suggested that nutrition and food availability along with health expenditures are the main positive factors for improving longevity whereas smoking seems to be the main cause for mortality[35]. The correlation between per capita GDP, public health expenditure, and average years of education with the cross country life expectancy as measured at birth using cross-sectional data from several sources have signaled that there are underlying issues that affect the overall life expectancy throughout the world[35]. A better understanding of the macroeconomic shocks at a different point in time in an economy will help public officials, aid organizations, and world health policymakers more effectively appropriate resources in an effort to increase global life expectancy.

The cross-national study of female life expectancy, gender stratification, health status, and level of economic development which seeks to assess the utility of gender stratification theory in accounting for cross-national differences in female life expectancy has presented that several aspects of women's status have a positive effect on female life expectancy. Indicators of women's educational status, women's economic status, and women's reproductive autonomy all prove to be important predictors of female life expectancy. Analysis of interaction effects suggests that the strength of the effects of some aspects of

women's economic status and the effect of some aspects of health status on female life expectancy vary with the level of economic development. The scope of this study is more gender inclined with several countries involved, therefore; it will be more fascinating to restrain the study to Nigeria as well as focusing on the unexpected events that change the direction of the nation's economic activities at a point in time.

In estimating the impact of race and education on past and present life expectancy, examine trends in disparities from 1990 through 2008, and place observed disparities in the context of a rapidly aging society that is emerging at a time of optimism about the next revolution in longevity. The study has found out that adult men and women with fewer than twelve years of education had life expectancies not much better than those of all adults in the 1950s and 1960s[35]. When race and education are combined, the disparity is even more striking. In 2008 white US men and women with 16 years or more of schooling had life expectancies far greater than black Americans with fewer than 12 years of education—14.2 years more for white men than black men and 10.3 years more for white women than black women.

Changes in Life Expectancy in the Mid-1990s in cause-specific death rates at ages 15–74 years were examined among Russians. Rates for 1998 were compared with those for 1994 (the year of lowest life expectancy) and for 1991 (the year the Soviet Union broke up) and it was found that the decline in mortality since 1994 was, however, mainly due to a reduction in the rate of deaths from a group of causes associated with alcohol consumption, this study asserts that alcohol takers are liable to die young, but failed to considered other factors among the population with less alcohol consumption but yet experienced low life expectancy[35]. Also, the application of extreme bound analysis has used panel data to study life expectancy at birth, this empirical approach to the social determinant of health with a focus on Life Expectancy in 54 low-income Countries, between 1990 and 2012, so convincing as it sounds, no evidence

that national income, public spending on healthcare and education, secondary schooling, terms of international trade, employment, debt service, and relief, out-of-pocket expenditures, agricultural exports or imports, foreign investment, urbanization or environmental degradation were robustly associated with population health and life expectancy[35]. It should be noted that all the low-income countries sampled also have dissimilar economic information rather than only income as the indicator. Therefore, a more elaborate country-specific based research could be more appropriate.

A panel of researchers examined health expenditure and socio-economic determinants of life expectancy between 1995 and 2003 where it was discovered that improvement in per capita income, unemployment, and exchange rates also improves health outcomes[35, 35]. In addition to the claims of the preceding proponents, the vector autoregressive distributive estimation technique used to examine health expenditure distribution and life expectancy in Nigeria between 1980 and 2015 has shown that the highest shocks to the life expectancy were accounted for by the share of government expenditure[35]. The second in rank was the number of physicians and carbon dioxide also contributed immensely to low life expectancy in Nigeria. From the results, the contribution of the real growth rate of income was indirect and marginal. Other variables such as Death and Birth rate did not contribute significantly to the life expectancy in Nigeria during the study period[35]. Considering the time gap and failure to extend the search to unprecedented occurrences in the economy as at the time of this study could render this research incapable of representing the real situation in the country.

Also, studying the dynamic relationship between life expectancy and life span equality by performing time series analysis on human mortality data set from 49 countries also demonstrated that both changes in life expectancy and life span equality are weighted totals of rates of progress in reducing mortality, the link between life expectancy and life span

equality is especially strong when life expectancy is less than 70 years[35]. In recent decades, life expectancy and life span equality have occasionally moved in opposite directions due to larger improvements in mortality at older ages or a slowdown in declines in midlife mortality among developed nations. Be that as it may since Nigeria is not yet a developed nation it will be salient to remodel the study to conform to Nigeria's circumstances.

2.3.4 Economic Performance, Pandemic and Life Expectancy: Empirical Evidence from Emerging and Developing Economies

The epidemiologists have also described Ebola as a shock in their investigation which pictured an upward trend of mortality in survivors of ebola virus disease (EVD)[35]. Long-term sequelae of Ebola virus disease including myalgia, arthralgia, ocular diseases, and mental confusion have come to light in survivors of the 2014–16 Ebola outbreaks. The frequency and duration of these sequelae, which are collectively referred to as post-Ebola virus disease syndrome, have since been reported, but regardless of the fact that this study failed to take cognizance of both the physical and emotional damage from this epidemic shock, it is of utmost importance to also examine the effects on life expectancy. The direct effects of the ebola outbreak on life expectancy have shown possible reductions in life expectancy resulting from EVD deaths ranged from 1.63 years (low Results: In Liberia, possible reductions in life expectancy resulting from EVD deaths ranged from 1.63 years (low EVD scenario) to 5.56 years (high EVD scenario), whereas in Sierra Leone, possible life expectancy declines EVD scenario) to 5.56 years (high EVD scenario), whereas in Sierra Leone, possible life expectancy declines ranged from 1.38 to 5.10 years. In Guinea, the direct effects of EVD on life expectancy were more limited[35]. Throughout the EVD and post-EVD season study of such was an oversight in Nigeria.

Furthermore, investigators have shed light on the impact of the outbreak of coronavirus disease of 2019 (COVID-19) in Nigeria, this pandemic was described as causing a global economic shock in which economic activities all over the world have taken different directions. Results here indicated that COVID-19, on average, influenced the Nigerian agricultural sector to a great extent. On the test for the individual hypothesis, the result revealed that the pandemic exerted a significant positive effect on Nigerian farmer's earnings influenced economic greatness potentials of the Nigerian agricultural sector, exert a negative significant effect on agricultural productivity in Nigeria, and a positive insignificant effect on Nigeria's foreign exchange earnings through agricultural produce exportation[35].

Assessing food poverty, vulnerability, and food consumption inequality in the context of COVID-19 as well as exploring the importance of different socio-demographic and environmental factors in which the adopted feasible generalized least square method reflects that, a greater percentage of households with young children or with elderly people are found to suffer high food vulnerability. In addition, households in environmentally endangered regions e.g. drought-prone areas or river erosion-affected places are more food vulnerable than those in other parts of the country. Certain occupation groups e.g. day laborers and self-employed are found to be highly vulnerable to food poverty while according to our decomposition analysis of food consumption inequality, area of residence (urban vs. rural) is expected to cause sizable inequality in food consumption which all in all can engender low life expectancy[35].

In line with previous submissions, the examination of the effects of globalization on life expectancy in Nigeria between the periods of 1986 and 2016 has proved that economic globalization has a positive and significant impact on life expectancy in Nigeria[35]. Hence, in providing policies that concern globalization in Nigeria, the economic dimension of

globalization should be well defined for it has a long-run relationship with an enhancement of longevity in Nigeria[35]. Though this research was completed in 2016 yet the variables used to arrive at the conclusion were unknown which could subject this study to a more critical investigation.

Nonetheless, the longitudinal employment survey data of over 100,000 children ages 10–16 analyzed to examine the impact of household economic shocks on the schooling and employment transitions of young people also indicated that an unemployment shock significantly increases the probability that a child enters the labor force, drops out of school, and fails to advance in school. The effects can be large, implying increases of as much as 50% in the probability of entering employment for 16-year-old girls. In contrast, shocks occurring after the school year do not have significant effects[35]. Even so, the study was based on teenagers who are still dependents, in addition, school enrolment was the major focus of this study therefore, the experience of macroeconomic shocks may be limited on this population sample.

In the same manner, the analysis of aggregate economic shocks on child schooling and health have predicted that economic shocks reduce investments in children, they may have a long-lasting impact on poverty and its intergenerational transmission[35,35]. In richer countries, like the United States, child health and education outcomes are counter-cyclical: they improve during recessions. In poorer countries, mostly in Africa and low-income Asia, the outcomes are pro-cyclical: infant mortality rises and school enrollment and nutrition fall during recessions.

The Nigeria scenarios about life expectancy differences and the disease cycle as a major predictor in Africa which delineated some morbid determinants of such differences as they relate to observed disease patterns in Nigeria and the relationship between life expectancy

and the disease cycle has presented that since the 1900s average life expectancy worldwide has more than doubled to between 70 and 72 years, while the figure for the African region still falters at about 62.5 years[35]. On the global scale, Nigeria ranks 177/178 for current life expectancy at birth. Based on the age-standardized mortality rate per 100,000 of population ranking of the causes of death in Nigeria, topmost conditions include tuberculosis (1st), fall (2nd), maternal conditions (3rd), Pertussis (4th), and diarrhoeal diseases[35]. In terms of percentage ranking of the causes of death in Nigeria, top on the list are Influenza and Pneumonia (15.03%), diarrhoeal diseases (9.16%), Tuberculosis (8.62%), HIV/AIDS (8.31%), Malaria (5.53%), Low Birth Weight (4.30%), Stroke (4.10%), Birth Trauma (4.01%), Coronary Heart Disease (3.76%) and maternal conditions (3.14%). All of these offer differential explanations and contributions to variations in the life span of the Nigerian populace.

2.3.5 Economic Performance, Life Expectancy, Environmental Problems and Climate Change: Empirical Evidence from Developed and Developing Economies

Environmentalists have equally argued that the emission of greenhouse gases (GHGs) in the process of economic activities in which the GHGs were the main cause of ozone depletion that is responsible for the low life expectancy in Nigeria. In their quest to investigate the extent to which environmental hazards affect life expectancy it has been exposed that environmental hazards in terms of carbon dioxide (CO2) emission from solid fuel consumption reduce life expectancy (LEX) by 1 month and 3 weeks with a statistically significant result. Also, income, as proxied by GDP, extends LEX by 1 year 6 months with statistically insignificant results, while population growth (POPG) equally extends LEX by 5 years 5 months due to an increase in human resource/manpower which enhances agricultural

productivity[35]. Seemingly, this study was based on the global context which should be narrow down to various countries.

An inter-disciplinary study also exposed that life expectancy could be determined by the quality of atmospheric air; this is evidenced in the investigation carried out in China where two approaches were used to estimate the relationship between total suspended particulates (TSPs) and human health. The first approach is a "conventional" strategy that uses ordinary least squares to fit the following equation to the cross-sectional data, their results indicated that the Huai River policy of uncontrolled air pollution led to a staggering loss of over 2.5 billion life years. Further, data from 2003 to 2008 revealed that PM10 (particulate matter smaller than 10 μm) concentrations are 22.9 μg/m3 higher (95% CI: 13.5, 23.3) or 26% higher north of the Huai River, suggesting that residents of the North continue to have shortened lifespans. The TSP concentrations that prevailed during the study period greatly exceed the current concentrations in developed countries but are not typical for many cities in developing countries today[35].

Investigating the effects of population growth on average life expectancy in Nigeria taking into account the explicit role of healthy citizens in economic development also pointed out that rising population growth have positive and insignificantly impacts life expectancy, but 1% decrease in fertility rate and population of 65-and-above dependency ratio could positively stimulate an improvement in longevity by 5.84, and 81.5 respectively in Nigeria[35].

In the same view, research conducted in 2019 on the impact of environmental pollution on life expectancy in Nigeria have purported that the impact of environmental pollution on life expectancy was negative and significant[35]. Also, longer life expectancy could be achieved significantly by a reduction in the ambient PM2.5 concentrations, increasing per capita

income and provision of effective adult education[35]. Furthermore, a long-term relationship was found to exist between environmental pollution and life expectancy[35].

The role of governance in public health spending and health outcome in Nigeria as described in a study conducted in 2020 has shown that public health spending had no significant effect on health outcomes except when interacted with governance quality[35]. The interaction of government health spending with governance effectiveness as well as that for control of corruption improved health by inducing a fall in maternal deaths, whereas government health expenditure interacted with rule of law raised maternal mortality. Public health spending interacted with regulatory quality improved life expectancy while that of political instability with public health spending induced a fall in life expectancy, poor maternal and infant health[35]. Political stability and the control of corruption had a direct influence on maternal health.

Analyses of the social determinants of health inequality and life expectancy among women of Edo State, Nigeria also outlined that listening to the radio; persons responsible for decisions on reproductive health issues, employment, and type of place of residence had significant positive effects on parity and age at the first delivery[35]. Employment was the best predictor of both dependent variables. The ability to read and write had a negative relationship with the age at first delivery. The social change implications include the attainment of longer lives in Edo State, Nigeria, through effective policies on employment and education.

A recent study on the effect of the current COVID-19 pandemic that has plagued globally on the Nigerian populace was researched in the year 2020, findings from the bounds test trace the long-run relationship between public health expenditure and economic growth over the study span. Although health expenditure was not significant, empirical results showed that a 1% increase in life expectancy and death rate increases and decreases economic growth by

3.85 and 1.84%, respectively[35]. Though, a study giving first estimates of the potential direct impact of the COVID-19 pandemic on life expectancy has summarized statistically that at a 10% COVID-19 prevalence rate, the loss in life expectancy at birth is likely above 1 year in North America and Europe and in Latin America and the Caribbean[35]. In Southeastern Asia and sub-Saharan Africa, one year lost in life expectancy corresponds to an infection prevalence of about 15% and 25%, respectively[35]. Given the uncertainty in fatality rates, with a 50% prevalence of COVID-19 infections under 95% prediction intervals, life expectancy would drop by 3 to 9 years in North America and Europe, by 3 to 8 years in Latin America and the Caribbean, by 2 to 7 years in Southeastern Asia, and by 1 to 4 years in sub-Saharan Africa[35]. Intensive research on other macroeconomic components will help to strongly establish the facts stated above.

A macroeconomic determinant of life expectancy in Nigeria was studied in 2019 using data collected between 1980 and 2015 on variables such as income per capita, unemployment, inflation, income inequality, health investment; health system measured by physician per 1,000 population and the environment measured by the carbon dioxide emission index have suggested that macroeconomic variables significant in explaining life expectancy are income per capita and government capital expenditure on health. Also, carbon dioxide emission and physician per 1,000 population were found to be significant in explaining life expectancy in Nigeria[35]. However, this study could not relate the degree to which these variables impacted life expectancy which, therefore, the examination of macroeconomic shocks on life expectance would be expected to incorporate.

2.4 Gap in Literature

Despite the high numbers of studies conducted to show the links between life expectancy, health outcome and economic growth, it can be seen that there are a limited number of studies paying attention to comparing and contrasting the impact of economic growth input compositions such as capital, labour and technology on the life expectancy in terms of government health spending, income per capita, unemployment rate, inflation rate and foreign exchange rate in developing countries like Nigeria. Empirical results are opposite between effects of life expectancy and economic growth on long-run economic development. This provides some gaps in existing empirical research to examine the relationship between economic performance indicators and life expectancy among different gender in Nigeria. Therefore, this study is to bridge these gaps in existing empirical research by investigating the impact of economic performance indicators on life expectancy in Nigeria between 1981 and 2020

Furthermore, the study will also focus on the responses of life expectancy to various economic performance indicators since the aspect has been an oversight in the previous studies. Lastly, the causal effects between life expectancy and economic performance indicators in Nigeria between 1981 and 2020 shall be examined.

2.5 Theoretical Framework

The theoretical foundation of this study hinges on the neoclassical growth theory and endogenous growth theory as it proposes that government can boost output growth rates like the health sector if they can bring goods and services to private sectors in which there would other side be sub-optimal investment. Under the neoclassical model, taxation and government expenditure may affect the incentive to invest in human and physical capital, but in the long-run these affect only the equilibrium factor ratios, not the growth rate, although in general

there will be transitional growth effects. Meanwhile, the endogenous growth model predicts that taxation and government expenditure will influence the long-run growth rate. Within this part, this study focuses solely on reviewing government expenditures side, which is assumed to be financed using lump-sum tax in order to recognize the differences of government spending between neoclassical and endogenous growth models. A lump-sum tax is favored for building an economic growth framework as it has no effect on household or firm's decisions (saving and investment) and thus will not change the effects of expenditure growth.

Studying the public spending in endogenous growth models is whether fiscal policy fits into either the production or consumption sectors of the model. Only productive expenditures that are included in the production sector as a complementary to private sector production can have a direct effect on growth. Meanwhile, non-productive expenditures which include much of government consumption are assumed to be perfect substitutes for private consumption and therefore modelled as additional inputs to the household utility function. The non-productive expenditures have no effect on the saving and investment decision due to the assumed nature of the preference function. A large proportion of government spending could be thought of as increasing or decreasing the production of output in the economy, but it is possible that only a few of them affect output growth in a homogeneous manner. By using model of Barro, the relationship between government expenditure and the growth of output can be discussed widely under two types (i) changes in how spending affects the production of output (spending that encourages the accumulation of additional reproducible factors); and (ii) changes to characteristics of the productive spending term.

Furthermore, the production function is written in a Cobb-Douglas from, with constant return to scale in capital and labor for simplicity. The term G_Y is used to denote productive government expenditures. Productive expenditures are descried as non-rival, non-excludable

public goods and a flow of goods and services. G_Y is presumed to be produced under an identical technology to that of private goods, which affect production directly and for all productive goods have a homogeneous effect on output. The elasticity of output with respect to government spending is given by β and it is assumed that $0< \beta<1$ so that public goods like all inputs in the equation below are subject to diminishing marginal returns.

The Solow model focuses on four variables: output (Y), capital (K), labor (L), and "knowledge" or the "effectiveness of labor" (A). At any time, the economy has some amounts of capital, labor, and knowledge, and these are combined to produce output. The production function takes the form

Y (t) = F (K (t), A(t)L(t)), ... (1.1)

where t denotes time.

Notice that time does not enter the production function directly, but only through K , L, and A. That is, output changes over time only if the inputs to production change. In particular, the amount of output obtained from given quantities of capital and labor rises over time—there is technological progress—only if the amount of knowledge increases.

F (cK , cAL) = cF (K, AL) for all $c \geq 0$. ..... (1.2)

The assumption of constant returns allows us to work with the production function in intensive form. Setting c = 1/AL in equation (1.2) yields

$$F\left(\frac{K}{AL}, 1\right) = \frac{1}{AL}F(K, AL)$$

..... (1.3)

AL is Y/AL, output per unit of effective labor. Define k = K /AL, y = Y/AL, Here K /AL is the amount of capital per unit of effective labor, and F (K , AL)/ and f (k) = F (k,1). Then we can rewrite (1.3) as

$y = f(k)$. ..... (1.4)

$F(K, AL) = K^{\alpha} (AL)^{1-\alpha}$

$F(cK, cAL) = (cK)^{\alpha} (cAL)^{1-\alpha}$ ..... (1.5)

$= c^{\alpha} c^{1-\alpha} K^{\alpha} (AL)^{1-\alpha}$ ..... (1.6)

$= cF(K, AL)$.

The endogenous model is also set in continuous time. There are two sectors, a goods-producing sector where output is produced and an R&D sector where additions to the stock of knowledge are made. Fraction a_L of the labor force is used in the R&D sector and fraction $1 - a_L$ in the goods-producing sector. Similarly, fraction a_K of the capital stock is used in R&D and the rest in goods production. Both a_L and a_K are exogenous and constant. Because the use of an idea or a piece of knowledge in one place does not prevent it from being used elsewhere, both sectors use the full stock of knowledge, A.

The quantity of output produced at time t is thus

$Y(t) = [(1 - a_K)K(t)]^{\alpha} [A(t)(1 - a_L)L(t)]^{1-\alpha}, \quad 0 < \alpha < 1.$ .....(1.7)

Aside from the $1 - a_K$ and $1 - a_L$ terms and the restriction to the Cobb– Douglas functional form, this production function is identical to those of our earlier models. Note that equation (1.7) implies constant returns to capital and labor: with a given technology, doubling the inputs doubles the amount that can be produced.

Increase in output depends on the quantities of capital and labor engaged in research and on the level of technology. Given our assumption of generalized Cobb–Douglas production, we therefore write

$\dot{A}(t) = B[a_K K(t)]^{\beta} [a_L L(t)]^{\gamma} A(t)^{\theta}, \quad B > 0, \ \beta \geq 0, \ \gamma \geq 0,$ .....(1.8)

where B is a shift parameter.

Likewise, we continue to treat population growth as exogenous and constant. For simplicity, we do not consider the possibility that it is negative.

Aligning with the Cobb-Douglas form $Y = AK^{\alpha} L^{1-\alpha-\beta} G^{\beta}{}_{\gamma}$ ..... (1.9)

Taking the natural logarithm of the above equation, it becomes:

$\ln Y = \ln A + \alpha \ln K + \text{ø} \ln L + \beta \ln G_{\gamma}$ ..... (2.0)

transmitting government health spending, per capita income, foreign exchange, inflation, external debt, and unemployment through investment from capital accumulation, labour and technology for the purpose of this study, then equation (2.0) becomes:

$\ln LE = \mu + \alpha_1 \ln GHE + \alpha_2 \ln IPC + \alpha_3 \ln ED + \alpha_4 \ln FX + \alpha_5 \ln INF + \alpha_6 \ln UNEMP$ ..... (2.1)

where μ is the intercept/constant

α = coefficient of the economic performance indicators

the above represents the theoretical model of this study.

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Chapter Three

Methodology

For robustness of results, the hypotheses were tested on average life expectancy (LEXP), male life expectancy (LEXPM) and female life expectancy (LEXPF). Following the

conceptual framework postulated in the previous chapter, this chapter starts by specifying the models in relations to the specific objectives in the first chapter of this study. Also, the sources of data and measurements, the a'priori expectation, and the technique of estimation were also presented in this chapter.

3.1 Model Specification

3.1.1 Empirical Model of the Relationship between Economic Performance and Life Expectancy

From the conceptual framework of economic performance and life expectancy developed by the researcher in chapter two of this study. This model is extracted to investigate the link between economic performance (fluctuations in the macroeconomic variables) and life expectancy, the model is shown in a functional form in equation (3.1).

$LE = f(IPC,\ INF,\ GHE,\ EB,\ UNE,\ FX)$ …… ……..(3.1)

Proxy the health stock (h_t) by life expectancy (LE), the equation (2.1) becomes:

$LE_t = h(,\ IPC_t,\ INF_t,\ GHE_t,\ ED_t,\ UNE_t,\ FX_t)$ …….(3.2)

The mathematical form of (3.2) becomes:

$LE_t = \beta_0 + \beta_1 IPC_t + \beta_2 INF_t + \beta_3 GHE_t + \beta_4 ED_t + \beta_5 UNE_t + \beta_6 FX_t$ ……(3.3)

Where: LE represents life expectancy, IPC represents income per capita, INF represents inflation rate, GHE represents government health expenditure, EB represents external debts, UNE represents unemployment rate, and FX represents foreign exchange rate.

To put the variables in the same scale of measurement and an estimable form, both sides of equation 3.3 is log-linearized and the disturbance term is introduced as shown in equation 3.4.

$$LogLEXP_t = \beta_0 + \beta_1 IPC_t + \beta_2 INFt + \beta_3 LogGHE_t + \beta_4 ED_t + \beta_5 UNEMPL_t + \beta_6 FX_t + \varepsilon_t$$

…..(3.4)

Where: Log represents the natural log of the variables, and ε is the disturbance term which is meant to capture errors due to misspecification of the model, measurement errors. The variable on the left-hand side is the regressand while the variables on the right-hand side of the equation are the regressors.

3.1.2 Model Analysing the Shocks in Economic Performance and Life Expectancy

The variance autoregressive (VAR) approach was used to examine the causal relationship between economic performance and life expectancy which allows an interaction between all the specified variables. A VAR framework constitutes a convenient framework to assess the interrelationships within a system of variables when the imposition of strong a-priori restrictive assumptions cannot be derived by economic theory[35,35]. The variables included in the VAR are life expectancy (*LE*), output growth (GDP), income per capita (*IPC*), inflation rate (INF), government health expenditure (GHE), unemployment rate (UNE), public debts (PB), and foreign exchange rate (FX). The VAR model takes each of the variables in the system and relates its variation to its own past history and the past values of all the other variables in the system. A typical VAR model in standard form can be written as:

$$Y_t = C + \sum_{t=1}^{p} A_i Y_{t-1} + \varepsilon_t \qquad \text{……(3.5)}$$

Where Y_t denotes the vector of the endogenous variables given by vectors $Y = f(LEXP_t, IPC_t, INF_t, GHE_t, UNE_t, EB_t, FX_t)$; C is a (8x1) vector of intercept terms, A_i is the matrix of autoregressive coefficients of order i. The basic identification scheme uses a recursive VAR model that follows the following ordering as $[LE_t, IPC_t, INF_t, GHE_t, UNE_t, EB_t, FX_t]$, where the contemporaneously exogenous variables

are ordered first. The variable in the VAR is thus ordered from the most exogenous to the least exogenous one.

3.1.3 Model for Analyzing the Causality between Life Expectancy and Economic Performance Indicators

This study adapts the unrestricted vector autoregressive (VAR) approach[35] by estimating seven-variable VAR models by using $LE_t, IPC_t, INF_t, GHE_t, UNE_t, EB_t, FX_t$ to provide an empirical insight on the response of life expectancy to shocks from economic performance in Nigeria. The model is stated as:

$$X_t = u + A_1 X_{t-1} + \ldots + A_p X_{t-p} + u_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(3.6)$$

Where X_t is an 7×1 vector matrix incorporating $LE_t, IPC_t, INF_t, GHE_t, UNE_t, PB_t, FX_t$ as variables; A is a matrix polynomial for the lag operator of considered variables; and u_t is a vector of un-estimated shocks for each of the economic performance variables and it is assumed to be serially uncorrelated structural disturbance for Var (u_t) = Ω. where Ω is a diagonal matrix, so the structural disturbances are assumed to be mutually uncorrelated.

3.2 A'Priori Expectation

The theoretical expectation hypothesizes that economic growth is primarily the outcome of endogenous forces and not external forces. Beyond this, economic agents' health and life expectancy are also tied to economic growth resulting from endogenous forces. Also, the two-period overlapping generation model in which an agent is born in period *t* lives to the old age. Therefore, since the economic performance is determined through macroeconomic variables, then a growing and well improved gross domestic product (GDP) is assumed a healthy economy which is expected to bring about improved welfare and standards of living

and consequently translates to improved life expectancy. Again, per capita income is a measure of the amount of money earned per person in a nation, higher income per capita is sometimes expressed in the standard of living and quality of life of the population, this study expected income per capita and life expectancy to follow the same trend movement. Of course, inflation is seen as a persistent rise in the general price level which reduces the purchasing power of the agents, this is expected to have an impact on every aspect of human life especially in the developing countries that are not producing optimally.

Furthermore, government spending on health (GHE) goes a long way to define the state of health care of a country; poor health funding is expected to yield poor quality of health and low life expectancy. High levels of debt (PD) slow down the economy because a large portion of what a country earns through tax revenues goes into repayment of the debt and the interest rather than being employed for productive use. When the economy slows down, unemployment is expected to rises and there is deterioration in people's standard of living. Evidently, unemployment (UNE) is strongly associated with an increased risk of morbidity, mortality, mental health problems, and lower life satisfaction levels[35], therefore, a perfect negative correlation is expected between the unemployment rate and life expectancy in Nigeria. Finally, when exchange rates change, the prices of imported goods also change in value, including domestic products that rely on imported parts and raw materials. Exchange rates also impact investment performance, interest rates, and inflation - and can even extend to influence the job market and real estate. Thus, for countries that rely on foreign economies, the likelihood of a relationship between foreign exchange volatility and life expectancy is expected.

3.3 Methods of Estimation

3.3.1 Unit Root Test

This test is necessary to examine the stationarity level of individual variables. It indicates whether the variables are stationary or non-stationary. Shocks in stationary time series will be temporary and its effects over time eliminated as the series revert to their long run mean values. Meanwhile, non-stationary time series contain permanent components of shocks and its means and variances depend on time. Different methods under the conventional and modified test were employed to carry out the tests.

3.3.1.1 Conventional Unit-root Tests

The simplest and pioneer approach to test for a unit root referred to as Dickey-Fuller (DF) test begins with an AR(1) model:

$$Y_t = \theta + \varphi Y_{t-1} + a_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.8)$$

Where: $a_t \sim N(0, \delta_a^2)$. Equation 3.8 is simplified further for ease of computation and interpretation as:

$$Y_t - Y_{t-1} = \theta_0 - (1-\varphi)Y_{t-1} + a_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.9)$$

Where: $(1-\varphi) = \delta$; equation 3.9 can be re-written as:

$$\Delta Y_t = \theta_0 - \delta Y_{t-1} + a_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.10)$$

If $\delta = 0$, the system has a unit root $\Rightarrow H_0 : \delta = 0; H_1 : \delta < 0$.

Applying OLS method on the regression equation 3.8, the study test for unit root based on the test statistic given as:

$$t_{\varphi=1} = \frac{\hat{\varphi} - 1}{s.e(\hat{\varphi})} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.11)$$

The test is a one-sided left tail test. If $\{Y_t\}$ is stationary (i.e; $|\varphi|<1$), it can be shown that: $\sqrt{n}(\hat{\varphi}-\varphi)\rightarrow N(0,(1-\varphi^2))$. This means that under H_0 , the limiting distribution of $t_{\varphi=1}$ is $N(0,1)$.

3.3.1.2 Augmented Dickey Fuller (ADF)

Said and Dickey augment the basic autoregressive unit root test to accommodate general ARMA(*p, q*) models with unknown orders; their test is referred to as the Augmented Dickey-Fuller (ADF) test. If serial correlation exists in the DF test equation (i.e., if the true model is not AR(1)), then the AR(*p*) is used to get rid of the serial correlation[3].

$$\varphi_p(B)Y_t=\theta_0+a_t \quad \text{..... ....(3.12)}$$

Where;

$\{a_t\}\sim WN(0,\delta_a^2)$ with $E(a_t^4)<\infty$ and $\varphi_p(B)=1-\varphi_1(B)-...-\varphi_p(B)'$ may contain a unit root.

To test for unit root; the assumption assume that: $\varphi_p(B)=(1-B)\varphi_{p-1}(B)$

Where: $\varphi_{p-1}(B)=1-\varphi B-...-\varphi_{p-1}B^{p-1}$ has unit roots lying outside the unit circle.

$$\varphi_{p-1}(B)(1-B)Y_t=\theta_0+a_t \quad \text{..... (3.13)}$$

$$\varphi_{p-1}(B)\Delta Y_t=\theta_0+a_t$$

$$\Delta Y_t-\sum_{j=1}^{p-1}\varphi_j\Delta Y_{t-j}=\theta_0+a_t$$

Hence, testing for a unit root is equivalent to testing $\varphi=1$ in the following model:

$$Y_t=\varphi Y_{t-1}+\sum_{j=1}^{p-1}\varphi_j\Delta Y_{t-j}+\theta_0+a_t \quad \text{..... (3.14)}$$

Or; $\Delta Y_t = (\varphi - 1)Y_{t-1} + \sum_{j=1}^{p-1} \varphi_j \Delta Y_{t-j} + \theta_0 + a_t \;;\; (\varphi - 1) = \delta$ ……..(3.15)

ADF test equation then becomes:

$$\Delta Y_t = \delta Y_{t-1} + \sum_{j=1}^{p-1} \varphi_j \Delta Y_{t-j} + \theta_0 + a_t \quad \text{..... (3.16)}$$

For ADF Hypothesis, we have:

$H_0 : \varphi = 1 \;\; H_0 : \delta = 0$
$H_1 : |\varphi| < 1 \;\; H_1 : \delta < 1$

Reject H_0 if $t_{\varphi=1} < CV$ and also reject H_0 if $t_{\delta=0} < CV$.

3.3.1.3 Efficient Unit Root Tests

1) Elliot, Rothenberg and Shock (1996) DF-GLS Test

Elliot, Rothenberg and Shock (ERS) (1996) modified the ADF test and show that their test referred to as DF-GLS has the limiting power function close to the point optimal test. ERS propose a family of tests whose power functions they showed is tangent to the power envelope at one point and never below. This test is called $P_T = (0.5)$, signifying that they are optimal at 50% power. They also show that their DF-GLS has the limiting power function close to $P_T = (0.5)$.

The DF-GLS test regression is given as:

$$\Delta y_t^d = \gamma^* y_{t-1}^d + \sum_{j=1}^{p-1} \varphi_j \Delta y_{t-1}^d + \mu_t \qquad (3.17)$$

where y_t^d is the detrended y_t and the null of a unit root is $H_0 : \gamma^* = 0$.

It should be noted that although DF-GLS has better power properties, the issue of lag length selection still remains. Ng and Perron (1996) find that ERS has poor size properties when the underlying Data Generating Process (DGP) has large negative moving average terms. The test is augmented by using Modified Information Criteria (MIC) and show it overcomes this problem, if indeed there are large negative moving averages in the underlying DGP.

3.3.2 Johansen Cointegration Test

This cointegration test method was used to examine the existence of a long-term relationship among the variables incorporated in the specified model systems[35]. The relationships among the variables were based on the following model:

Consider a VAR of order p

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t \quad \text{…….. …. (3.18)}$$

Where y_t is a k-vector of non-stationary I(1) variables, x_t is a d-vector of deterministic variables, and ε_t is a vector of innovations. This VAR can be rewritten as:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-1} + Bx_t + \varepsilon_t \quad \text{…….. ……. (3.19)}$$

Where; $\Pi = \sum_{i=1}^{p} A_i - \mathrm{I}$, $\Gamma_i = -\sum_{j=i+1}^{p} A_j$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank r $<$ k, then there exists k x r matrices α and β each with rank r such that $\Pi = \alpha\beta'$ and $\beta' y_t$ is I(0). r is the number of cointegrating relations (the cointegrating rank) and each column of β is the cointegrating vector and α represents the speed of adjustment parameters.

Johansen developed two likelihood ratio tests for testing the number of cointegration vectors (r): the trace and the maximum Eigenvalue test. The trace statistics test the null hypothesis of r = 0 (i.e. no cointegration) against the alternative that r > 0 (i.e. there is one or more cointegration vector). The maximum Eigenvalue statistics test the null hypothesis that the number of cointegrating vectors is r against the alternative of r + 1 co integrating vectors.

The co integration test was conducted using auto selection of lag-lengths based on minimum Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) in the system.

3.3.3 Vector Autoregressive Estimator

The specified model (3.4) is meant to capture the precise interaction between life expectancy and the set of economic performance indicators. After performing unit-root tests and cointegration and the findings indicated a stationary I(0) series and cointegrated respectively, then the estimates from the system would be valid and reliable. Otherwise, in the case of non-stationary that is I(1) series and cointegrated, the models give the long run causality which is analogous to the long run relationship in a single-equation model. Similarly, the short run dynamics of the model are captured with the Vector Error Correction Model (VECM); similar to the short run adjustment. The VECM model in this study is represented as follows:

$$\begin{bmatrix} \Delta IPC_t \\ \Delta GHE_t \\ \Delta INF_t \\ \Delta UNE_t \\ \Delta PD_t \\ \Delta FX_t \end{bmatrix} = \begin{bmatrix} c_1 \\ c_2 \\ c_3 \\ c_4 \\ c_5 \\ c_6 \end{bmatrix} + \sum_{i=1}^{v} \begin{bmatrix} \pi_{1,1} & \pi_{1,2} & . & . & . & \pi_{1,6} \\ \pi_{2,1} & \pi_{2,2} & . & . & . & \pi_{2,6} \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ . & . & . & . & . & . \\ \pi_{6,1} & \pi_{6,2} & . & . & . & \pi_{6,6} \end{bmatrix} \times \begin{bmatrix} \partial_1 \\ \partial_2 \\ \partial_3 \\ \partial_4 \\ \partial_5 \\ \partial_6 \end{bmatrix} \left[LE_{h,t-1} \right] + \begin{bmatrix} \mu_{1,t} \\ \mu_{2,t} \\ \mu_{3,t} \\ \mu_{4,t} \\ \mu_{5,t} \\ \mu_{6,t} \end{bmatrix} \quad \ldots\ldots\ldots (3.20)$$

Where: Δ is the first difference operator; Error Correction Term (ECT) is extracted from the long-run relationship or the residual from the h*th* cointegration equation lagged one period.

The dynamic model (3.20) is estimated at appropriate lag length based on the minimum value of Akaike Information Criteria (AIC) and Schwarz Information Criteria (SIC).

3.3.4 Pairwise Granger Causality Test

In order to examine whether there are lead-lag relationships between life expectancy and considered economic performance indicators in Nigeria, the Granger causality test was employed. If the time series of a variable is non-stationary, I(1) and is not cointegrated, the variable is converted into I(0) by first differencing and Granger-causality test which can be applied as follows in a first difference VAR framework (this approach examines the long run causality):

$$\Delta X_t = \vartheta_x + \sum_{i=1}^{k} \rho_{x,i} \Delta X_{t-1} + \sum_{i=1}^{k} \psi_{x,i} \Delta Y_{t-1} + \varepsilon_{x,t}, \quad (3.21)$$

$$\Delta Y_t = \vartheta_y + \sum_{i=1}^{k} \rho_{y,i} \Delta Y_{t-1} + \sum_{i=1}^{k} \psi_{y,i} \Delta X_{t-1} + \varepsilon_{y,t}, \quad (3.22)$$

Where: ΔX_t and ΔY_t are the first differences of time series variables while the series is non-stationary. However, if the variables are non-stationary and cointegrated, the Granger causality test will be run based on the following ECM equations (the VECM approach examines the short run causality):

$$\Delta X_t = \vartheta_x + \sum_{i=1}^{k} \rho_{x,i} \Delta X_{t-1} + \sum_{i=1}^{k} \psi_{x,i} \Delta Y_{t-1} + \varphi_x ECT_{x,t-1} + \varepsilon_{x,t}, \quad (3.23)$$

$$\Delta Y_t = \vartheta_y + \sum_{i=1}^{k} \rho_{y,i} \Delta Y_{t-1} + \sum_{i=1}^{k} \psi_{y,i} \Delta X_{t-1} + \varphi_y ECT_{y,t-1} + \varepsilon_{y,t}, \quad (3.24)$$

Where: φ_x and φ_y are the parameters of the ECT term, measuring the error correction mechanism that drives the X_t and Y_t back to their long run equilibrium relationship.

The null hypothesis for the equations (3.21) and (3.22) is $H_o : \sum_{i=1}^{k} \psi_{x,i} = 0$, suggesting that the lagged item ΔY_t do not belong to the regression. Conversely, the null hypothesis for the equations (3.21) and (3.22) is $H_0 : \sum_{i=1}^{k} \psi_{y,i} = 0$, suggesting the lagged term ΔX_t do not belong to the regression. These hypotheses are tested using the F-test.

3.3.5 Causality Test

The third hypothesis is to examine the causal relationship between economic performance and life expectancy in Nigeria. This will be achieved by using the Toda and Yamamoto[35] and Doladao and Lutkepohl[35] (TYDL) augmented Vector autoregressive (VAR) procedure for evaluating the causal estimates. The equation is written as:

$$Z_t = A_0 + \sum_{i=1}^{k} \Gamma_j Z_{t=j} + \mu_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3.25)$$

Where Z_t is a 10 by 1 dimensional vector of non-stationary endogenous variables of the model, A_0 is a 10 by 1 dimensional vector of constant; Γ is a vector of parameters; μ_i is *k*-dimentional vector of stochastic error term normally distributed with white noise properties $N(0, \sigma^2)$. A modified-Wald test will be used in the TYDL augmented VAR procedure. In this procedure, a VAR $[k + d(\max)]$ that has *k* degree of freedom with a maximum order of cointegration for the series $d(\max)$ is estimated.

3.4 Sources and Measurements of Data

Owing to the nature of the study, data from secondary sources will be adopted using both quantitative and descriptive analyses. Specifically, the study shall utilize secondary data complied majorly by the Central Bank of Nigeria (CBN), Statistical Bulletin, and World

Development Indicators (WDI, 2020). The time-series data for analyzing the relationship between life expectancy and main macroeconomic indicators in Nigeria span from 1981 through 2020. The explanatory variables considered for this study include income per capita (IPC), inflation (INF), government health expenditure (GHE), unemployment rate (UNE), foreign exchange rate (FX) and External debt (ED)

Table 3.1: Source of Data and Variable Measurement

S/N	Variables	Description	Measurement	Data source
1.	*LEXP*	Life expectancy is a statistical measure of the average time human is expected to live based on the year of its birth, its current age	Measure of mortality that comes with an implicit age standardization	World Development Indicators (WDI, 2020)
2.	*IPC*	The income per capita is a measure of the amount of money earned per person in a nation	It is measured in percentage	Bureau of Statistics, CBN Statistical Bulletin, WDI, 2020
3.	*INF*	Inflation is measured as the percentage change in general price level using 2005 as the base year	It is measured in percentage	Statistical Bulletin, WDI, 2020
4.	*GHE*	Total government spending on health care provision in a country for a fiscal year	It is measured in billions of US Dollars	CBN statistical bulletin, 2020
5.	*UNE*	Unemployment, the number of people in a particular country who cannot get a job	It is measured in percentage	WDI, 2020
6.	*FX*	Foreign Exchange, the price of one currency in terms of another	It is measured in percentage	WDI, 2020

7.	*ED*	External Debt, the total amount, including total liabilities, borrowed by the government to meet its development budget	Measured in billions of US Dollars	CBN statistical bulletin, 2020

Endnotes

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Chapter Four

Results and Discussion of Findings

The empirical results of the study are discussed in this chapter. The sub-sections are presented in three parts, where the first sub-section discussed the result of the descriptive statistics analysis while the second sub-section addresses the empirical results according to the stated objectives while the last sub-section presents the summary of findings.

The discussion of results started with descriptive analysis and summary statistics, which provided trend analysis of basic indicators of economic performance and average life expectancy in Nigeria. Detail analysis relating to male life expectancy (LEXPM) and female life expectancy (LEXPF) are presented in the appendix. The chapter also provided some diagnostic tests using some test statistics in order to ensure that the estimated results are reliable for meaningful inferences.

4.1 Data Presentation

4.1.1 Preliminary Analysis (Descriptive, Trend and Correlation Analysis)

The preliminary analysis on descriptive statistics, trend and correlation analysis of our intended variables for empirical analysis based on formulated hypotheses are presented in this section. This section answers the first specific objective on the trend and pattern of economic performance and life expectancy in Nigeria. Charts and tables were employed for the presentation of these results. Also, the interval growth rate of economic performance and life expectancy in Nigeria were computed in respect of successive political dispensation as parts of answering the first specific objective of this study.

4.1.2 Results of the Empirical Model of the Relationship between Economic Performance and Life Expectancy in Nigeria

The descriptive statistics of economic performance variables like annual percentage GDP per capita growth (*IPC*), government health expenditure (*GHE*), external debt (*ED*), inflation rate (*INF*), unemployment rate (*UNEMPL*), foreign exchange rate (*FX*), and the life expectancy variables such as average life expectancy in Nigeria *(LEXP)*, female life expectancy in Nigeria *(LEXPF)*, and male life expectancy in Nigeria *(LEXPM)* between the year 1981 – 2020 are presented in table 4.1. The summary statistic of the variables in the table shows that the average of annual percentage of GDP per capita growth stood at 40.1 per cent. This implies that the actual economic activities have increased and consequently improvement in income per capita has also been recorded over the years as it grows at an average of 40.1 per cent. This is also evident in the average life expectancy that has grown from minimum value of 45.637 years to maximum value 55,02 years. The average annual government health expenditure of N80,986 billion showed that government health spending contributed largely than inflation rate, unemployment rate[1], and foreign exchange rate to both male life

expectancy and female life expectancy in Nigeria. Additionally, the average values of income per capita of 40.1% increase and the average value of government health expenditure at N80,986 billion is an indication that the two variables have been the major contributors to improved life expectancy in Nigeria

Table 4.1: Descriptive Statistics

Variable	Measurement	Mean	Std De	Max.	Min.	Kurtosis	Skewnes	Count	Jarque-Bera	Prob
LEXP	Average life expectancy	48.446	3.171	55.020	45.63	-0.810	0.869	40	5.8828	0.0529
LEXPF	Life expectancy for female	49.227	2.879	55.619	46.62	-0.440	1.036	40	7.0953	0.0288
LEXPM	Life expectancy for male	47.223	3.162	53.789	44.09	-0.805	0.868	40	5.8642	0.0533
IPC	Income per capita	0.401	5.310	12.457	-15.4	1.952	-0.841	40	8.4761	0.0144
ED	External debt (%of GDP)	35.140	30.514	120.835	4.951	0.210	0.889	40	67.1907	0.0000
UNEMPL	Unemployment rate	10.620	7.533	30.200	1.800	-0.206	0.814	40	4.2638	0.1186
INF	Inflation rate	18.998	16.869	72.836	5.388	2.622	1.895	40	29.9378	0.0000
GHE	Government health expendi	80.986	112.06	388.37	0.041	0.864	1.383	40	12.4227	0.0020
FX	Foreign exchange rate	100.76	100.73	358.811	0.618	0.160	0.924	40	5.2655	0.0528

Note: Std. Dev. – standard deviation; Max. – maximum; Min. – minimum; Prob. – probability; and number of observations is 40.
Source: Author's computation (2020).

Furthermore, the life expectancy variables i.e. the average life expectancy, average female life expectancy and average male life expectancy were 48.446 years, 49.227 years and 47.223 years respectively. Also, the standard deviation of the variables is low in relations to

their mean values. More so, only the income per capita data is negatively skewed with a value of -0.841, while other indicators skewed on the right side. Of all the variables, the kurtosis showed that average life expectancy; female life expectancy, male life expectancy and unemployment variables were negative and displayed platykurtic form in distribution, while income per capita and inflation rate followed a leptokurtic distribution, implying all of the variables are not normally distributed. More so, the Jarque-Bera statistics revealed that five variables are significant at 0.05 critical values while others are not. The implication is that there is presence of outliers in the values of some variables, indicating some level of asymmetry and discreteness in the data sets.

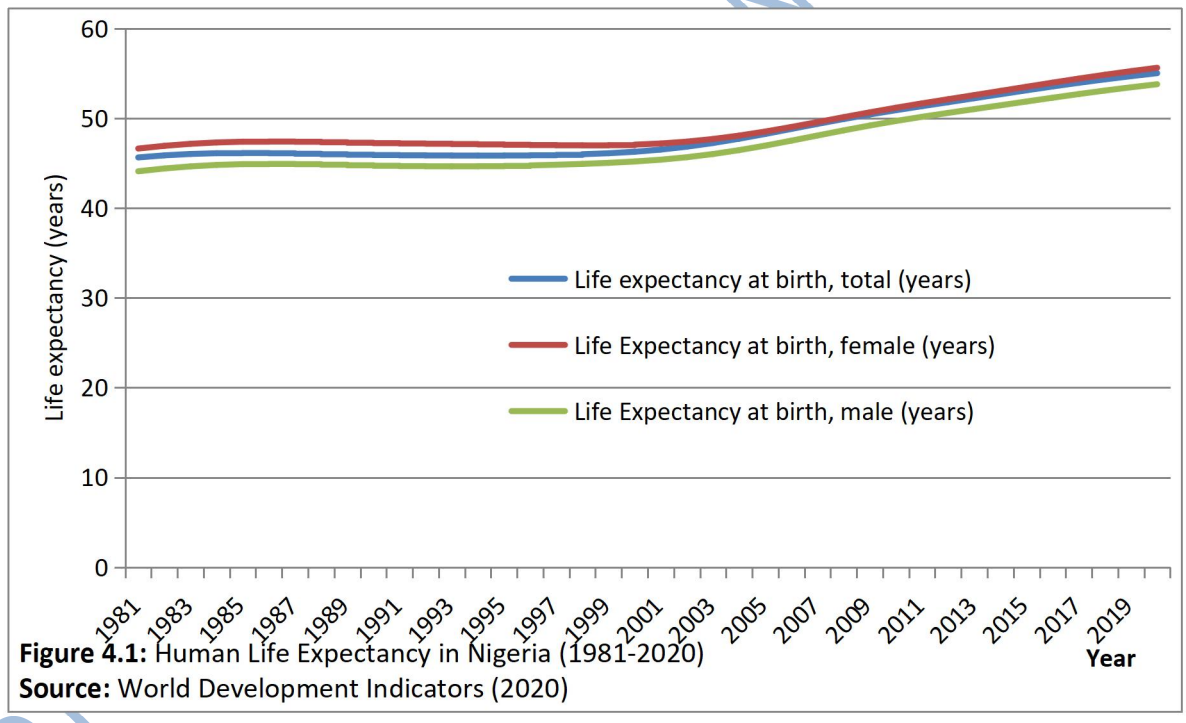

Figure 4.1: Human Life Expectancy in Nigeria (1981-2020)
Source: World Development Indicators (2020)

Figure 4.1 Trend analysis of life expectancy in Nigeria between the year 1981-2020.

The figure above shows that the average life expectancy at birth in Nigeria as well as the female life expectancy and male life expectancy were between 45.64 years and 55.02 years revealing an average increase of 9.38 years in 4 decades. Similarly, between 1981 – 2020 the

female life expectancy has reported to gain additional 8.992 years while male life expectancy has also improved by 9.694 years in Nigeria.

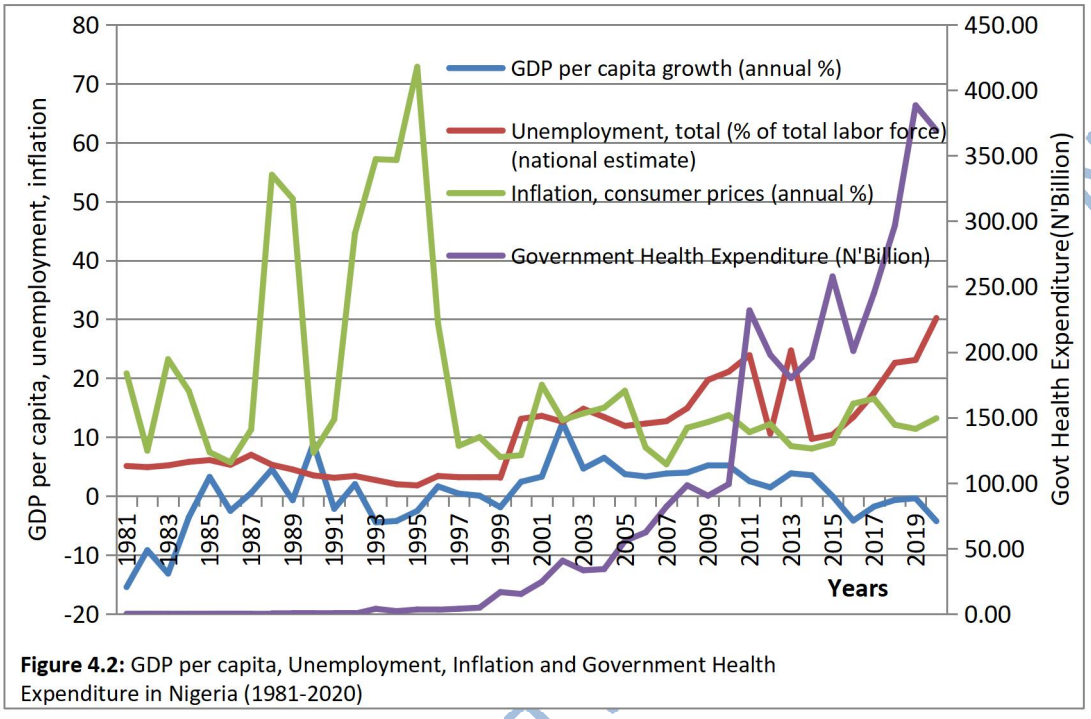

Figure 4.2: GDP per capita, Unemployment, Inflation and Government Health Expenditure in Nigeria (1981-2020)

Figure 4.2 reveals the trend analysis of economic performance indicators in Nigeria between 1981 – 2020. The macroeconomic variables behaviours were observed to follow different patterns, where the annual percentage growth in GDP per capita and government health expenditure grew from negative in 1981 to 1985 for GDP per capita as well as negative for government health expenditure between 1981 – 2008. Also, inflation rate was noticed to be lower in percentage change (7.4353) in 1985 through 1986 and 1987 with percentage change value of 5.7171 and 11.2903 respectively until 1988 that an acute rise was experienced followed by the highest rate of 72.8355 per cent ever recorded in the history of the Nigerian economic performance. Though, unemployment rate appeared to have a cyclical variation even as all the economic performance indicators in figure 4.2 tend to converge between 2007 and 2008. Nonetheless, the consistent growth in government health spending has taken the lead over other variables of economic performance in Nigeria.

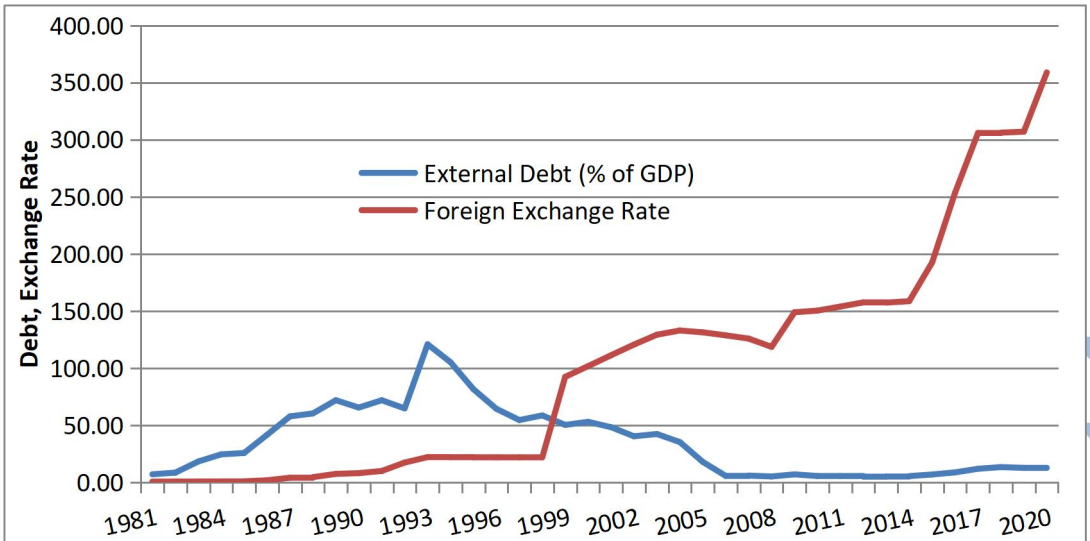

Figure 4.3: External Debt and Foreign Exchnage in Nigeria (1981-2020)
Source: World Development Indicators (2020)

Figure 4.3 shows the trend plot of the Nigerian external debt and foreign exchange in which the external debt were measured as percentage of GDP, it could be inferred from the figure 4.3 where foreign exchange rate were observed to have a consistent upward trend movement since 1991 – 2014 but a geometric progression in the inflation trend were also noticed between 2015 – 2020. Similar to inflation rate, the Nigerian external debt grew continuously from 7.03% in 1981 to 120.84% in 1993 after which it started to decline. However, the Nigerian external debts were noticed to be stationary at 5.6% from 2006 through 2014 even as another era of debts (11.86% in 2017 and 13.06% in 2020) has begun to accrue.

Also, the interval growth of the Nigerian economy measured using the adopted macroeconomic variables as reported in Table 4.2 in which the year intervals represents each political dispensation which is further broken down as follows; the civilian government era that spill over to 1981 through 1983 headed by Shehu Usman Aliyu Shagari; followed by military regime of Major General Muhammadu Buhari between 1983 – 1985, another military era by General Ibrhim Badamasi Babangida from 1985 – 1993 and late General Sani Abacha (1994-1998), Olusegun Obasanjo (1999-2007), late Yardua and Goodluck

Jonathan (2007-2015) and Buhari administration (2015-2020). The table revealed that the female life expectancy, male life expectancy and the overall human life expectancy grew at an average rate of 0.45%, 0.51% and 0.48% between 1981 and 2020. Negative growth rate were recorded against female life expectancy during the military era of General Badamosi Babangida (-0.07) 1985 - 1993and General Sanni Abacha (-0.08%) 1994 – 1998 while the interval growth rate in male life expectancy accounted for -0.6 per cent between 1985 – 1993. Also, the interval growth rate of income per capita were negative during the government administrations of Shehu Aliyu Shagari (-5.22%), General Mohammadu Buhari (-45.44%), General Sani Abacha (-12.58%), and the Civilian President Muhammadu Buhari (-6.30%) but a significant positive growth rate in income per capita were also recorded between 1999 – 2007 during President Obadanjo led administration.

Between the intervals of 1985 and 1993, external debt showed -10.26% of GDP while 1999 – 2007 and 2007 – 2015 accounted for -23.54% and -1.14% respectively, the average interval growth rate of external debt from 1981 – 2020 is 1.6%. the unemployment growth rate was 29.12% between 1985 – 1993 and 20.84% between 2015 and 2020 which are considered to by highest growth value, the overall growth in unemployment between 1981 – 2020 stood at 4.67%. The average inflation growth rate between 1981 and 2020 is -1.16%, the period of 1081 – 1983 also revealed a negative inflation growth of -0.66% and 1999 -2007 showed -2.54%. General Ibrahim Babangida regime of 19985 -1993 and General Sani Abacha era recorded highest inflation growth rate of 35.71% and 41.26% respectively. The table further showed that inflation growth rate is gradually gathering momentum as revealed in 2007 – 2015 (5.93%) and 2015 – 2020 (8.56%). The government health expenditure has shown a growth rate of ₦80.94 billion between 1983 and 1985 over previous government administration, the average government health expenditure growth rate is ₦23.98 billion. The periods characterized by lower growth rate of foreign exchange were 1999 -2007 (3.94%)

and 2007 – 2015 (3.36%) while the highest growth rate in foreign exchange of 41.61% and 32.44% recorded during General Muhammadu Buari (1983 – 1985) and General Ibrahim Babangida (1985 – 1993) respectively were above the average growth rate between 1981 and 2020, followed by the exponential growth observed from 3.36% (2007 – 2015) to 14.58% (2015 – 2020).

Variable	1981-198	1983-1985	1985-1993	1994-1998	1999-2007	2007-2015	2015-2020	**Average 1981-2020**
LEXP	0.28	0.34	-0.06	0.09	0.86	0.93	0.73	**0.48**
LEXPF	0.38	0.55	-0.07	-0.08	0.67	0.97	0.79	**0.45**
LEXPM	0.41	0.61	-0.06	0.14	0.82	0.97	0.75	**0.51**
IPC	-5.22	-45.44	5.98	-12.58	18.10	7.37	-6.30	**-3.25**
ED	0.65	1.29	-10.26	7.58	-23.54	-1.14	15.79	**1.60**
UNEMPL	3.70	-34.99	29.12	-30.16	19.28	-3.78	20.84	**4.67**
INF	-0.66	16.67	35.71	41.26	-2.54	5.93	8.56	**-1.16**
GHE	37..41	80.94	10.84	-11.57	22.05	13.27	11.14	**23.98**
FX	5.42	41.61	32.44	27.01	3.94	3.36	14.58	**17.72**

Table 4.2: Interval Growth of Economy and Life Expectancy (1981-2020)

Note: the computation is based on the emergence of different government dispensation in Nigeria between 1981 -2020
Source: Author's computation (2020).

The correlation analysis presenting the level of association between life expectancy variables and economic performance indices for our empirical analysis between 1981 and 2020 is reported in Table 4.2. The magnitude of the various relationships of the indicators of economic performance and overall behaviour of life expectancy variables are strong and positive but none of them is up to 0.9 except for external debt and inflation rate which were negative but still low for empirical analysis. Similarly, the level of associations between the variables of economic performance was reported in the table. Summarily, the correlation values suggest the absence of perfect multicollinearity among the predictive variables, as positive and negative relationships were reported among the variables of interest in varying magnitudes and signs. Although, the correlation coefficients among human life expectancies have values greater than 0.9, but they are not regressed together in the same model.

Table 4.3: Correlation Matrix

	LEXP	LEXPF	LEXPM	IPC	ED	UNEMPL	INF	GHE	FX
LEXP	1	0.995	0.997	0.103	-0.663	0.712	-0.347	0.764	0.730
LEXPF		1	0.995	0.060	-0.621	0.784	-0.311	0.772	0.715
LEXPM			1	0.119	-0.649	0.812	-0.345	0.764	0.732
IPC				1	-0.016	0.265	-0.204	0.034	0.163
ED					1	-0.637	0.666	-0.578	-0.565
UNEMPL						1	-0.408	0.789	0.848
INF							1	-0.305	-0.342
GHE								1	0.716
FX									1

Source: Author's computation (2020).

4.1.3 Pre-Estimation Test (Unit Root Test)

This test is necessary to examine the stationarity level of individual variables. It indicates whether the variables are stationary or non-stationary. Shocks in stationary time series will be temporary and its effects over time eliminated as the series revert to their long run mean values. Meanwhile, non-stationary time series contain permanent components of shocks and its means and variances depend on time. In this current study the conventional Augmented Dickey-Fuller unit root test was employed to carry out the test.

Table 4.4: Conventional Unit Root Test for the Time Series Data, 1981 - 2020

Variable	Level	First Difference	*I*(d)
	ADF	ADF	
IPC	-2.496702(1)[-3.533083]	-10.46642(0)[-4.219126]***	*I*(1)
ED	-2.311435(0)[-3.529758]	-5.958524(0)[-4.219126]***	*I*(1)
GHE	-0.351956(0)[-3.198312]	-6.876975(0)[-4.226815]***	*I*(1)
INF	-4.068644(1)[-3.533083]**	-	*I*(0)
UNEMPL	-3.323012(0)[-3.529758]	-10.08609(0)[-4.219126]***	*I*(1)
FX	-0.443643(1)[-3.196411]	-4.715474(0)[-4.219126]***	*I*(1)
LEXP	-2.509100(0)[-3.533320]	-4.529112(0)[-3.540328]***	*I*(1)
LEXPM	-0.784411(0)[-3.540328]	-5.874480(0)[-3.540328]***	*I*(1)
LEXPF	-3.440644(4)[-3.540328]	-5.064430(4)[-3.540328]***	*I*(1)

Note: *** significant at 1%; ** significant at 5%;. Calculated at trend and intercept and lag lengths selected automatically using the Schwarz Info Criterion (SIC).
Source: Author's compilation (2020).

The ARDL bounds test is based on the assumption that the variables are I(0) or I(1). So, before applying this test, we determine the order of integration of all variables using the unit root tests. The objective is to ensure that the variables are not I(2) so as to avoid spurious results.

The ADF unit root tests under the conventional methods revealed the following decision on stationary level of variables of interest at varying significant levels for income per capita (IPC), external debt (ED), government health expenditure (GHE), unemployment rate (UNEMPL), foreign exchange rate (FX) , average life expectancy (LEXP), male life expectancy (LEXPM) and female life expectancy (LEXPF) which were found not to reject the null hypothesis "not stationary at level" at 5% McKinnon significance levels, but, only

the time series variable of inflation rate (INF) was found to reject the null hypothesis "unit root at level". This indicates that at level, the time series inflation rate (INF) was stationary and integrated of order zero and therefore, suggests that without differencing the series (INF) converge to their long run equilibrium or true mean.

4.2 Presentation of Results

4.2.1 Empirical Results of the Impact of Economic Performance on Life Expectancy

Cointegration Test (Autoregressive Distributed Lag (ARDL) Cointegration Technique)

The discussion in this subsection answers the first hypothesis that economic performance does not have a significant impact on human life expectancy in Nigeria. As part of the first objective, the trend analysis, descriptive statistics and unit root test were used to test the properties and profiles of economic performance indicators as well as life expectancy in Nigeria. The trend relationship among the variables is not clear enough to indicate whether it is positive or negative. Thus, there is the need for empirical analysis with more appropriate econometrics tools; given the directions of the variables were inconclusive.

In order to empirically analyze the long-run relationships and short run dynamic interactions among the variables of interest (income per capita, external debt, government health expenditure, unemployment rate, inflation rate, foreign exchange rate, average life expectancy, male life expectancy and female life expectancy), we apply the autoregressive distributed lag (ARDL) cointegration technique. The ARDL can be used under this 3 conditions (a) series are integrated of order 0, that is, stationary in level (this requires no differencing), (b) series are integrated of order 1 that is, stationary after first difference, (c) series are integrated of different orders that is, having a combination of I(0) and I(1) series[2]. The ARDL cointegration approach is also suitable for this analysis due to its three advantages in comparison with other previous and traditional cointegration methods. The first one is that the ARDL does not need that all the variables under study must be integrated

of the same order and it can be applied when the under-lying variables are integrated of order one, order zero or fractionally integrated. The second advantage is that the ARDL test is relatively more efficient in the case of small and finite sample data sizes. The third advantage is that by applying the ARDL technique we obtain unbiased estimates of the long-run model[3]. However, the F-statistics estimates for testing the existence of long-run relationship between economic performance and life expectancy are presented in Table 4.5. The estimated F-statistics of the normalized equations were found greater than the lower and upper critical bound at 1%, 5% and 10% significance level. It implies that the null hypothesis of no long-run relationship is rejected at 5% significance level.

Table 4.5: Cointegration Test Results using ARDL Bound Test

Dependent varia	AIC Lags	Functions	F-statistics	Decision
Model I ARDL (2, 1, 2, 2, 2, 2, 1)	2	$F_{\log(l\exp($(\log(l\exp)|ipc,\log(ghe),ed,\inf,unempl,fx)$	27.80078	Cointegrated
Model II ARDL (2, 1, 2, 2, 2, 2, 1)	2	$F_{\log(l\exp m)}(\log(l\exp m)\|ipc,\log(ghe),ed,\inf,unempl,fx)$	31.27909	Cointegrated
Model III ARDL (2, 1, 2, 2, 2, 2, 1)	2	$F_{\log(l\exp f)}(\log(l\exp f)\|ipc,\log(ghe),ed,\inf,unempl,fx)$	29.59891	Cointegrated

Significance Level	**1%**		**5%**		**10%**	
Upper and Lower Bounds	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Critical bound value	1.99	2.94	2.27	3.28	2.88	3.99

Note: ***, ** and * denote rejection of null hypothesis at 1%, 5% and 10% significance levels respectively).
Source: Author's computation (2020).

The implication of the above estimation is that there is existence of long-run relationship between economic performance and life expectancy measured by income per capita, government health expenditure, external debt, inflation rate, unemployment rate and foreign exchange rate and overall average human life expectancy as well as male and female life expectancy in Nigeria. The models have equilibrium condition that keeps the variables together in the long-run.

As the above submission indicated that there exists a long-run relationship among the variables, the short-run and long-run estimates using the ARDL method are shown in Tables 4.5.1a and 4.5.1b respectively for the first hypothesis.

Table 4.6a: Short-run Estimates of Average Human life Expectancy in Nigeria, 1981 – 2020

	Dependent Variable: (y)		
Variable	LOG(LEXP)	LOG(LEXPM)	LOG(LEXPF)
Δ(y)-1))	0.795070 (0.0000)***	0.806327 (0.0000)***	0.822065 (0.0000)***
ΔIPC(-1)	0.000000231 (0.9848)	-0.0000314 (0.0065)***	-0.0000308 (0.0087)***
ΔINF(-1)	0.0000112 (0.0026)***	0.0000127 (0.0004)***	0.0000119 (0.0011)***
ΔLOG(GHE)-1)	-0.000389 (0.0002)***	-0.000385 (0.0000)***	-0.000273 (0.0012)***
ΔED(-1)	-0.00000837 (0.0573)*	-0.0000006 (0.0261)**	-0.00000864 (0.0359)**
ΔFX(-1)	0.000000580 (0.7922)	0.00000579 (0.0270)**	-0.00000426 (0.1016)
ΔUNEMPL(-1)	-0.0000553 (0.0000)***	-0.0000603 (0.0000)***	-0.0000523 (0.0000)***
ECT(-1)	-0.31847 (0.0000)***	-0.34678 (0.0000)***	-0.28966 (0.0000)***
R Square	0.897980	0.894316	0.878316
Adjusted R^2	0.777126	0.787603	0.747604
S.E	0.000239	0.000215	0.000223
F-Statatistics	27.80078	31.27909	29.59891
Breusch-Godfrey Serial Correlation	(2.360397)	(0.210832)	(6.717727)
Normality Test	(0.853296)	(0.329082)	(0.312649)
Heteroskedasticity test	(20.10758)	(22.32884)	(6.717727)

Note: ***, ** &* denotes rejection of the hypothesis at the 0.01, 0.05 and 0.1 level respectively.
Source: Author's computation (2020).

Thus, this answers the null hypothesis which state that economic performance does not have significant impact on life expectancy in Nigeria between 1981 - 2020. The error correction mechanism that measure the speed or degree of adjustment are reported in the

short-run estimation results in Table 4.5.1a. It is the rate of adjustment at which the dependent variable changes due to changes in the independent variables. The ARDL test automatically choose the lag length on all variables as the model was set at two to ensure sufficient degree of the freedom based on automatic selection of Akaike Information Criterion (AIC).

The coefficients of the error correction term (ECT) were found to be negative and statistically significant for the models of average life expectancy (LEXP), male life expectancy (LEXPM), and female life expectancy (LEXPF). Correspondingly, the ECT values implied that the models correct their short-run disequilibrium by 31.85%, 34.68%, and 29.0%, speed of adjustment in order to return to the long run equilibrium. The results of the parameter estimate in the short-run revealed that the lag one of government health expenditure, external debt and unemployment negatively influence the life expectancy over the periods.

For the long-run estimates presented in Table 4.5.1b, the coefficients of income per capita were positive for the models but have very low influence on life expectancy. Similarly, government health expenditure and inflation rate also recorded positive coefficients for the models, though the influence is very low as well. In contrast, the external debt was statistically significant for male life expectancy and female life expectancy showing adverse effect on the overall life expectancy in Nigeria. Unemployment rate also revealed negative influence on both average life expectancy and female life expectancy while that of male life expectancy was positive. The foreign exchange rate coefficient was also spotted to have negative influence on male life expectancy while remain positive for average life expectancy and female life expectancy.

Table 4.6b: Long-run Estimates of Average Human life Expectancy in Nigeria, 1981 – 2020

Variable	Dependent Variable (y)		
	LOG(LEXP)	LOG(LEXPM)	LOG(LEXPF)
(y)-1))	-0.031847 (0.0002)***	-0.034678 (0.0000)***	-0.028966 (0.0000)***
IPC(-1)	0.0000596 (0.0081)***	0.000075 (0.0003)***	0.0000959 (0.0000)***
INF(-1)	0.00000254 (0.8654)	0.0000248 (0.0079)***	0.0000217 (0.0341)**
LOG(GHE)-1)	0.000505 (0.0005)***	0.000516 (0.0001)***	0.000311 (0.0007)***
ED(-1)	-0.0000162 (0.2846)	-0.0000303 (0.0197)**	-0.0000288 (0.0279)**
FX(-1)	0.0000121 (0.0004)***	-0.000110 (0.0000)***	0.0000151 (0.0000)***
UNEMPL(-1)	-0.0000450 (0.1016)	0.0000164 (0.0000)***	-0.0000939 (0.0004)***
Constant	0.123269 (0.0002)**	0.133652 (0.0000)***	0.113065 (0.0000)***

Note: ***, ** &* denotes significance at 0.01, 0.05 and 0.1 level respectively.
Source: Author's computation (2020).

The regression for the underlying ARDL equation of average life expectancy (LEXP), male life expectancy (LEXPM) and female life expectancy (LEXPF) fits very well and the model is significant at 1% level. It also passes all the diagnostic tests against serial correlation (Breusch-Godfrey test, heteroscedasticity, White Heteroskedasticity Test, and normality of errors (Jarque-Bera test). The Ramsey RESET test also suggests that the model is well specified. All the results of these tests are shown in Table 4.7.

The stability of the long-run coefficient is tested by the short-run dynamics. Once the ECM model given by LEXP, LEXPM, and LEXPF equations have been estimated, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMSQ) tests are applied to assess the parameter stability[35].

Figure 4.1 represented the average human life expectancy while Figure 4.1.1 and Figure 4.1.2 in the appendix revealed male life expectancy and female life expectancy. The results for CUSUM and CUSUMSQ test results for average life expectancy (LEXP) and female life expectancy (LEXPF) indicates the absence of any instability of the coefficients because the plot of the CUSUM and CUSUMSQ statistic fall inside the critical bands of the 95% confidence interval of parameter stability except that of male life expectancy CUSUMSQ which exhibited a deviation from 5% boundary between the year 2012 and 2014. By implication, this model may be suffering from structural change even though the model became stable after what.

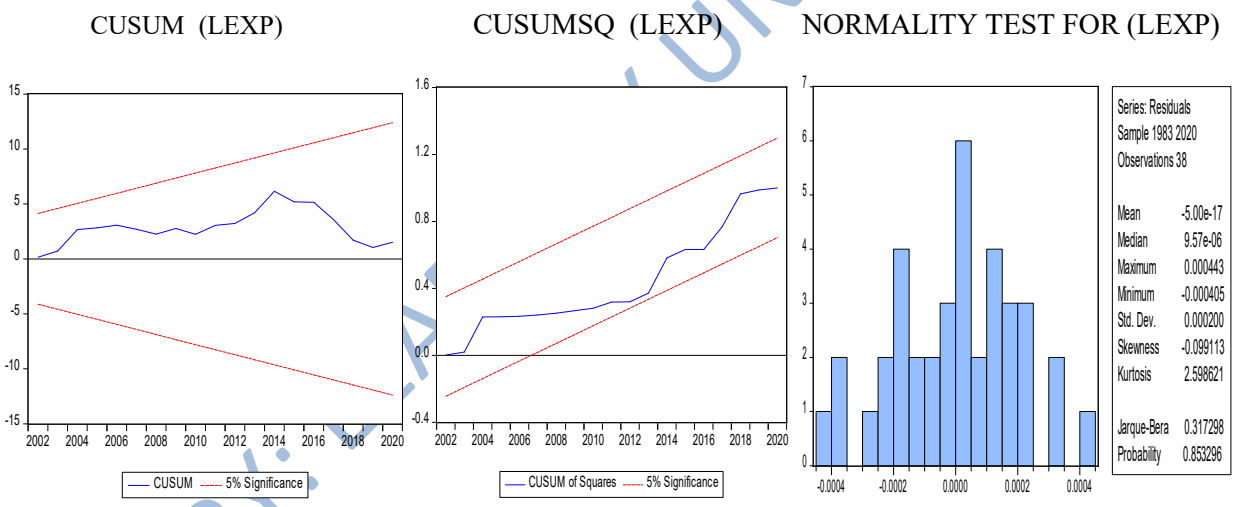

Figure 4.4: Average Life Expectancy Diagnostic Tests
Source: Author's Computation (2020)

Table 4.7. Results of Diagnostic Tests

	χ^2 -statistic		
	LEXP	LEXPM	LEXPF
Breusch-Godfrey Serial Correlation test	2.3604 (0.3072)	0.2108 (0.9000)	6.7177 (0.0348)
White Heteroskedasticity test	1.1862 (0.3570)	1.5040 (0.1926)	1.2613 (0.3097)
Jarque-Bera test	0.3173 (0.8533)	22.3288 (0.2177)	0.3126 (0.8552)
Ramsey RESET Test (log likelihood ratio	0.5164 (0.6120)	0.7177 (0.4821)	0.9293 (0.3650)

Source: Author's computation (2020)

The Chow Breakpoint and Chow Forecast tests are used to examine significant structural break in the data in 2001 and over the nascent democracy period. Therefore, the year 2001 was selected as breakpoint since Nigerians were already reaping the dividend of democracy and period 2001 – 2020 is chosen for chow forecast test. The F-statistics and the Log likelihood ratios indicated the existence of structural break (Table4.7).

Table 4.8: Statistical Output for Stability Tests

	Forecast period Breakpoint	F-statistic	Probability of F-statistic	Log likelihood ratio	Probability of Log likelihood ratio
Chow Forecast Test	2001 – 2020	73.74798	0.0000	189.6085	0.0000
Chow Breakpoint Test	2001	6.205993	0.0002	39.29579	0.0000

Source: Author's computation (2020)

4.3 Empirical Results of the Effect of Shocks in Economic Performance on Life Expectancy 4.3.1 Impulse Response and Variance Decomposition Analysis

The discussion in this subsection answers the second hypothesis that the shocks in economic performance do not significantly influence the human life expectancy in Nigeria. The section carried out two econometric methods; impulse response function (IRF) and variance decomposition analysis (VDA) to examine the response of life expectancy to shocks in economic performance in Nigeria. For robustness of result, responses of shocks in economic performance to life expectancy were equally carried out not only for average life expectancy but for male life expectancy and female life expectancy as well. The estimates and plots from the analysis of the techniques are presented in figure 4.6.1, figure 4.6.2, figure 4.6.3; table 4.6.2; table 4.6.3; and table 4.6.4. It was observed in the empirical review that among all the studies covered on the effect of economic performance components on health outcomes in Nigeria, none examined life expectancy's response to shocks in economic indicators to the best of the author's knowledge. Hence, this formed the basis for investigating how life expectancy responds to shocks in economic performance indicators.

4.3.1.1 Impulse Response Analysis

This revealed the contemporaneous response of human life expectancy to Cholesky one squared variances shocks exerted on itself, income per capita, government health expenditure, external debt, inflation rate, unemployment rate, and inflation rate. The purpose of this section is to determine the mechanism through which life expectancy respond to one-standard deviation of economic performance shocks as a result of innovation distortion.

A) Impulse Response of Average Life Expectancy to Economic Performance

Figure 4.6.1 presents the IRF plots of average life expectancy to economic performance shocks in Nigeria.

The IRF analysis reveals that average human life expectancy negatively responds to external debt. In other words, a one standard deviation shock to external debt causes significant decreases in average life expectancy. Though, an increase was observed between period 2 through 5 after which it consistently declines again, between period 12th and 20th showed an increasing negative response of average life expectancy which means external debt possesses short-run and long-run adverse effect on average life expectancy in Nigeria.

In the first to fifth period, average human life expectancy responds positively to one standard deviation shocks exerted on unemployment rate in Nigeria. The increase started from negative during 1st period and rose above 0 in 2nd period and subsequently responds at same levels throughout the horizon. This indicated an unexpected change in unemployment rate during those periods which tends to significantly influence changes in average human life expectancy in Nigeria.

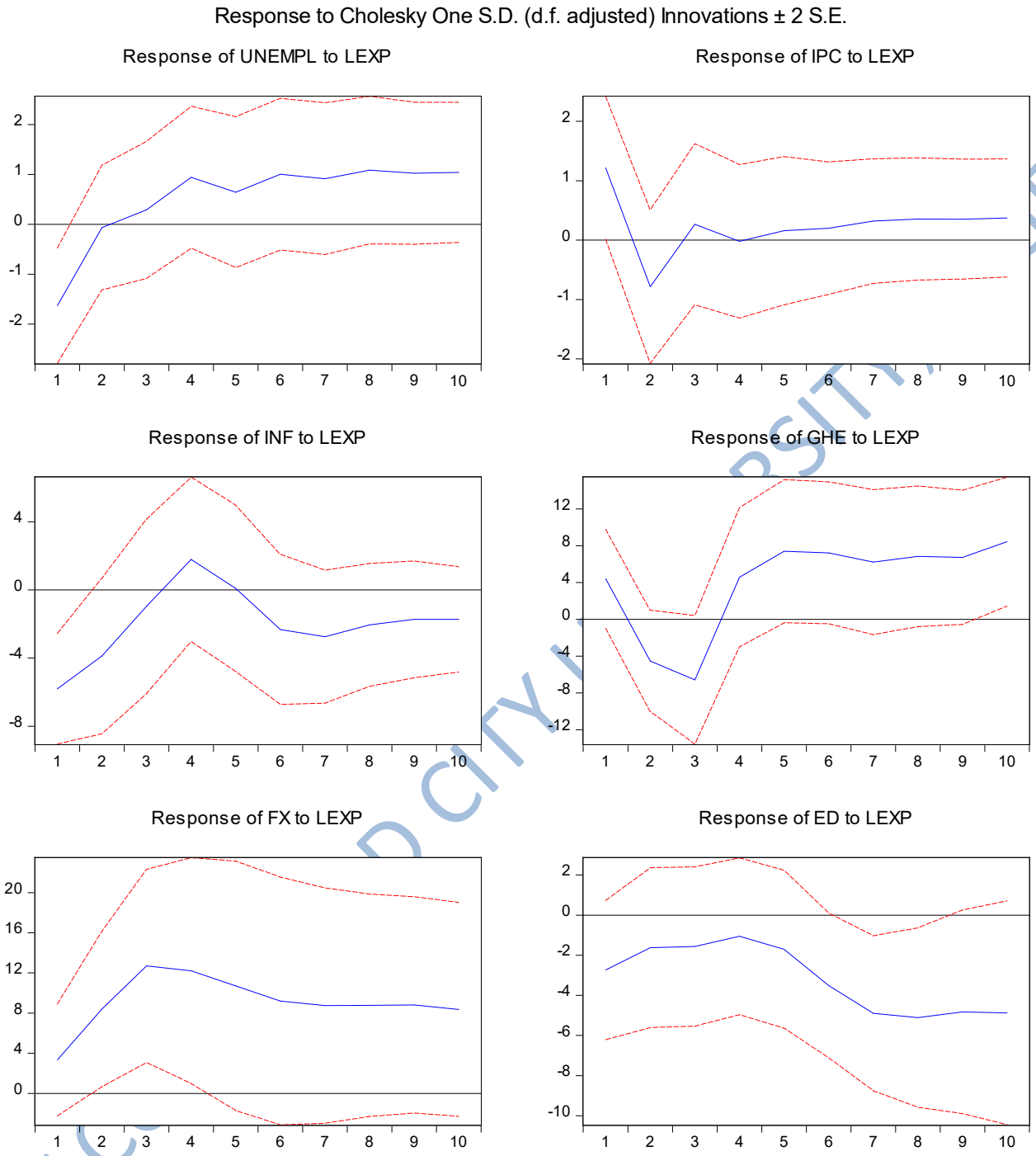

Figure 4.6.1: Impulse Response Graph of Average Life expectancy and Economic Performance Shocks. ***Source:*** Author's computation (2020)

The impulse response of average life expectancy to shocks in income per capita showed that a one standard deviation shock to income per capita causes significant increase in average life expectancy for 1st period after which it sharply declined in the 2nd period. But, between

3rd period and 12th it has been sustained at steady state before it declined again in the 16th period. From period 20th, the response is gradually returning back to the steady state. This indicated a shock to income per capita will have asymmetric impacts on life expectancy in the short-run and long-run.

Also, for the response of inflation rate to average life expectancy, a one standard deviation shock given to average life expectancy will start with increasing inflation rate in the first period to 5th period onward the result decline below 0. This implied that inflation will have negative impact on average life expectancy in Nigeria. Further, the response of average life expectancy reacts negatively in the 1st period through 3rd period to shocks in government health expenditure in Nigeria after which a steady positive response was noted throughout the periods. A shock in foreign exchange rate has also showed that average life expectancy reacts positively through 1st to 20th periods. Though, foreign exchange rate is considered external shock to economic performance and life expectance, therefore the it is treated as extraneous variable and as such, its relationship with life expectancy may require a further investigation since same a'priori expectations are expected from external debt, inflation and foreign exchange rate.

The result of the impulse response therefore shows that shocks external debt, inflation rate, unemployment rate, government health expenditure and income per capita all have impact on average life expectancy in Nigeria but at varying degree.

B) Impulse Response of Male Life Expectancy to Economic Performance Shocks

Using a horizon of 20 periods (i.e. 20 years), Figure 4.6.2 (in Appendix) shows the IRF plots of male life expectancy to shocks in economic performance in Nigeria.

The impulse of male life expectancy to shocks in external debt and inflation rate revealed that both variables exacts negative impact from 4th period to the end of the periods for inflation rate while the negative effect of external debt were felt all through the periods. The implication is that a one standard deviation shock to external debt and inflation causes significant decrease in male life expectancy from short-run into the future. Response of male life expectancy to income per capita, unemployment and government health expenditure both revealed negative response at the early periods before it all return to steady state. All things been equal, the current trends of these 3 variables showed that a Cholesky one squared variances to shocks in them will cause significant increases in male life expectancy in Nigeria. The result of the impulse response of male life expectancy therefore shows that shocks from external debt do have short-run and long-run adverse impacts while inflation rate, unemployment rate, income per capita and government health expenditure also have short-run negative impact but this effect dissipates as it tends into the future for male life expectancy in Nigeria.

C) Impulse Response of Female Life Expectancy to Economic Performance Shocks

Figure 4.6.3 (in Appendix) presents the impulse response function (IRF) plots of female life expectancy to each of the selected economic performance indicators in Nigeria, using the same horizon as earlier done (20 years). The IRF analysis reveals that female life expectancy positively has a significant impulse to one standard deviation shocks exerted on government health expenditure and unemployment rate from 3rd period all through the horizon.

Furthermore, external debt and foreign exchange rate are noticed to react in opposite direction to each other. Indicating that one standard deviation shock to external debt will always cause a decline in female life expectancy in Nigeria while it is in contrary to the foreign exchange rate result, even when it is considered exogenous in behavior.

The response of female life expectancy to Cholesky one squared variances shocks in income per capita has showed both positive and negative responses. Similar to that of male life expectancy, there was a sharp decrease between the 1st and 2nd period but the response was normalized from 4th period up to the 10th period before it starts to decline again. In this situation, since the case of positive and negative responses exists, the shock on income per capita will have asymmetric effect on female life expectancy in Nigeria.

Nevertheless, response pattern reported for female life expectancy to one standard deviation shock to external debt and inflation also showed no evidence of returning to the steady state any time soon. By implication, the desired improvement in male life expectancy in Nigeria may not be attained soonest. The above results indicated that shocks in economic performance indicators constituted critical impact to female life expectancy in different amounts.

4.3.2 Variance Shocks Decomposition Analysis

This section is complementary to the previous section 4.3.1 which analyses the impulse response function of life expectancy to one standard deviation innovation economic performance shocks. While, the impulse reaction functions traced the effects of a shock to one endogenous variable on the other variables in the VAR, Variance Decomposition separates the variation in an endogenous variable into the component shocks of the VAR. Thus, the variance decomposition provides information about the relative importance of each random innovation in affecting the variables in the VAR system. Tables 4.9, 4.11 and 4.13 show the variance regression (VAR) model and variance decomposition analysis (VDA) of human life expectancy and economic performance shocks in Nigeria.

Also, it determines the proportion of the forecast error variance of average life expectancy, male life expectancy and female life expectancy accounted for by innovations to their individual shocks, income per capital shock, government health expenditure shock, external debt shock, unemployment shock, inflation rate shock, and foreign exchange rate shock in the unrestricted VAR model system.

A) Variance Decomposition of Average Life Expectancy and Economic Performance Shocks

The result of variance decomposition of average life expectancy (LEXP) to individual innovation shocks in the VAR is presented in Table 4.9. The Table presents separate variance decomposition for each endogenous variable. The second column, labeled "S.E", contains the forecast error of the variable at the given forecast horizon. The source of this forecast error was the variation in the current and future values of the innovations to each endogenous variable in the VAR. The other columns for each of the macroeconomic variables give the percentage of the forecast variance due to each innovation, with each row adding up to 100. Also, the forecast period of 10 years is selected but split into short-run and long-run where 1 to 5 years is considered short-run while 6 through 10 years is the future or long-run.

Table 4.9: Variance Decomposition Analysis for Average Life Expectancy

Variance Decomposition of LEXP:

Period	S.E.	LEXP	UNEMPL	ED	IPC	INF	GHE	FX
1	0.018467	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.048710	92.81741	1.345679	0.002595	0.947837	1.761644	0.221919	2.902917
3	0.095472	82.80709	2.845411	0.087942	2.023243	4.787813	1.092333	6.356170
4	0.158376	73.69502	4.078180	0.052006	2.941580	7.409030	1.652167	10.17202
5	0.238218	64.97320	5.277020	0.044268	3.391272	9.588410	1.892980	14.83285
6	0.337338	57.46874	5.804277	0.192319	3.368927	11.37809	2.025967	19.76168
7	0.456545	51.57101	5.666158	0.470897	3.027199	12.98961	2.136232	24.13889
8	0.595083	47.08710	5.100371	0.839935	2.565910	14.47248	2.199399	27.73481
9	0.750951	43.66870	4.347088	1.280784	2.110333	15.70813	2.218872	30.66609
10	0.920892	41.09632	3.550264	1.749629	1.713429	16.65034	2.212850	33.02717

Source: Author's computation (2020)

In the first year, 100% forecast error is explained by the variable itself in which other variables have exogenous impact as they do not influence average life expectancy in the short-run, this fact is also established in the vector autoregression estimate where average life expectancy at lag 1 accounted for highest t-statistics value. Similarly, in the second period, except foreign exchange rate that has a strong influence in predicting average life expectancy in the 3rd period. In the long-run, 41.09% forecast error is explained by the variable itself indicating a weak influence into the future, this result is confirmed in the VAR estimates in which the variables weakly influenced life expectancy. Looking at inflation rate and

exchange rate, the influence is rising year by year even though the influence is weak there is likelihood of predicting average life expectancy in the future.

For the purpose of clarity and simplicity, the variation in life expectancy due to various shocks within and outside is decomposed into different economic performance indicators. Thus, the results of the percentage share of life expectancy changes accounted for by the considered shocks from various economic performance indicators are presented in Table 4.10. The table showed that life expectancy shocks (shocks from itself) accounted for 61.69% of the total variation in life expectancy in Nigeria respectively. Concerning the economic performance indicators, foreign exchange accounted for 18.84% of the total variation in life expectancy, followed by shocks in inflation (10.53%), unemployment (4.22%), income per capita (2.45%), government health spending (1.74%) and external debt (0.53%) respectively.

Table 4.10: Percentage of Life Expectancy Variation due to Economic Performance Shocks

Overall % Share of Economic Performance Variables Shocks						
Life Expectancy Shocks	**Unemployment Shocks**	**External Debt Shocks**	**Income Per Capita Shocks**	**Inflation Shocks**	**Government Health Expenditure Shocks**	**Foreign Exchange Shocks**
61.69%	4.22%	0.53%	2.45%	10.53%	1.74%	18.84%

Source: Author's computation.

B) Variance Decomposition of Male Life Expectancy and Economic Performance Shocks

The result of variance decomposition of male life expectancy to individual innovation shocks in the VAR is presented in Table 4.11. The table presents separate variance decomposition for each endogenous variable. The second column, labeled "S.E", contains the forecast error of the variable at the given forecast horizon. The source of this forecast error was the variation in the current and future values of the innovations to each endogenous variable in

the VAR. The other columns for each of the macroeconomic variables give the percentage of the forecast variance due to each innovation, with each row adding up to 100. Also, the forecast period of 10 years is selected but split into short-run and long-run where 1 to 5 years is considered short-run while 6 through 10 years is the future or long-run.

Table 4.11: Variance Decomposition for Male Life Expectancy

Variance Decomposition of LEXPM:

Period	S.E.	LEXPM	ED	UNEMPL	IPC	INF	GHE	FX
1	0.018657	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.049312	95.88545	0.158462	0.055751	1.682245	0.577487	0.062155	1.578450
3	0.095347	88.20754	0.053058	0.398895	4.284215	2.329329	0.538626	4.188336
4	0.155948	80.48999	0.030322	0.777220	6.580193	4.071890	0.783048	7.267334
5	0.231902	72.46886	0.076474	1.269952	8.315956	5.781354	0.865180	11.22222
6	0.325748	65.16250	0.211891	1.609111	9.248978	7.443825	0.931498	15.39220
7	0.437615	59.10607	0.432907	1.764221	9.511244	9.151080	1.007900	19.02658
8	0.566144	54.19773	0.758398	1.776011	9.349231	10.81544	1.053213	22.04997
9	0.709250	50.19941	1.197798	1.693837	8.952759	12.24750	1.069886	24.63880
10	0.864199	47.00717	1.699930	1.546956	8.441139	13.39652	1.074927	26.83335

Source: Author's computation.

First period revealed that 100% forecast error is explained by male life expectancy variable itself in which other variables have exogenous impact as they do not influence average life expectancy in the short-run, this corroborates the result of the VAR estimate where male life expectancy statistics constituted the highest significant t-statistics. Similarly, in the second period, except foreign exchange rate that has a strong influence in predicting average life expectancy in the 3rd period. In the long-run, 47% forecast error is explained by the variable itself indicating a weak influence into the future, the VAR estimates also confirm the result that other variables are not significant and does not strongly predict the future.

For the purpose of clarity and simplicity, the variation in male life expectancy due to various shocks within and outside is decomposed into different economic performance indicators. Thus, the results of the percentage share of male life expectancy changes accounted for by the considered shocks from various economic performance indicators are presented in Table 4.12. The table showed that male life expectancy shocks (shocks from itself) accounted for 68.08% of the total variation in male life expectancy in Nigeria respectively. Regarding the economic performance indicators, foreign exchange accounted for 14.69% of the total variation in male life expectancy, followed by shocks in income per capita (7.37%), inflation (7.31%), unemployment (1.21%), government health spending (0.82%) and external debt (0.51%) respectively.

Table 4.12: Percentage of Male Life Expectancy Variation due to Economic Performance Shocks

Overall % Share of Economic Performance Variables Shocks						
Male Life Expectancy Shocks	**Unemployment Shocks**	**External Debt Shocks**	**Income Per Capita Shocks**	**Inflation Shocks**	**Government Health Expenditure Shocks**	**Foreign Exchange Shocks**
68.08%	1.21%	0.51%	7.37%	7.31%	0.82%	14.69%

Source: Author's computation.

A) Variance Decomposition of Female Life Expectancy and Economic Performance Shocks

The result of variance decomposition of female life expectancy to individual innovation shocks in the VAR is presented in Table 4.13. The table presents separate variance decomposition for each endogenous variable. The second column, labeled "S.E", contains the forecast error of the variable at the given forecast horizon. The source of this forecast error was the variation in the current and future values of the innovations to each endogenous variable in the VAR. The other columns for each of the macroeconomic variables give the percentage of the forecast variance due to each innovation, with each row adding up to 100.

Also, the forecast period of 10 years is selected but split into short-run and long-run where 1 to 5 years is considered short-run while 6 through 10 years is the future or long-run.

Table 4.13: Variance Decomposition for Female Life Expectancy

Variance Decomposition of LEXPF:

Period	S.E.	LEXPF	ED	UNEMPL	IPC	INF	GHE	FX
1	0.01784	100	0	0	0	0	0	0
2	0.04769	94.9867	0.79682	0.06214	1.16301	0.57175	0.06818	2.35143
3	0.09286	86.82	1.3005	0.38526	2.5778	2.17186	0.59183	6.15277
4	0.15223	78.3364	2.24049	0.80622	3.43982	3.75715	0.86436	10.5556
5	0.22736	69.2539	3.60909	1.37812	3.71749	5.28157	0.95235	15.8075
6	0.32112	60.9765	5.02783	1.74808	3.41349	6.72518	1.0133	21.0957
7	0.43429	54.1321	6.3091	1.86949	2.81439	8.17403	1.0897	25.6112
8	0.5664	48.6098	7.4858	1.79536	2.15792	9.55634	1.13656	29.2582
9	0.71648	44.1487	8.59538	1.60912	1.57381	10.7174	1.15277	32.2028
10	0.88246	40.6302	9.56585	1.36345	1.11095	11.63	1.15426	34.5453

Source: Author's computation.

Furthermore, variance decomposition for female life expectancy indicated that 100% of forecast error is explained by the female life expectancy variable itself in the first year while other variables have exogenous impact as the shocks accounted for by these variables are less important to the female life expectancy. In the long-run, 40.6% forecast error is explained by the variable itself indicating a weak influence into the future, the VAR estimates also confirm the result that other variables are not significant and does not strongly predict the future.

For the purpose of clarity and simplicity, the variation in female life expectancy due to various shocks within and outside is decomposed into different economic performance indicators. Thus, the results of the percentage share of female life expectancy changes

accounted for by the considered shocks from various economic performance indicators are presented in Table 4.14. The table showed that female life expectancy shocks (shocks from itself) accounted for 64.21% of the total variation in female life expectancy in Nigeria respectively. Regarding the economic performance indicators, foreign exchange accounted for 19.73% of the total variation in female life expectancy, followed by shocks in inflation (6.51%), external debt (4.99%), income per capita (2.44%), unemployment (1.22%), government health spending (0.89%) and respectively.

Table 4.14: Percentage of Female Life Expectancy Variation due to Economic Performance Shocks

Overall % Share of Economic Performance Variables Shocks						
Female Life Expectancy Shocks	**Unemployment Shocks**	**External Debt Shocks**	**Income Per Capita Shocks**	**Inflation Shocks**	**Government Health Expenditure Shocks**	**Foreign Exchange Shocks**
64.21%	1.22%	4.99%	2.44%	6.51%	0.89%	19.73%

Source: Author's computation.

4.4 Empirical Results of Causal Relationship between Economic Performance and Life Expectancy

This sub-section provides the answer to the third null hypothesis that there is no significant causal link between economic performance and life expectancy in Nigeria. It is achieved by computing the Granger causality test using both the VECM and the Toda and Yamamoto and (TYDL) augmented VAR procedure of the causal relationship between average life expectancy, male life expectancy, female life expectancy data and economic performance indicators measured by income per capita, government health expenditure, inflation rate, external debt, unemployment rate and foreign exchange rate in Nigeria between 1981 and 2020 (causality analysis results in the Appendix). TYDL is an alternative procedure for granger causality test developed in 1995 in order to overcome the short-comings of the normal conventional granger causality test. The conventional granger causality test is based on F-statistics in which F-statistics followed a standard normal distribution which means that when variables are integrated the granger causality test becomes fragile and unable to generate robust result since the resulting test statistics does not follow a standard normal distribution. The emerged Toda Yamamoto augmented VAR generates the asymptotic word statistics in the form of χ^2 statistics distribution. Further, the result of causal estimates for average life expectancy is reported for both short- and lung- run in Tables 4.7.1 and 4.7.2, male life expectancy is presented in Tables 4.7.3 and 4.7.4, female life expectancy in Table 4.7.5, and 4.7.6 respectively. The short-run causality result based on the TYDL procedure indicated that external debt, inflation rate, government health expenditure have unicausality effects on average human life expectancy while income per capita equally caused external debt. The effect of foreign exchange rate on unemployment is unidirectional, same way average life expectancy caused income per capita. Also, inflation rate, government health

expenditure and foreign exchange rate indicated no causal link with economic performance indicators in the short-run.

Table 4.15: Short-run Granger Causality Results of Average Life Expectancy based on TYDL Procedure and VECM

Dependent Variables	Results based on an Augmented VEC Model [Short run lagged differences (F-statistics)]							Direction of causality
	Independent Variables							
	ΔLEXP	*ΔIPC*	*ΔGHE*	*ΔED*	*ΔINF*	*ΔUNEMPL*	*ΔFX*	
ΔLEXP		2.487094	**17.27934**	**3.894305**	**6.174702**	**6.330359**	**3.561474**	GHE, ED, INF,UNEMPL. FX → LEXP (one-way causality)
		(0.1148)	(0.0000)	(0.0485)	(0.0130)	(0.0119)	(0.0591)	
ΔIPC	**4.101060**		0.083451	0.229400	0.001684	0.252316	0.025035	LEXP → IPC (one-way causality)
	(0.0429)		(0.7727)	(0.6320)	(0.9673)	(0.6154)	(0.8743)	
ΔGHE	0.659735	0.207764		0.004724	0.373165	0.110393	0.207455	-
	(0.4167)	(0.6485)		(0.9452)	(0.5413)	(0.7397)	(0.6488)	
ΔED	1.217725	**3.924797**	0.354270		1.707801	0.273967	0.402965	IPC → ED (one-way causality)
	(0.2698)	(0.0476)	(0.5517)		(0.1913)	(0.6007)	(0.5256)	
ΔINF	1.489104	0.158084	0.254686	2.210366		0.430374	0.101850	-
	(0.2224)	(0.6909)	(0.6138)	(0.1371)		(0.5118)	(0.7496)	
ΔUNEMPL	0.205198	0.114047	0.911777	0.025605	0.002107		**8.753182**	-
	(0.6506)	(0.7356)	(0.3396)	(0.8729)	(0.9634)		(0.0031)	
ΔFX	0.884936	0.170281	0.254947	0.067158	0.263926	0.213934		-
	(0.3469)	(0.6799)	(0.6136)	(0.7955)	(0.6074)	(0.6437)		

Note: Values in parenthesis are probability values. The bolded values are found statistically significant at 1%, 5% and 10% significance level.
Source: Author's computation (2020).

Table 4.16: Long-run Granger Causality Results of Average Life Expectancy based on TYDL Procedure and VAR

Dependent Variables	Results based on an Augmented VAR Model (TYDL Procedure) (Modified Wald-statistics)							Direction of causality
	Independent Variables							
	LEXP	*IPC*	*GHE*	*ED*	*INF*	*UNEMPL*	*FX*	
LEXP		4.241748	0.577526	**19.98562**	**8.590510**	0.757068	2.770978	ED, INF → LEXP; LEXP → ED, INF (Bi-causality)
		(0.1199)	(0.7492)	(0.0000)	(0.0136)	(0.6849)	(0.2502)	
IPC	2.336370		**5.754309**	0.855643	0.407333	3.523645	1.253781	IPC → LEXP
	(0.3109)		(0.0563)	(0.6519)	(0.8157)	(0.1717)	(0.5343)	
GHE	**6.667767**	0.735387		2.365542	1.294010	1.828801	**10.14915**	GHE → INF (one-way causality)
	(0.0357)	(0.6923)		(0.3064)	(0.5236)	(0.4008)	(0.0063)	
ED	**11.63014**	**5.327355**	0.156221		**6.270153**	1.510180	0.059995	IPC → ED (one-way causality)
	(0.0030)	(0.0697)	(0.9249)		(0.0435)	(0.4700)	(0.9704)	
INF	3.548454	4.227526	4.443979	**14.18843**		0.456314	4.394863	ED → INF (one-way causality)
	(0.1696)	(0.1208)	(0.1084)	(0.0008)		(0.7960)	(0.1111)	
UNEMPL	1.077267	0.287315	3.253580	0.318320	0.139146		**9.690217**	FX → UNEMPL (one-way causality)
	(0.5835)	(0.8662)	(0.1966)	(0.8529)	(0.9328)		(0.0079)	
FX	**5.061670**	0.674872	**7.392535**	0.969097	**4.798197**	3.891241		LEXP → FX (one-way causality)
	(0.0796)	(0.7136)	(0.0248)	(0.6160)	(0.0908)	(0.1429)		

Note: Values in parenthesis are probability values. The bolded values are found statistically significant at 1%, 5% and 10% significance level.
Source: Author's computation (2020).

The long-run causality test revealed that external debt and inflation rate granger caused average life expectancy in bi-directional form while income per capita has a uni-causality with average life expectancy[4]. Foreign exchange rate caused unemployment rate and average life expectancy also caused foreign exchange rate (Table 4.16).

Further, the causality results of male life expectancy based on augmented vector error correction showed that external debt, unemployment rate, income per capita, inflation rate and government health expenditure all granger caused male life expectancy in the short run. The income per capita showed a one-way causality for external debt while foreign exchange rate also caused unemployment rate. The average life expectancy indicated a bi-directional causality with income per capita while inflation rate, government health expenditure and

foreign exchange rate showed no causal link with economic performance indicators in the short-run (Table 4.15.2, Results in appendix for details).

Table 4.4.3 in Appendix presented the long-run Granger causal results using the TYDL augmented VAR procedure to explain whether male life expectancy is proactive or reactive to economic performance indicators in the long-run. The result showed that income per capita, external debt and foreign exchange rate male life expectancy while there are no feedbacks. Similarly, government health expenditure was found to have causal effect on income per capita also male life expectancy and inflation rate to cause external debt whereas feedback was only reported from external debt. For government health expenditure and external debt, the both have causal impact on inflation rate while foreign exchange caused unemployment rate, inflation rate, government health expenditure caused foreign exchange rate and male life expectancy and foreign exchange rate caused government health expenditure without feedbacks.

For short-run female life expectancy, table 4.15.2 (in Appendix) report a uni-causal relationship between government health expenditure, inflation rate, income per capita, unemployment rate and female life expectancy. However, there is a uni-directional relationship moving from foreign exchange rate to unemployment rate while the economic performance indicators could not establish any causal link with income per capita, inflation, government health expenditure and foreign exchange rate.

Result of long-run causality for female life expectancy is presented in table 4.16.2, where income per capita, external debt, foreign exchange rate, and government health expenditure granger caused female life expectancy showing a bi-directional relationship for only external debt. Also, government health expenditure revealed causal relationship for income per capita with no feedback. Moreover, female life expectancy, income per capita, external debt,

foreign exchange rate and government health expenditure have demonstrated a uni-directional relationship with inflation rate at varying significance level whereas no feedback has been reported.

Female life expectancy and inflation rate also granger caused external debt, while foreign exchange rate caused unemployment and government health expenditure caused foreign exchange rate revealing no feedback.

4.5 Discussion of Findings

This research study investigates the impact of economic performance indicators on average life expectancy, male and female life expectancy (measured by per capita income, government health expenditure, external debt, inflation, foreign exchange, and unemployment rate) in Nigeria. As for the first objective, the findings showed that income per capita exhibited negative coefficients for both male and female life expectancy with significant results at 99% confidence level but not significant for average life expectancy which implied that income per capita has an instantaneous and adverse impact on life expectancy in the short-run though, there were no convincing evidence to reject the null hypothesis that no significant relationship between average life expectancy and income per capita in the short-run, this corroborates previous studies that the initial level of real per capita GDP are held constant in the short-run with negative impact[5]. In the long-run, per capita income is found to be highly significant with positive impact on all the three classes of life expectancy indicating that per capita income is more futuristic in nature and very critical for a long-run improvement in life expectancy rather than in the short-run. The constant return to scale between per capita income and life expectancy is also evidenced in the long-run which agreed with other studies that return to scale is more a future concerns[6].

It was also observed that government health expenditure is statistically significant with negative coefficients for all the three classes of life expectancy which by implication could mean that the government has failed to attain the threshold for health financing in Nigeria, that is, money expended on health over the years does not translate to improvement in life expectancy. This corroborates the results of previous studies, that government spending on health passively impacts health outcomes in the short-run but failed to support the results of some studies. It however went contrary with the studies that found government expenditure positively influencing the health sector's long-run growth. Similartly, external debt showed adverse impact on life expectancy in the short-run with statistical significance at 0.05 convention level, by implication, the foreign loans obtained by the government have not been used for the purpose for which it was borrowed for which adversely impacted life expectancy in short-run and long-run.

Foreign exchange rate and unemployment rate are both statistically significant for the three classes of life expectancy with negative value in both short-run and long-run which implied that the two economic indicators adversely impact life expectancy both in the early stage and across time horizon.

Concerning the second objective, the study found that life expectancy responds to a Cholesky one standard deviation shock in unemployment by dragging in the negative region in the early period but quickly adjusts to the steady state above the line from the second period where it has remained stable through the future though, life expectancy reaction to unemployment in the future remain unpredictable. Income per capita and government health expenditure displayed similar characteristics by moving from the positive to the negative region in the early period but ascended above the line to maintain a steady course into the future while life expectancy adversely reacted to external debt by remained in the negative

region from the early period into the future. Life expectancy showed a positive reaction towards foreign exchange indicating deviation from dependent on importation and diverting to domestic production and consumption which has shown to be beneficial to life expectancy, this is tandem with other studies that increased investment in the domestic economies a way to improve the welfarism[7]. The percentage of life expectancy variation due to economic performance shocks showed that life expectancy explained shock in itself by 61.69% while unemployment contributed 4.22% shock, inflation, government health expenditure and foreign exchange accounted 10.53%, 1.74% and 18.84% shocks respectively.

Findings from the third objective show that government health expenditure, external debt, inflation, unemployment, and foreign exchange rate granger cause average life expectancy, male and female life expectancy in the short-run, and there is no evidence of feedback from life expectancy to the economic indicators. In the long-run, external debt and inflation rate cause average life expectancy, male and female life expectancy where life expectancy also send feedback to these indicators, this implies that a causal relationship exists in the short-run but a combination of unicausality and bi-causal relationship exist in the long-run. This result aligned with the a'priori expectations of the neoclassical and endogenous economic growth model which concerns itself more with long-run growth rather than the short-run[8].

Endnotes

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Chapter Five

Conclusion

This chapter presents the conclusion on the impact of economic performance on life expectancy, followed by policy recommendations for improved human life expectancy for sustainable development in Nigeria.

5.1 Summary of Findings

The external debt (ED) contributed negative effect to average life expectancy (LEXP), male life expectancy (LEXPM), female life expectancy (LEXPF) in both short-run (S-R) and long-run (L-R) while, income per capita (IPC) reflected negative impact on LEXPM, LEXPF no significant effect on LEXP in the L-R. Government health expenditure (GHE) exerted negative impact on all life expectancies in the S-R but revealed a positive influence on LEXP only in the L-R. Inflation rate (INF) showed positive but weak effect on LEXPM in the S-R and as well showed weak effect on LEXPM and LEXPF in the L-R. The unemployment rate (UNEMP) recorded negative effect on LEXP, LEXPM, LEXPF in the S-R revealing positive but weak influence on LEXPM in the L-R. The ECT indicated that S-R (LEXP, LEXPM, LEXPF) models correct their disequilibrium by 31.85%, 34.68% and 29% speed of adjustment to return to L-R equilibrium. Also, Life expectancy responds to a Cholesky one standard deviation shocks in UNEMP, IPC, GHE in the early stages by risen above the positive line in which a constant course of action was observed over a long horizon. Overall percentage share of economic performance variables shocks signified LEXP (61.69%), FX (18.84%), INF (10.53%), IPC (2.45%), UNEMP (4.22%), GHE (1.74%). GHE, ED, INF, UNEMP, FX uni-directionally caused life expectancies indicating only uni-causality exist in the S-R. But the long-run showed a combination of bi-causality and uni-causality.

5.2 Conclusion

This study investigated the impact of economic performance indicators (measured by income per capita, government health expenditure, inflation rate, unemployment rate, external debt and foreign exchange rate) on life expectancy over the periods of 1981 to 2020 using the ARDL bound resting approach. In the empirical model, findings showed that external debt,

income per capita and inflation rate consistently impacts life expectancy negatively in both short-run and long-run at 5% level of significance. The negative impact of Government health expenditure and unemployment rate was confirmed in the short-run before maintaining its long-run balance at the steady state. This depicts that economic performance indicators have varying degree of impact on life expectancy. Furthermore, average life expectancy and female life expectancy was found to respond to shocks in economic performance indicators within the 95% critical bounds except male life expectancy that deviated between the year 2012 and 2014 which could be evidence of structural change.

In addition, all variables showed both uni-causality and bi-causality relationships in the long-run but no presence of bi-causality relationships in the short-run which corroborated the outcome of weak relationship among the variables in the short-run. Still on the short-run causality, variables such as government health expenditure, income per capita, inflation rate and foreign exchange rate did not get feedbacks from female life expectancy result while for male life expectancy only 3 variables which include government health expenditure, inflation rate and foreign exchange rate did not get feedbacks. This indicated that life expectancy responds in different ways to economic performance in Nigeria.

5.3 Recommendations

Following the reported findings discussed in the subsequent chapters of this study, below policy recommendations are suggested:

(i) Government should control inflation to ideal level. Since contractionary monetary policy measures for controlling inflation has failed over time, it is advised to implement policies that support macroeconomic stability, inclusive growth, and job creation as well as facilitating access to financing for small and medium enterprises in

key sectors, this will protect and mitigate the effects of inflation on the citizenry and set the path to attaining improved life expectancy in Nigeria.

(ii) Accumulation of external debt should be avoided or discouraged and when it is unavoidable such money should be channel towards the course for which it is been borrowed. For instance, a loan obtained to improve health sector should be judiciously utilized for the purpose, this will positively cause improved health care delivery and human longevity.

(iii) Government should implement policies that helps to increase capital accumulation and augment labour with technology, this will help to boost investment in all sectors, grow human capital investment, improve quality of life. Investment in education will help in birth control, guide individuals in making decisions regarding number of children to have, reduce poverty level and reduce mortality rate. This is critical to increase life expectancy in Nigeria.

5.4 Contribution to Knowledge

This study has contributed to the body of knowledge by revealing the magnitude of relationship (short-run and long-run) that exist between life expectancy and the selected economic performance indicators (EPIs) in Nigeria. It has demonstrated how life expectancy reacted to shocks in economic indicators and it exposed that a uni-causality exist between economic performance indicators and average life expectancy which is contrary to male life expectancy and female life expectancy that exhibited both uni-causality and bi-causality.

5.5 Areas of Further Studies

The following are suggested for further studies: -

i) Examination of life expectancy in Nigeria in line with relevant economic theories and framework.

ii) Adoption of a multidisciplinary research approach aiming at developing a PESTLE (Political, Economic, Social, Technology, Legal & Regulatory System, and Environment) model to study life expectancy in Nigeria.