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Health Outcomes and Agricultural Output in Nigeria

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Abstract

Attaining sustainable agricultural development in any economy indubitably points towards ensuring improved quality of life and enough food for both present and future generations. The need to understand the links between agricultural output and health outcomes necessitates an inquiry to ascertain the extent the changes in health outcomes can influence agricultural output. This study using the dynamic error correction built an econometric model such that mortality rate and life expectancy are proxies for health outcomes while agricultural output is the dependent variable; HIV/AIDS is the dummy. Results showed that HIV/AIDS has lethal effects on health outcomes and aggregate output. It revealed that health outcomes also have significant impact on agricultural output potentials; and there is a causal relationship between health outcomes and agricultural output in Nigeria. This implies that if the healthcare system in Nigeria can be taken as a policy priority, a tremendous increase in the agricultural sector is unarguably expected. A simultaneous front involving both the public and private sectors in extending the healthcare services is necessary to enable workers and prospective workers access to healthcare delivery; this will invariably boost the agricultural output.

Keywords: Mortality rate; Life expectancy; Causality; Healthcare; Agricultural output; Human capital.

1. Introduction

The idea of health as a form of human capital determinedly makes health an instrument for raising economic value and income levels of individuals. It also has, as noted by Grossman (1972) become a direct source of human welfare. Therefore the impact of healthcare may have significant effects on prospective lifespan and lifecycle and health status of a worker as well as on a worker's productivity. Studies like that of Bloom and Canning (2008), Deaton (2006), Cutler and McClellan (2001), Schultz (2005), Licchetta and Stelmach (2016), Rice and Aragón (2018), suggest there might be significant impact of good health on corporal and intellectual development and economic achievements of a worker. The expected returns to human capital investment like healthcare serves as benchmark for a worker's level of earnings over his/her lifetime and approximation of the worker's market activities (Onodugo *et al.*, 2013). Access to healthcare seems to vary according to World Health Organization (2017), within and across countries, communities and individuals, which sometimes is predisposed by social and economic conditions. World Health Organization (2012), also stressed that a major (about 50%) determinant of economic growth differentials between/among nations can be attributable to health status and life expectancy. This seems to suggest that sufficient healthcare could be seen as key policy-element in promoting broad based regional and national development.

Going by the above, there appears to be an inseparable link between healthcare and labour productivity. This submits that enhanced labour output in the agricultural sector could provide the required nutrition needed by the worker to further the productive processes in agricultural and other sectors. Ill health and low life expectancy have significant downward effects on the productivity of agricultural labour in the developing economies (World Bank, 2018). Increase in diseases and loss of labour to death and lack of adequate know-how are the reasons attributed to the low productivity in the agricultural sector. A look at Nigerian economy by Anowor *et al.* (2013a), showed that agriculture has provided desired market-mediated linkages by providing workforce, enlarging markets for industrial output and providing export earnings to pay for imported capital goods. Agriculture provides the enabling environment, as noted by Anowor *et al.* (2013b), for majority of the world's poorest to take advantage of the immense opportunities to improve incomes and enjoy healthy lives. Growth in the agricultural sector as asserted by World Bank (2017), may narrow the inequality gap and extensively be beneficial to the poor. Thus commitments in the health sector could also affect human productivities exhumed in the agricultural sector.

Among the previous discussion regarding healthcare and health outcomes, we are yet to come across any work centered on the relationship and/or causality between health outcomes and agricultural output especially in Nigeria.

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Examples**:** Kim and Lane (2013), in a comparative study among 17 OECD countries only carried out an investigation on government health expenditure and public health outcome. Akinkugbe and Mohanoe (2009), worked on public health expenditure as a determinant of health status in Lesotho. Chung and Muntaner (2006), worked on political and welfare state determinants of infant and child health indicators. Omotosho and Ichoku (2016), concentrated their work to the distributional analysis of household health expenditure in Nigeria. Olaniyan *et al.* (2013), limited their study to the equity in health expenditure in Nigeria. Fatuase *et al.* (2016), focused on the effect of agriculture and health expenditures on economic growth in Nigeria. On the other hand, Aboubacar and Xu (2017), stressed their work on the impact of health expenditure on the economic growth in Sub-Saharan Africa. Hence there is need to carry out empirical study on the effect of health outcomes on the agricultural output.

Obviously, it appeared that efforts have been made over the years in Nigeria to strengthen the health sector. The National Health Policy (NHP) promotes the establishment and appointment of Local Government Health Committees (LGHCs) to ensure delivery of health services to communities and to enhance community participation. The Primary health Care (PHC) scheme emphasizes on the need for multi-sectoral linkage and community participation to cater for the health of immediate communities and catchment areas. The Health Pricing Policy (HPP) was introduced since government cannot shoulder the entire financial burden of providing the healthcare services alone. The HPP was also introduced to ensure an uninterrupted provision of efficient and regular healthcare services at minimal fee that is less than the real cost of providing such services. Such services includes laboratory and ancillary services, surgical operation fees, private/special admission facilities, private ambulance use, mortuary services, hospital bed and feeding services, specific ante-natal care and so on Aregbeyen (2001). Community Health Insurance (CHI) is a financing scheme whereby households in socio-economic group, or geographical group, or ethnic group finance or co-finance the costs associated with a given set health services thus also having some involvement in the management of the community financing scheme and organization of health services. On the financial commitments of the State on health: spending has been on the rise from 89 million Naira in 1970 to 160.3 million Naira in 1975 to 302.5 million Naira in 1980 to 658.1 million Naira in 1990 to 18181.8 million Naira in 2000 to 62884.04 million Naira in 2010 and to 340.45 billion Naira in 2018.

Among the challenges as remarked in Anowor *et al.* (2013a), faced in agricultural sector that have led to low productivity and income which culminate in poor savings and investment are: limited access to credit, inadequate technological experience, insufficient knowledge and skills, attitudes on land ownership, system of cropping and rearing of livestock, inadequate infrastructure, and healthcare challenges which incorporate diseases, morbidity, mortality and low life expectancy. However, Nigerian government seemed to have made efforts to stimulate her agricultural sector. She had formulated and adopted programmes and schemes such as National Accelerated Food Production Programme (NAFPP) in 1970, Operation Feed the Nation (OFN) in 1976, River Basin Development Authority (RBDA) in 1978, Agricultural Credit Guarantee Scheme Fund (ACGSF) in 1979, Green Revolution Programme (GRP) in 1980, National Agricultural Land Development Authority (NALDA) in 1990, Fadama Development Projects in 1990, Presidential Initiatives on Select Crops (1999 - 2007), Special Programme for Food Security (SPFS) in 2002, Agricultural Transformation Agenda (ATA) in 2010/2011, Rural Finance Institutions Building Programme (2012-2017), and the Anchor Borrower's Programme (ABP) phase-1 (2014 – 2019).

Despite the programmes and initiatives mentioned above, it is still worrisome that by 2017, infant mortality rate was 70 deaths per 1,000 live births; under-5 mortality rate was 120 deaths per 1,000 live births; the percentage of Nigerian children who are underweight, stunted in growth, and wasting were respectively 31.5%, 43.6%, and 10.8%; maternal mortality rate for the period 2007-2013 was 576 per 100,000 live births; HIV prevalence was 2.9% with about 3.2 million Nigerians living with the virus and the second highest in the world after South Africa's 7.06 million (see: https://africacheck.org/factsheets/factsheet-tracking-state-nigerians-health-10-years/).

In the light of the above, the need to understand the links between agricultural output and health outcomes is pertinent. This also necessitates the inquiry to ascertain the extent the changes in health outcomes can influence agricultural output. These particularly formed the starting point of this study which aimed at providing answers to the following questions: To what extent has life expectancy affected agricultural output in Nigeria? To what extent has mortality rate affected agricultural output in Nigeria? What direction of causality exists between health outcomes and agricultural output in Nigeria?

2. Literature Review

Studies on health outcomes have been principally preoccupied with determining the relationship between detailed causal factors and mortality and morbidity in the society. Interestingly, social scientists have used health theories to improve studies on human capital. That is to say inclusion of health as human capital variable every bit has enhanced human capital theory. Human capital theory provided the foundations which have been laid by the seminal works of Schultz (1961), Becker (1964), Grossman (1972), and Mincer (1974). This theory has proven very effective in contributing to the understanding of decision with respect to education and health. The health based human capital model has served as the pillar of model in health economics and has immensely contributed to the understanding of a wide range of phenomena in health and healthcare (Van Kippersluis and Galama, 2013). One of the foremost pathways responsible for the link between health, health outcomes and economic conditions is the strong influence health has on labour force participation, wealth, and earnings. Because unhealthy individuals most likely drop out of labour force sooner, and lose income as a result (Deaton, 2006; Møller, 2005).

The demand for health investment, like the demand for input factors, is a derived demand because individuals invest in health due to the underlying demand for good health. Current health status as observed by Van Kippersluis and Galama (2013), is a function of the initial level of health and histories of prior health investment. Becker (1964),

and Mincer (1974), posited that human capital arises out of any activity that would raise individual worker's productivity. It follows that human capital being the aggregate stock of knowledge, skill and vitality is important in the creation of measurable economic value. This theory posits that there are different kinds of investment in human capital which includes training, knowledge, skill and healthcare.

Creating a sustainable agricultural development path simply implies improving the quality of life by ensuring enough food for both present and future generations and generating sufficient income (Udemezue and Osegbue, 2018). However the problem of agricultural development is not that of transforming a static agricultural sector into a modern dynamic sector, but of accelerating the rate of growth of agricultural output and productivity consistent with the growth of other sectors of a modernizing economy (https://ageconsearch-umn-edu/bitstream/135054/Fris-1972-11-02-245pdf). Agricultural development within the ambit of the conservative model was capable in many areas of the world of sustaining rate of growth in agricultural production around 1.0% per year over relatively long periods of time. However this rate is not compatible with modern rates of growth in the demand for agricultural output which typically fall between 3-5% in the developing countries (Udemezue and Osegbue, 2018).

The Urban-Industrial Impact model explains geographic variation in the intensity of farming system and in the production of labour in a modern society. This model explains the more effective performance of the factor and product markets linking both agricultural and non-agricultural sectors in regions characterized by rapid industrial development. The High Pay off Input model is concerned on the high-pay off inputs available to farmers in developing nations. Farmers in traditional agricultural systems were viewed as rational and efficient resource allocators; but they remained poor because there were only limited economic opportunities to which they could respond. The enthusiasm with which the high pay off input model has been accepted and translated into economic doctrine has been due in part to the proliferation of studies reporting high rates of returns to public investment in agricultural research.

3. Model and Method

This study is anchored on human capital theory. This theory contends that improvement in human capital variables like education and health facilitates growth. Therefore improvement in health outcomes is expected to enhance agricultural output. The measurement of health is referred to as health status (health outcomes), which can be measured by life expectancy and mortality rate.

In basic expression, we presented Cobb-Douglas production function which shows that the production effect of one production factor could be represented by the effect of another.

$$Q = AK^{\beta}L^{1-\beta}, \qquad 0 < \beta < 1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Where, Q is the real product, A is transformation parameter, L is the labour, K is the physical capital, β is labour elasticity coefficient and (1 – β) is capital elasticity coefficient.

If β + 1 - β = 1, then there are constant returns to scale.

The transformation parameter A is a coefficient of the aggregate productivity of production factors, which refers to both factors (also called total factor productivity).

Generally the augmented two-factor production function can be expressed as follows:

$$Y = f(K,L) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where Y is the real product, L is the labour and K is the capital.

Equation (2) is taken to be the starting point equation in this study considering the proxies we have for health outcomes (life expectancy and mortality rate). Nevertheless, we go on to modify equation (2) by controlling for HIV/AIDS. This is so because HIV/AIDS epidemic has been a devastating factor that has been of adverse effects on the health of population within the Sub-Saharan African region. Therefore HIV/AIDS epidemic is built into our model to account as a dummy variable. We have two sub-periods in relation to this variable in determining the links between health outcomes and agricultural output. The two periods are 1981 – 2001(no anti-retroviral drugs) and 2002 - 2017 (anti-retroviral drugs). The first period is given the value one (1) and the second zero (0). There was no record case of HIV/AIDS in the years preceding 1980. Development and introduction of anti-retroviral drugs from 2002 consequently brought down cases of fatalities (deaths) related to HIV/AIDS and therefore has the potential of prolonging the life expectancy of the affected persons.

Our model of analysis is of the form:

$$LogAGR = \beta_0 + \beta_1 MOR + \beta_2 LogLEX + \beta_3 HIA + \mu \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Where:

AGR = Value of Agricultural Output

MOR = Mortality Rate

LEX = Life Expectancy

HIA = HIV/AIDS $\quad \sum_{0\,=\,if\ \text{anti-retroviral drugs}}^{1\,=\,if\,no\ \text{anti-retroviral drugs}}$

μ = Stochastic Error Term

Where: $\beta's =$ The Parameters of the independent variables to be estimated.

Secondary data was utilized and the methodology that was adopted to estimate the structural parameters is the multiple linear regression with the application of dynamic error correction model since it has been established that all the variables used in the equations are integrated of order one I[1], the Ordinary Least Squares OLS t-values are no longer reliable and cannot be used . Data covering 1981 to 2017 was sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin and the World Bank Development Indicators (WDI).

4. Unit Root Test

To avoid estimating parameters with unreliable estimates, it becomes necessary to carry out a unit-root test on the variables. The table below displays the summary results of the unit-root test using Augmented Dickey-Fuller (ADF) statistic.

Table-1. Unit Root Test

Variable	ADF Statistic	Critical-Value @5%	Order of Integration
MOR	-9.35683	-1.951000	I(1)
LEX	-5.266417	-1.951000	I(1)
AGR	-3.614753	-1.951000	I(1)

Source: *Authors' Computation Using E-views Software*

The table 1 above shows that mortality rate, life expectance and agricultural output were stationary at first differencing which means they individually integrated at order one.

5. Cointegration Analysis

Null Hypothesis: Residual has a unit root

The result of co integration test showed that there exists a long run relationship among the variables namely; mortality rate, life expectancy and agricultural output. This is so because at 5% level of significant, the absolute value of the t-statistics of the cointegration test (-4.6324) is greater than the absolute value of the corresponding critical value (-1.9614) at level form. Also the probability value of 0.0057 further confirmed cointegration of the specified variables.

6. Regression Analysis

Table-2. Parsimonious Result

Variables	Coefficients	Std.Error	t-statistics
MOR	-0.026331	0.002526	-10.42488
LEX	0.162133	0.042049	3.38558
HIA	-0.612613	0.376508	-1.62709

R^2 = 0.7372; F-statistics = 46.6741; Durbin-Watson = 2.4352

The regression analysis as shown in table 2 showed the impact of health outcomes (mortality rate and life expectancy) on agricultural output in Nigeria. The coefficient of mortality rate (MOR) yielded a negative value at the magnitude of -0.026331. This implies that all things being equal, a one percent increase in mortality rate will lead to 2.63 unit loss of agricultural output potentials. On the positive note, this conforms to economic a priori expectation because loss in manpower (through death) is also loss in agricultural output potentials.

On the other hand, the coefficient of life expectancy (LEX) yielded a positive parameter at the magnitude of 0.162133. This implies a direct relationship exists between life expectancy and agricultural output in Nigeria. Expectedly, this conforms to economic a priori expectation which connotes that a positive coefficient of the elasticity of life expectancy will result to rise in agricultural output potentials. This infers that a unit increase in life expectancy (LEX) will bring about an increase in agricultural output potentials by 16.21 units.

The coefficient of determination (R^2 = 0.7372) suggested that the explanatory power of the independent variables is high. It further denotes that 73.72% variations in agricultural output are accounted for by the changes in health outcomes (MOR and LEX). This therefore indicates that health outcomes variables have significant influence over agricultural output in Nigeria.

By the rule of thumb, the explanatory variables (MOR and LEX) are all statistically significant. This is so because the absolute value of respective t-statistics for MOR and LEX (-10.42488 and 3.38558) is greater than 2. This indicates that each of the explanatory variables has significant impact on agricultural output in Nigeria.

The dummy variable in the model accounted for the impact of HIV/AIDS on the agricultural output potentials in Nigeria. The regression coefficient of HIA (-0.61) pointed to a strong negative impact of HIV/AIDS and damaging effect it has on the agricultural output potentials in Nigeria. This possibly alluding to the comparative cruelty and of the influence HIV/AIDS has on productivity and consequently on agricultural output potentials. The negative correlation coefficient (-0.53) between HIV/AIDS and life expectancy (LEX) and the positive correlation coefficient (0.18) between HIV/AIDS and mortality rate (MOR) further highlight the malicious effects HIV/AIDS has on the lives of the population.

7. Granger Causality

Table-3. Pairwise Granger Causality Tests

Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
MOR does not Granger Cause AGR	35	6.07540	0.0061
AGR does not Granger Cause MOR		0.71027	0.4996
LEX does not Granger Cause AGR	35	8.29572	0.0018
AGR does not Granger Cause LEX		6.21493	0.0055
LEX does not Granger Cause MOR	35	15.0277	0.0015
MOR does not Granger Cause LEX		8.29362	0.0014

Source: *Authors' Computation using E-views*

The result of the causality test in table 3 above, with the probability values, shows that mortality rate and life expectancy granger caused agricultural output potentials in Nigeria.

8. Normality Test

The normality test via Jarque-Berra (JB) Statistic to ascertain if the residuals are normally distributed was carried out. The result of the normality test shows that the JB statistic is 3.6802; this points that the residuals are optimally distributed.

9. Conclusion and Recommendation

Findings from this study show that:

- Life expectancy has significant impact on agricultural output potentials in Nigeria.
- Mortality has significant impact on agricultural output potentials in Nigeria.
- There is a causal relationship between health outcomes and agricultural output in Nigeria.
- It is also observed from literature that the policy instruments in the economy have not been able to prioritize the health sector and hence there is no adequate manpower to propel the agricultural sector.

The result reveals that health outcomes have significant impact on agricultural output potentials in Nigeria. This implies that if the healthcare system in Nigeria can be taken as a policy priority, a tremendous increase in the agricultural sector is unarguably expected. Having captured heath outcomes with life expectancy and mortality rate, the numerical coefficients produced expected results. The implication of the signs and magnitudes of the coefficients is that immediate policy actions will lead to positive contribution to the agricultural sector in Nigeria.

The slope of HIA (-0.61) and its respective correlation coefficient of -0.53 for LEX and 0.18 for MOR shows the monstrous and lethal nature of HIV/AIDS and its posing threats to the lives of individuals and the potential output of the agricultural sector. Hence the need to stomp out its destructive effects on productivity.

More so, farmers should be granted specialize free/subsidized medical services in order to sustain and increase their engagement capacity in the agricultural sector. A simultaneous front involving both the public and private sectors in extending the healthcare services for a nonprofit purpose is necessary to enable workers and prospective workers access to healthcare delivery; this will invariably boost the agricultural output. Special committee or an agency should be set up to continuously monitor and evaluate performances and track the use of resources, health policies and reforms to ensure efficiency in the delivery of services.

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