Socioeconomic Determinants and Drivers Life Expectancy in West Africa

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ABSTRACT

This study empirically analyses the socioeconomic determinants and drivers of life expectancy in West Africa. The study adopted a Panel Fixed Effect Least Square Dummy Variable Regression with data from World Development Indicators (WDI) spanning through the period 1985-2018. The result of the analysis shows that in West Africa, real per capita gross national income, old-age dependency ratio and child mortality rate significantly affect life expectancy. The study therefore, recommends that the governments in this sub-region should provide adequate social protection measures for the elderly so as to reduce the financial burden on the working population and adequately formulate and implement policy blueprints to improve health outcomes such life expectancy and others.

Keywords: Life Expectancy, health outcomes, infant and child mortality rates

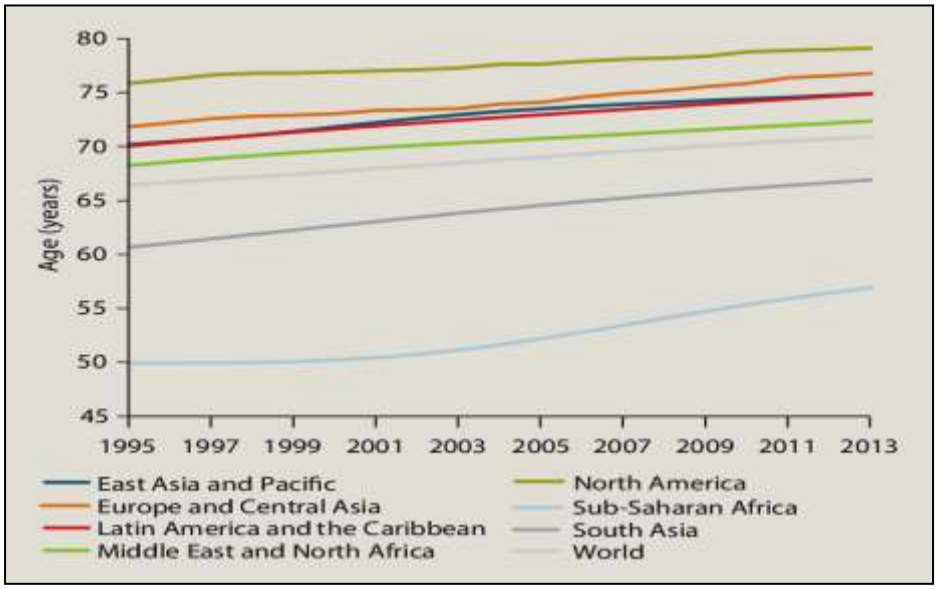
JEL Classification: H51, I14, I15

1. INTRODUCTION

Life expectancy as a summary measure of population health (SMPH), is an important indicator of the economic and by extension, the social advancement of a nation because every country strives for economic and social development. All countries, wealthy or poor undertake tremendous efforts to make their citizens better off with respect to improvements in health outcomes such as increase life expectancy, reduction in infant mortality rate and under-five mortality rate or child mortality rates etc (Orji, Ogbuabor, Mba, and Anthony-Orji, 2021). Though these goals are laudable, the pace with which they are achieved and the magnitude varies from country to country. Empirical evaluations of health outcomes are among the primary concerns of academics, policy makers and medical researchers so as to facilitate

effective and efficient channeling of funds towards specific segments of the health sector in order improve citizen's health. Projections of health outcomes are a prerequisite in the formulation and implementation of policies needed to bring about the much needed improvement in population health (Orji, Ogbuabor, Anthony-Orji, Okoro and Aniorji, 2020). The institution of governance should be such that has a framework to cater to the peculiar health needs of its population. The fact of changing population structure will continually be at the front burner of policy makers. Population health is one of the most pressing national issues as it is often said that "health is wealth". The comprehensive evaluation of the drivers or determinants of population health based on current and future population structure as well as their anticipated ramifications is the bedrock of any sound and informed health policies geared towards achieving specific and broad socio-economic objectives. At the macro level of policy formulation, the sustenance, expansion and improvement of population health is one of the basis not of sustainable growth and development (Bayati, Akbarian, & Kavosi, 2013). Crude death rate does not accurately capture levels of mortality or general population health status and by extension standard of living attained by a country. Literatures on population and demography and researchers have adopted the use of life expectancy at birth (LEB) in the empirical descriptions of mortality levels. Life expectancy (Rabbi Fazle, 2013) at birth is a conventional summary index of population health along with longevity. The definition of "good health" is predicated on improved socio-economic conditions such as a considerable reduction in social inequality (health inequality inclusive), unemployment, food security, access to quality and affordable health care and overall improvement in the well-being of the populace. Africa with all its wealth in human and natural resources have dismal health outcomes (Orji, Ogbuabor,, Nwanosike and Anthony-Orji, 2019**)**. The average life expectancy in Africa is approximately 63 years (Statista, 2019) However, an indication of poor health outcomes as measured by very low life expectancy means gross socioeconomic underdevelopment which has bedeviled the African continent. Instructively, life expectancy at birth (LEB) in North Africa is much higher than what obtains in West Africa because the former is seriously contending with the challenges of high infant and child mortality rates as well poor standard of living, high level of social inequality, political instability, wars, low literacy rate and lack of access to quality

and affordable health care services. Also, despite the impressive feat achieved by countries in North Africa in regards to the improved life expectancy which averaged 72.6 years (World Mortality, 2019) in comparison to West Africa which averaged 57.9 years in the same period, the average life expectancy on the African continent is still below the global average of 72.6 years as estimated by the United Nations for the year 2019. It is on the strength of the above information that this study investigates the socioeconomic determinants and drivers of life expectancy in West Africa. Figure 1. Shows a rising life expectancy globally but still remains low on the average in Africa.



Source: World Development Indicators (2021).

From figure 1 above, the diagram shows the respective trends of the average life expectancy for each sub-regions in Africa as well as the projections of trends in life expectancy. The dark blue trend indicate that the North Africa sub-region has the highest average life expectancy in Africa while the green trend shows the average life expectancy in West Africa which is way below that of North African countries.

Figure 1, shows how the trends in average life expectancy differ among the different regions of the world. The trend lines in golden-yellow and light-brown respectively show that countries in North America and Europe and Central Asia have the highest average life expectancy in the world. The green and light-blue trend lines respectively show that even though countries in the Middle East and North Africa (represented by the green line) have higher life expectancy than those in Sub-

Saharan Africa (represented by the light-blue line), it is still below the global average (represented by the faint-blue line). The imperative of impressive health outcomes as an integral part of economic development is encapsulated in the defunct Millennium Development Goals (MDGs) and recently the Sustainable Development Goals (SDGs). Life expectancy is one of the primary indices for assessing a country's level of development as well as the efficiency and effectiveness of its health sector/systems. The ASDI (Africa Social Development Index): West Africa Report (2016) shows a particularly low life expectancy at birth in line with the assertion above that West Africa has the lowest Life expectancy in Africa. Life expectancy is one of the important statistical measures of health outcomes and researchers use it access the mortality level in a population, the level of old-age dependency ratio (OADR), the quality of health care systems, affordability of health care services and overall socioeconomic progress. Some researchers have overtime championed alternatives or variants of life expectancy such as health-adjusted life expectancy (HALE), disability-adjusted life years (DALY) and potential years of life lost (PYLL).The singular fact that Africa has the least life expectancy at birth (LEB) in the world goes to show the gross level of underdevelopment in its public health care system as well as years of policy somersaults and maladministration by successive governments in the managements of the affairs of nations in the region. This study investigates the factors that determine life expectancy in West Africa sub-region using selected variables (but not all) such as real per capita GNI, old-age dependency ratio (OADR), urbanization /population growth, infant mortality rate (IMR), child mortality rate (CMR) or under-five mortality rate (U5MR/CMR), general government final consumption expenditure (GGFCE) which includes expenditures on health and education (components of human capital), CO2 emissions per capita, food production index (FPI) and total fertility rate (TFR).

In sum, this study investigates the socioeconomic determinants and drivers of life expectancy in the Western Africa sub-regions of the African continent. The study also determines the direction of causality between life expectancy and age-dependency in West Africa. The rest of the paper is structured as follows: section two reviews the literature, while section three provides the methodology. The results are presented and discussed in section four and section five concludes the paper.

2. LITERATURE REVIEW

There is plethora of studies such as Orji, Ogbuabor, Mba and Anthony-Orji (2021), Nixon and Ulmann (2006), Orji, Ogbuabor, Nwanosike and Anthony-Orji (2019), Cervantes, Monsef and Mehrjardi (2015), Orji, Okechukwu and Ogbuabor (2014), Balia and Jones (2008), Orji and Okechukwu (2015) among others, have been conducted on health demographics and health outcomes using different methodologies across different economies but this current study has a relatively different objective. For example, Nixon and Ulmann (2006) investigated the impact of health expenditures on specific health outcomes like infant mortality and life expectancy using a fixed effect estimation technique of a panel data obtained from 15 member countries of the European Union from the period 1980-1995.The findings shows that increase in health expenditures leads to a substantial decline in infant mortality but a less significant impact on life expectancy. Monsef and Mehrjardi (2015) studied how social (urbanization), economic (per capita GNI, inflation, unemployment and gross capital formation) and environmental variables (Co_2 emissions per capita) affect life expectancy using a panel data estimation of 136 countries from the period 2002-2010 and showed that unemployment and inflation have a statistical significant negative impact on life expectancy, gross capital formation and per capita GNI positively affect life expectancy while urbanization affects life expectancy negatively.

Furthermore, Balia and Jones (2008) investigated factors affecting early mortality and how individual health behaviours affect mortality through socioeconomic discrepancies in Great Britain using data from *British Health and Lifestyle Survey* and longitudinal follow up of May 2003, a maximum simulated likelihood (MSL) technique of the multivariate probit model (MVP) to estimate successive systems of equations for morbidity, mortality and lifestyles. Inequality in health is calculated using the Gini coefficients and a disaggregated technique the disaggregated analysis for mortality shows that after allowing for endogeneity, health behaviours has a statistically significant effect on variations in mortality making the variable of socioeconomic status less significant. Medeiros and Schwierz (2015) studied how the efficiency of health care systems contributed to desirable health outcomes in the European Union (EU) using an assortment of models such as Data Envelopment Analytic(DEA) model, Stochastic Frontier Analytic(SFA) model, Efficiency Effect Frontier(EEF) model,

panel regression models (2010-2013) of life expectancy and SFA Error Component Frontier (ECF) model with a blend of both input(per capita health care expenditures and environmental factors) and output variables (health outcomes such as life expectancy, health life expectancy and mortality rates.).The results showed that on the average in the EU, life expectancy at birth could be raised by 2.3% when there are positive progressions in the efficiency frontier meaning that an increase in the life expectancy at birth is predicated on the degree of efficiency of a country's health care delivery system. In another study, Schoder and Zweifel (2011) investigated the determinants of health status as being dependent on both medical and non-medical inputs using the method of standard of life expectancy in 24 OECD nations from 1960-2005 and results showed that a 10% increase in health care spending will lead to a predicted 0.42% decrease in life expectancy. Baltagi, Moscone and Tossetti (2011) investigated variability in health outcomes across OECD nations with specific reference to life expectancy at age 65 in the period 1960-2007 using a health production function where life expectancy is dependent on lifestyle choice, medical technology and health care and social spending alongside a panel data fixed effect(FE) regression model. Findings suggest that health expenditures is statistically significant and has a small impact on health outcomes given a level of medical innovation. Medical innovations significantly affect life expectancy and indicate a high degree of interdependence among nations. The results also showed that countries in the OECD with lower life expectancy overtime tend to close the gap with countries having higher life expectancy. Gerdtham, and Abubakar, Nketiah-Amponsah and Owoo, (2019) examined the effect of selected socioeconomic variables-GDP per capita, health expenditures per capita, education(secondary school enrolment), HIV/AIDS prevalence rate and CO_2 emissions per capita) on life expectancy in 44 countries in Sub-Saharan Africa (SSA) from 2000-2015 using the Generalized Method of Moment (GMM) estimation approach. The author discovered that GDP per capita, health expenditure per capita and education had a statistically significant positive effect on life expectancy while CO_2 emissions per capita and HIV/AIDS prevalence rate had a statistically significant negative effect on life expectancy. The authors made the following assertions based on their research findings that governments of countries in the Sub-Saharan Africa aggressively pursue

development policies that will enhance life expectancy for all and sundry.

Furthermore, Sede and Ohemeng (2015) empirically examined the impact of socioeconomic variables (secondary school enrolment, government health spending, per capita GNI, unemployment rate and exchange rate) on life expectancy in Nigeria from 1980-2011 using VAR and VECM (due to the nature of endogeneity of the variables).The authors show that per capita GNI, education and government spending health were not statistically significant. They however opined that life expectancy can be improved through improvements in socioeconomic factors. Akinkugbe and Mohanoe (2009) in their own study, examined the nexus between public health care spending and health indicators (life expectancy at birth, infant mortality rate and under-5 mortality rate (U5MR)) in Lesotho from 1980-2011 using a time series data and an error correction model ((ECM). The results show that public health spending, female level of education, child immunization and adequacy of medical personnel all contribute significantly to improvements in health outcomes in Lesotho and in stark variance to earlier research, per capita GNI was found to be statistically insignificant. The authors therefore concluded that Lesotho government should increase the rate of child immunization, number of medical personnel and female education so as to attain a desirable health measures.

Bein et al (2017) provided empirical evidence on the effect of health care expenditures on health outcomes-life expectancy at birth, infant mortality rate and under-five mortality rate of eight Eastern African nations-Burundi, Eritrea, Ethiopia, Kenya, Rwanda, Sudan, Tanzania, and Uganda from 2000-2014 using a panel data estimation method. The authors showed that there exists a positive correlation between health care spending and male and female life expectancy respectively and a negative relationship between health care spending and infant and child mortality. However health care spending had a more significant effect on female than male life expectancy. Majdi (2012) studied the link between health care costs and economic growth in 15 countries of the North and South Bank Mediterrean-which also include Algeria, Egypt, Libya, Morocco and Tunisia from 1990-2008 using panel data econometric method and showed that health care costs had a significant positive effect on economic growth through its effects on health outcomes and in turn the effects of positive impact of health outcomes on human capital development. The studied also

examined the impact of political factors on the administration of health care funds. Moreso, Tsaurai (2014) investigated the significance of Adolph Wagner's theory of public expenditure on health expenditure and its impact on economic growth in Botswana from 1995-2012 using the Granger causality test. The author showed that there existed no causal association between health expenditure and economic growth thereby rendering Wagner's theory irrelevant.

Again, Amponsah (2019) investigated the primary macroeconomic social variables that determine health care spending and by extension the effect of health care spending on health outcomes as measured by life expectancy at birth, under-five mortality and maternal mortality of 46 countries in the SSA region of the Africa continent using panel data from 1996-2015 and a panel fixed effect (FE) and random effect (RE) model. The results show that per capita GDP, physician per 1000 population, population aged above 65 years and under-five mortality are the primary factors that impact health expenditures in SSA. Also health expenditures were found to be statistically significant and impact positively on life expectancy, cause a reduction in under-five mortality as well as maternal mortality rate. The author concluded that increase in health care expenditures in countries in SSA will improve health outcomes.

Summarily, all the literature reviewed above though insightful, did not particularly investigate the socioeconomic determinants and drivers of life expectancy-in West Africa.

3. METHODOLOGY

3.1 MODEL SPECIFICATION

. This study uses annual data from World Development Indicators (WDI) for the period between 1985 and 2018**.**

Model specification for Determinants and drivers of life expectancy in West Africa.

$$LE_{jt} = \beta_0+\beta_1 OADR_{jt}+\beta_2 COE_{jt} + \beta_3 TFR_{jt} +\beta_4 FPI_{jt} +\beta_5 PCGNI_{jt} +\beta_6 GGFCE_{jt} +\beta_7 POPGR_{jt} + \beta_8 IMR_{jt} + \beta_9 U5MR_{jt} + \lambda_1 D_{ij} + \lambda_2 D_{2j} + \lambda_3 D_{3j} + \lambda_4 D_{4j} + \varepsilon_{jt} .....1$$

Where use is made of the fact that j=1,...N denotes the country in West Africa, t=1,...T denotes the time period and ε_{jt} is the error term assumed to be serially uncorrelated. Also the

dummies D_1, D_2 , D_3, and D_4 represent Ghana, Cote d'Ivoire, Niger and Burkina Faso and β_0 represents the base or benchmark category which is Nigeria

Model specification of the Determination of the causal relationship between life expectancy and old age dependency ratio in West Africa,

$$LE_{jt} = \sum_{j}^{n} a_j\, LE_{t-i} + \sum_{j=1}^{n} \Pi_i \mathrm{LE}_{t-j} + U_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 2$$

$$\mathrm{OADR}_{jt} = \sum_{\mathrm{j}=1}^{n} \theta_j OADR_{t-i} + \sum_{t=1}^{n} \Pi_j \mathrm{LE}_{t-j} + U_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

Where j represent countries in West Africa sub regions and a_i, β_i, θ_i, Π_i and a_j, β_j, θ_j, Π_j represent their coefficient

3.2 ESTIMATION TECHNIQUE

This study utilizes the fixed effect least squares dummy variable (LSDV) panel regression.This is because it provides consistent estimates for finite N and as T tends to infinity (Okeke and Okeke, 2016). In other words, fixed effect least squares dummy variable panel regression are suited to estimate panel data with T>N. This study utilizes 10 cross-sectional identities (N=10) and a total time period of 34(1985-2018) ie T=34. Additionally, it edummy or qualitative variables.

a. JUSTIFICATION OF VARIABLES

Old-age dependency ratio (OADR): Old-age dependency ratio is the proportion of persons of age 65+ that are dependent on the working population. This proportion is high in developed countries known to have high life expectancy while it is low in Africa countries known to have a low life expectancy. This study investigates the statistical significance of the ratio on life expectancy. **Carbon Emission Per capita (COE):** Carbon emission per capita (COE) is included in this study because it gives an indication of the level of environmental pollution (air pollution).The higher the emission, the poorer the air quality and the more susceptible the population are to respiratory diseases and other ailments. **Total Fertility Rate (TFR):** Total fertility rate (TFR) measures the average number of children that would be born of a woman during her reproductive life cycle given the prevailing maternal and infant mortality rate in the cohort population. **Food Production Index (FPI):** Food Production

Index (FPI) is an indication of the availability of food needed for nutritional efficiency, good health and a strong body. The quality of food available contributes to food security. **Per Capita Gross National Income (PCGNI):** Per capita gross national income (PCGNI) is one of the core variables of human socio-economic development. It is a measure of the standard of living when evaluated from the standpoint of purchasing power parity (PPP). According to Preston (1976), life expectancy is largely dependent on consistent increase in per capita gross national income. **General Government Final Consumption Expenditure (GGFCE)** This variable is used to account for government expenditure on goods and services that include expenditures on health and education which are major components of human capital development. This variable helps to determine the quality of health care institutions **Population Growth Rate(POPGR)** Population growth rate is a statistic that measures the rate of population increase(decrease) in relation to a country's total national output. If the increase in population growth rate is more than total output, then the population will have a poor standard of living. **Infant-Mortality Rate (IMR**): Infant mortality rate(IMR) is a measure of death of newborns below 2years of age. A substantial reduction of this rate shows an improvement in life expectancy, other things held constant.

4. PRESENTATION OF RESULTS

4.1 DESCRIPTIVE STATISTICS FOR COUNTRIES IN WEST AFRICA

TABLE 4.1

Variables	Observations	Mean	Std.Dev	Min	Max
LEB	N = 170	52.79294	5.758416	21.7	63.8
LCOEPC	N = 170	1.962099	.0475702	1.835691	2.025781
TFR	N = 170	.3229412	.2229513	0	0.9
FPI	N = 170	6.024118	1.273933	5	7.9
GGFCE(%of GDP)	N = 170	65.85647	27.50623	24.7	244.6
POPGR(annual %)	N = 170	1.494118	3.315281	-6.6	12.5
IMR	N =170	12.58765	5.928162	0.9	26.1
CMR	N =170	2.877176	.4863938	2.1	4
LRGPCNI	N =170	2.932559	.2215547	2.576111	3.396809
OADR	N =170	5.149412	.2765483	4.2	5

4.2 PRE-ESTIMATION TEST

4.2.1 STATIONARITY TEST/ UNIT ROOT TEST RESULT.

The test for stationarity is implemented using the Levin-Lin-Chu (2002) because the data generating process gives rise to a balanced panel data set and it is appropriate for a data set with few panels and many time periods. It also includes fixed effects and time trends in the model of the data generating process. The null hypothesis is that the series contains a unit root or is non-stationary while the alternate hypothesis is that there is no unit root or that the series is stationary. The null hypothesis is rejected if the Levin-Lin-Chu bias-adjusted t-statistic has a p-value that is less than 0.05 at the chosen level of significance which in this study is 5% otherwise we do not reject.

VARIABLES	ADJUSTED t* STATISTICS	P-VALUE @ 0.05	ORDER OF INTEGRATION	DECISION
LEB	-38.6370	0.0000	I(1)	Stationary
LCOEPC	-6.4970	0.0000	1(2)	Stationary
TFR	-7.1656	0.0000	I(1)	Stationary
FPI	-5.9360	0.0000	I(1)	Stationary
GGFCEof GDP	-7.4353	0.0000	I(2)	Stationary
POPGRannaul	-3.0247	0.0012	I(0)	Stationary
IMR	-6.8289	0.0000	I(1)	Stationary
CMR	-7.3049	0.0000	I(2)	Stationary
LRPCGNI	-3.6670	0.0000	I(1)	Stationary
OADR	-3.2780	0.0005	I(0)	Stationary

Source: Authors' Computation from Stata 15

4.2.2 COINTEGRATION RESULTS FOR VARIABLES IN WEST AFRICA

The cointegration test this stud employs is the Kao (1999) test for panel data cointegration combines statistics computed for each individual in the panel thereby producing a test with higher power. Furthermore, the limiting distribution of the combined test converges to a standard normal distribution after appropriate standardization, whereas test for cointegration based on a single time series have non-standardized distributions. The test also account for serial correlation of the error term and it report five statistics which are the Modified Dickey Fuller, Dickey Fuller, Augmented Dickey Fuller , un-adjusted Modified Dickey Fuller and un-adjusted Dickey Fuller test statistics. If the p-values of the associated t-statistics of the abovementioned statistics are all simultaneously less than 0.05 at the chosen level of significance, then the null

hypothesis of no co-integration is rejected
otherwise we fail to reject.

TEST STATISTIC	t-STATISTIC	P-VALUE
Modified Dickey-Fuller t	-13.0980	0.0000
Dickey-Fuller t	-13.9079	0.0000
Augmented Dickey-Fuller t	-3.8400	0.0001
Unadjusted Modified Dickey Fuller t	-16.2303	0.0000
Unadjusted Dickey-Fuller t	-14.0734	0.0000

Source: Authors' Computation from Stata 15

Comparing the p-values of all the different types of test statistics on the left, it can be shown that the p-values are all less than 0.05 meaning that all panels are cointegrated suggesting that a long-run relationship exist among all the variables that determine drivers of life expectancy among all the variables that determine life expectancy in West Africa.

4.2.3 GRANGER CAUSALITY TEST

This study utilizes the Dumitrescu and Hurlin (2012) Granger non-causality test for panel datasets which uses the p-values associated with test statistics of Z-bar and Z-bar tilde to either reject or fail to reject the null hpothesis of no causal relation between two variables.

TABLE 4.2.3

NULL HYPOTHESIS	Z-BAR	P-VALUE	Z-BAR TILDE	P-VALUE
OADR does not Granger-cause LEB	49.7823	0.0000	43.8948	0.0000
LEB does not Granger-cause OADR.	2.6234	0.0087	2.2186	0.0265

Source: Authors' Computation from Stata 15

From the table above, the p-values associated with both Z-bar and Z-tilde are less than 0.05 in each null hypotheses.Hence there is bi-directionally causal relationships between LEB and OADR.

4.3 PRESENTATION OF RESULTS FOR PANEL FIXED EFFECT DUMMY VARIABLE REGRESSION.

TABLE 4.3

Dependent variable: LEB

VARIABLES	COEFFICIENTS	STD. ERRORS	T-STATISTICS	P-VALUE
CONSTANT	-47.16294	34.83067	-1.35	0.178
LCOEPC	-0.4160496	14.61205	-0.03	0.977
TFR	0.4116003	1.936749	0.21	0.832
FPI	-0.2688975	0.2984123	-0.90	0.369
GGFCEofGDP	0.0593913	0.0105173	5.65	0.000
POPGRannual	-0.0080534	0.0671609	-0.905	0.120
IMR	0.2096312	0.0704727	2.97	0.003
CMR	4.9189710	0 .698144	7.05	0.000
LRPCGNI	16.51584 0	4.374414	3.78	0.000
OADR	7.276841	0.9041156	8.05	0.000
d1	-11.76119	-2.248585	5.23	0.000
d2	1.559566	1.3424	1.16	0.247
d3	-6.461164	1.268777	-5.09	0.000
d4	-5.020891	0.8479845	5.92	0.000
R^2 = 0.8310		F-stat=59		Prob.(F-stat)=0.0000
Adjusted R^2 = 0.8169		Wooldridge test=0.0858		

Source: Authors' Computation from Stata 15

4.3.1 PRESENTATION OF ROBUST STANDARD FIXED EFFECT REGRESSION RESULTS TO CORRECT FOR AUTOCORRELATION, HETEROSCEDASTICITY AND CROSS-SECTIONAL DEPENDENCY: DRISCOLL-KRAY STANDARD ERRORS

TABLE 4.3.1

Dependent Variable:LEB

VARIABLES	COEFFICIENTS	STD.ERRORS	T-STATISTIC	P-VALUE
CONSTANT	-51.49967	38.58637	-1.33	0.253
LCOEPC	-0.4160496	17.58324	-0.02	0.982
TFR	0.4116003	0.9905335	0.42	0.699
FPI	-0.2688975	0.2752381	-0.98	0.384
GGFCEofGDP	0.0593913	0.0239796	2.48	0.068

POPGRannual	-0.0080534	0.0613936	-0.13	0.902
IMR	0.2096312	0. 1192376	1.76	0.154
CMR	4.918971	0.5772775	8.52	0.001
LRPCGNI	16.51584	5.102229	3.24	0.032
OADR	7.276841	1.166436	6.24	0.003
Within R-squared= 0.7352		F-stat= 86.24	Prob.(F-stat)=0.0003	

Source: Authors' Computation from Stata 15

4.4 DISCUSSION OF RESULTS: DRISCOLL-KRAAY ROBUST STANDARD ERRORS:

LEB_{jt}=-51.49967-0.4160496$LCOEPC_{jt}$+0.4116003TFR_{jt}-0.2688975FPI_{jt}+0.0593913 $GGFCEofGDP_{jt}$-0.0080534$POPGRannual_{jt}$+0.2096312IMR_{jt}+4.918971CMR_{jt}+ 16.51584$LRPCGNI_{jt}$ +7.276841$OADR_{jt}$

From the regression result presented above, each coefficient represent the expected effect of each individual variable on the dependent variable ceteris paribus.

The value of the intercept is -51.49967, which means that when all the other explanatory variables are simultaneously equal to zero, LEB decreases by 51.49967 years on average.

The coefficient of the variable LCOEPC is -0.4160496. This implies that if carbon (iv) oxide emissions increases by one ton, then LEB on average will decrease by 1.46 or approximately one day (note that one year equals 365 days).This is in tandem with empirical studies that high air quality index leads to a fall in respiratory illnesses that could decrease LEB. Environmental pollution engenders low health status that could increase morbidity and mortality.

The coefficient of the variable TFR is 0.4116003, meaning that if total fertility rate increase by one child, then LEB increases by approximately five months (4.8 months, where one year equals 12 months).This is in stark contrast to the developed climes where a decrease in total fertility rate as a result of the educational and economic empowerment of women which enables them to earn non-agricultural wages in the formal sector of the economy leads to a healthy maternal status and by extension LEB on the average ceteris paribus. For the variable FPI whose coefficient is 0.2688975, an increase in its value by one unit decreases LEB by approximately three months (one year

equals 12 months).This contrasts the findings of Ferda (2010) but conforms to the findings of Rayhan, Hasan and Akter (2019). The negative value of the food production index can be attributed to the fact that in West Africa the problem of food insecurity is rife due to poor and undeveloped agricultural systems as food production index measures not only the availability of affordable food products but also its quality.

GGFCEofGDP has a coefficient of 0.0593913 which implies that if general government final consumption expenditure as a percentage of GDP increases by one dollar, then LEB will rise by eighteen days (one year is equal to 365 days).This conforms to the findings of Nsereko (2018), Abubakar, Nketiah-Amponsah and Owoo (2019), Sahnoun (2018) and Binase (2018).

POPGRannual has a coefficient of 0.0080534, this means that if population growth rate increases by one percent, LEB decreases by approximately 29 days (use is made of the fact that one year equals 365 days).This is actually evident in Nigeria with a rising and uncontrolled population growth a corresponding low value of LEB. For the variable IMR whose coefficient is 0.2096312, an increase in increase in infant mortality rate by one infant leads to a corresponding increase in LEB by 73days (use is made of the fact that one year equals 365 days). This does not conform to empirical researches such as Novignon, Olakojo and Novignon (2012) that stresses a reduction in infant mortality rate as one of the preconditions to engender improvements in health outcomes like LEB. Though the life expectancy value in West Africa is a little above average, the positive relationship between LEB and infant mortality can be traced to the fact that the increase in infant mortality rate is not significant enough to lead to a decrease in LEB on the average in relation to the general population.

The variable CMR has a coefficient of 0.91897.91 implying that if child mortality rate increases by child's death, LEB increases by approximately ten months (use is made of the fact that one year equals 12 months). Again this relationship is not consistent with empirical studies but can only be attributed to the fact that the increase in child mortality rate just like infant mortality rate is not significant to cause a reduction in in the LEB of the overall population. LRPCGNI has a coefficient of of 16.51584 which means that if real per capita GNI increases by one dollar amount, then LEB will rise by approximately 17 years which is in line with Monsef and Mehrjardi (2015), Bai et al (2018), Keita (2013), Sede and Ohemeng

(2015) and Ketenci and Murthy (2017). The variable OADR has a 7.276841 which means that if old-age dependency ratio increases by one percent, LEB will rise by 7 years. This conforms to what obtains in developed climes with a high proportion of elderly persons and a high life expectancy compared to less-developed countries with low life expectancy and low proportion of elderly persons.

4.4 .1 AUTOCORRELATION TEST

For this purpose, the Wooldridge autocorrelation test in panel data is used for this purpose.

H_0: the residuals are not Autocorrelated

H_1: the residuals are Autocorrelated

Decision Rule: reject H_0 if the P-value of the observed f-test is less than or equal to 0.05 at 5% level of significance and conclude that there is no first orde autocorrelation in the residuals or fail to reject if otherwise.

4.4.2 WOOLDRIDGE TEST RESULT

F-TEST	5.150
Prob.(F-TEST)	0.0858

Source: Author's computation from Stata 15

Since the P-value of the observed chi-square 0.0858>0.05, we accept the null hypothesis at 5% level of significance and conclude that the residuals are not autocorrelated.

4.4.3 CROSS-SECTIONAL DEPENDENCY TEST

The Breusch-Pagan LM test of cross-sectional independence is used to is used to test for cross-sectional dependency among the individual specific effects (unobserved variables) in 99.the panel .The problem of cross-sectional dependency is evident in the estimation of parameters that are biased and lead to misleading statistical inference. The problem can be rectified using the Driscroll-Kraay robust standard errors.The hypothesis testing is stated below:

H_0:There is no cross-sectional dependency

H_1 :There is cross-sectional dependency

Reject the null hypothesis if the p-value of the of the chi-square statistic of the Breusch-Pagan LM test is less than 0.05 otherwise we fail to reject.

	_e1	_e2	_e3	_e4	_e5
_e1	1.0000				
_e2	-0.3536	1.0000			
_e3	0.1369	0.2154	1.0000		
_e4	-0.2197	0.6076	0.1876	1.0000	
_e5	0.0404	-0.5596	-0.0753	-0.6175	1.0000

Breusch-Pagan LM test of independence: chi-squared(10)= 45.715, Pr=0.000

Source: Authors' Computation from Stata 15

From the table above, the p-value is 0.000<0.05.Hence it is safe to reject the null hpothesis and conclude that there is indeed cross-sectional dependency.

ROBUST STANDARD FIXED EFFECT REGRESSION RESULTS TO CORRECT FOR, HETEROSCEDASTICITY AND CROSS-SECTIONAL DEPENDENCY:DRISCOLL-KRAY STANDARD ERRORS

TABLE 4.5

Dependent Variable:LEB

VARIABLES	COEFFICIENTS	STD.ERRORS	T-STATISTIC	P-VALUE
CONSTANT	-51.49967	38.58637	-1.33	0.253
LCOEPC	-0.4160496	17.58324	-0.02	0.982
TFR	0.4116003	0.9905335	0.42	0.699
FPI	-0.2688975	0.2752381	-0.98	0.384
GGFCEofGDP	0.0593913	0.0239796	2.48	0.068
POPGRannual	-0.0080534	0.0613936	-0.13	0.902
IMR	0.2096312	0. 1192376	1.76	0.154
CMR	4.918971	0.5772775	8.52	0.001
LRPCGNI	16.51584	5.102229	3.24	0.032
OADR	7.276841	1.166436	6.24	0.003
Within R-squared= 0.7352		F-stat= 86.24	Prob.(F-stat)=0.0003	

Source: Authors' Computation from Stata 15

4.5.1 EVALUATION OF THE GRANGER CAUSALITY TEST.

This study utilizes the Dumitrescu and Hurlin(2012) Granger non-causality test for panel datasets which uses the p-values associated with test statistics of Z-bar and Z-bar tilde to either reject or fail to reject the null hypothesis of no causal relation between two variables.

TABLE 4.5.1

NULL HYPOTHESIS	Z-BAR	P-VALUE	Z-BAR TILDE	P-VALUE
OADR does not Granger-cause LEB	49.7823	0.0000	43.8948	0.0000
LEB does not Granger-cause OADR.	2.6234	0.0087	2.2186	0.0265

Source: Authors' Computation from Stata 15

From the table above, the p-values associated with both Z-bar and Z-tilde are less than 0.05 in each null hypotheses. Hence there is bi-directionally causal relationships between LEB and OADR

5. CONCLUSION AND POLICY RECOMMENDATIONS

5.1 CONCLUSION

The main objective of this research is to analyse the socioeconomic drivers and determinants of life expectancy in West Africa using selected countries from the region based on population size. The countries of interest for the West Africa sub-region in decreasing order of population size include Nigeria, Ghana, Cote d'Ivoire, Niger and Burkina Faso. The number of observations used is between the period 1985 and 2018. Using a panel fixed effect least squared dummy variable regression analysis and the Driscoll-Kraay robust standard errors. Using the latter to correct for cross-sectional dependency, autocorrelation and heteroskedasticity, child mortality rate, real per capita GNI and old-age dependency ratio significantly affect life expectancy in West Africa. The adoption of the aforementioned model is in line with some theoretical relationships based on specific theories in economics. The result also shows that there is a bi-directional causality between old-age dependency ratio and life expectancy at birth in West Africa.

5.2 POLICY RECOMMENDATIONS

Total fertility rates and child mortality rates are significant drivers of life expectancy in the selected countries in West Africa. Government of these countries should ensure that this rates are reduced significantly in addition to maternal mortality through investments in educational and health infrastructures which are the key components of human capital development. Also the education of the girl-child/ women should be a matter of urgent policy consideration so as to empower economically and reduce dependence. Empirical studies have shown that pollutants like carbon (iv) oxide and other gaseous pollutants like sulphur (iv) oxide and chloro-fluoro carbons (CFC) have negative impacts on the environment and the general health status of the population. Thus, efforts should be made by governments of the West African countries included in this study to formulate policies that would curtail the indiscriminate emissions of carbon (iv) oxide and other forms of gas flaring to reduce to the barest minimum or mitigates its effects on human health. This could be achieved through command and control measures whereby emissions standards are legally defined to regulate the quantity of a permissible amount of gaseous pollutants into the atmosphere over a specified period beyond which legal defined sanctions are imposed on the defaulting entities. Also the use of a market-based control measures such as tradable permits in relation to the carbon markets can equally adopted. The countries selected in West Africa equally had old-age dependency ratio to be a significant driver of life expectancy at birth as well as real per capita GNI. Sustainable economic policies that engender growth and long term development plans should be adopted by governments in these countries so as to improve the standard of living of its citizens and health outcomes such as a reduction in all the mortality rates as this would engender life expectancy. Africa lags behind in life expectancy in relation to the rest of the world; this can be attributed to the slow pace of our economic growth and socio-political development. Concerted efforts have to be made at by the political class to ensure that the institutions of governance are efficient and effective enough to improve the lots of its citizens.

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