Health – Industrial Productivity Gap in Nigeria: Issues and Perspectives

Peter N. Mba
Department of Economics, University of Calabar, Nigeria/University of the Gambia
Email- petermbanta@yahoo.com;
Anthony Orji
Department of Economics, Universsity of Nigeria, Nsukka, Nigeria.
Corresponding Email: anthony.orji@unn.edu.ng;

Ohatu, Ohatu Ekoh
Department of Economics, University of Calabar, Nigeria
ohatueohatu@gmail.com;

Mercy I. Chijioke
Department of Economics, University of Calabar, Nigeria
mercyic@yahoo.com

ABSTRACT
An efficient health system increases individuals' output through improvements in physical energy and mental activities. This study investigates the effect of health position on industrial productivity in Nigeria model from 1980 to 2020. Adopting the Autoregressive Distributed Lag (ARDL), the results showed that in both short-run and long-run periods, changes in rates of mortality, morbidity, literacy and life expectancy significantly affect the level of industrial productivity in Nigeria. However, in the long run, while economic growth and labour productivity positively affect industrial productivity, their impact on the dependent variable was abysmal. The findings, therefore, suggest that there's a need for the government at all levels to subsidize medical services as well as not only increase funding for the health sector but ensure that allocated funds reach the target population through effective monitoring and appraising of the operations of the health sector.

Keywords: Health, Industrial, Productivity, Growth, Outcome
JEL Classification: I1; L6; O4

1. INTRODUCTION

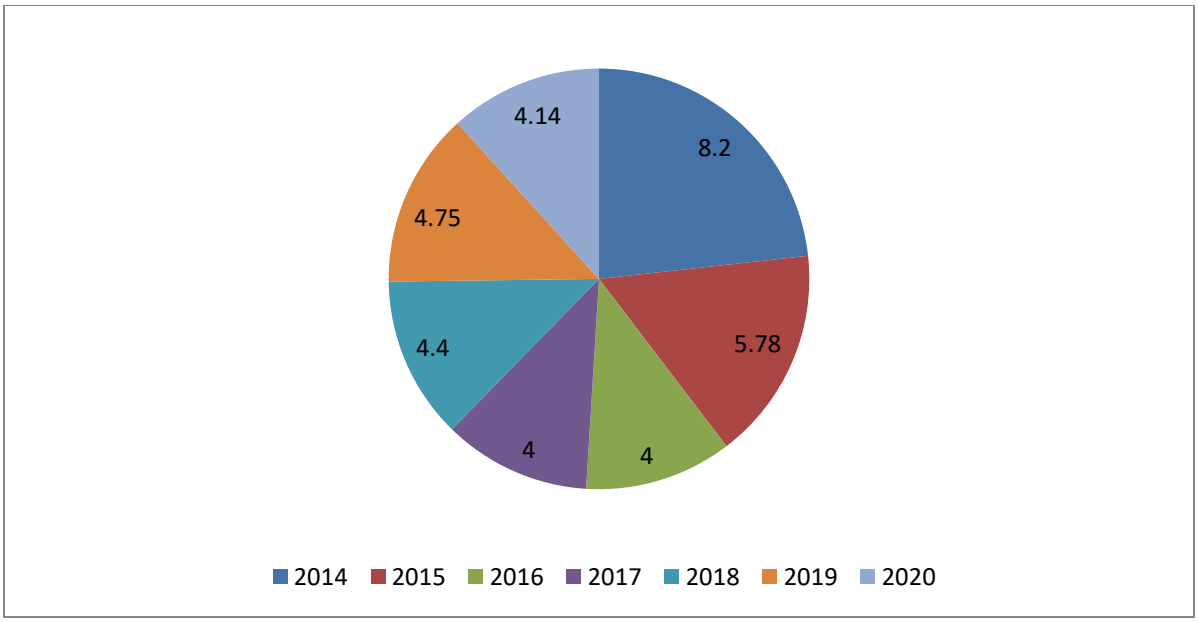
The touchstone of every nation's economic success is its ability to industrialize and produce goods and services for growth and

development. This aspiration was borne by the quest to ameliorate the sources of income and economic diversification, especially for primary product dependent countries of sub-Saharan Africa. A country's capacity to industrialize over time depends in part on the health of its workforce. This in turn propels the productive capacity and hence raises productivity.

Several factors have been adduced to enhance industrial productivity such as availability of finance, managerial talent, government policy and natural factors. In modern literature, an individual's condition of health is found to be an important determining factor of industrial productivity. Good health status raises the output of an individual through advancement in physical energy and mental activities and annual output through reduced illness while career outputs through decreased morbidity or increased longevity (Tompa, 2007). The burden of disease which may be a function of poverty is also likely to unfavourably affect a nation's production capacity and development prospects (Cole and Neumayer, 2006).

The overall health status is measured by life expectancy, morbidity and infant mortality rate, under-5 mortality rate, stillbirth rate, maternal mortality rate and crude death rate. Nigeria falls short of the 2001 declaration by the African Union agreement that member countries should allocate a minimum of 15 per cent of their annual budget to the health sector but devoted only 8.2 per cent in 2014. Rather than moving forward in 2015, budget allocation to health was 5.78 per cent and 4 per cent in 2016. From 2017 to 2020, budget allocation to health has declined to 4 per cent, 4.4 per cent 4.75 and 4.14 per cent respectively. The World Health Organization statistics (2016) ranked Nigeria 187 out of 191 countries in the world's health system performance. This poor health status performance has been linked to the primary health care system that is the principal level of care and has been retained in the weakest level of government and this resulted in a feeble and haphazard health care system thereby influencing the health population (Osain, 2011).

Figure 1: Budget allocation to the health sector in Nigeria from 2014 to 2020 in percentage



Source: Authors' computation from the BudgIT Research, Budget Office of the Federation (2021)

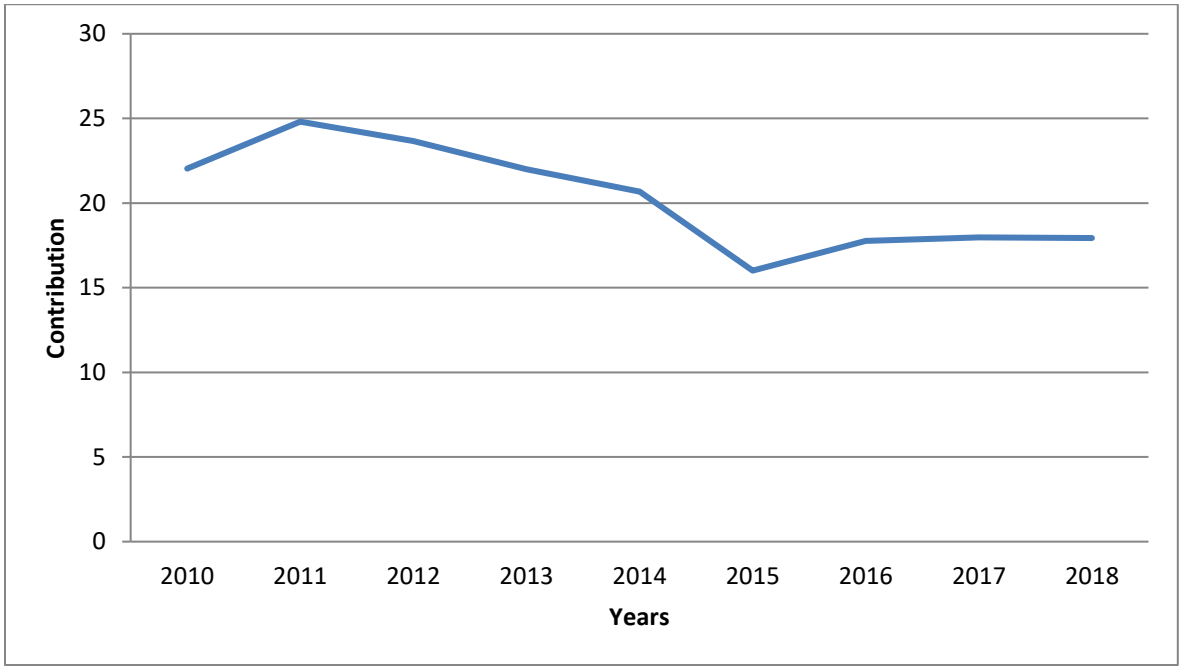
There exists an implication of ill-health on labour productivity. A high disease burden may have an unfavourable effect on a country's industrial productivity, growth and development. Disease drift explains a large percentage of avoidable mortality of the poor. Its burden forms a basic health risk confronting poor households, and cripples their earnings as sick individuals do often lack the capability to contribute to productivity growth (Yaqub and Umoru, 2013). According to Jack (1999), one-way health influences economic growth is by increasing the productivity of labour and the efficiency of labour can be determined by the mental and physical ability and investment in human capital (education and health). This was corroborated by Anyanwu and Erhijakpor (2007) and Onisanwa (2014) that health indicators affect economic growth positively in the long run. Consequently, any policy that will support an increase in health status in the economy will be indispensable.

There is also a close relationship between health and education. Bloom and Canning (2000) assert that productivity is higher in a healthier population because workers are energetic, physically and mentally robust. Longer life paves way for incentives to invest and develop skills and increases the return to investment in education while education increases productivity and higher income because health programmes depend on skills acquired through education needed for training of health workers. UNICEF Nigeria (2017) submit that many females have little or no opportunity for basic education in some regions of the country especially in the North East and North West where about 80% of the females have no education and are considered illiterates.

The inadequate and ineffectiveness of programmes and policies designed to tackle the several health issues in Nigeria have contributed little or no improvement in the

health status and have led to low industrial output, retarding resources shift from low to high productivity which is the main mover of the economy. This is evident in the Central Bank of Nigeria (CBN 2014) on the industrial sector's contribution to GDP of 22.03 percent in 2010. In subsequent years, the sector's contribution to GDP was 24.81 per cent in 2011: shrunk to 23.67 per cent in 2012; 21.99 per cent in 2013; 20.67 per cent in 2014 and down to 16.01 per cent in 2015. It averaged 17.9 per cent between 2016 and 2018 (CBN, 2018).

Figure 2: Industrial sector contribution to GDP in Nigeria from 2010 to 2018 in percentage



Source: Authors' computation from the CBN (2020)

It could be the case that the rate of diminishing health status in Nigeria is so high that several health programmes and financing efforts to improve productivity such as the National Health Insurance Scheme (NHIS), Social Health Insurance (SHI), water supply and sanitation sector reforms, Policy and Strategic Plan of Action on Prevention and Control of Non-Communicable Diseases, National Policy on Food and Nutrition, Centre for Integrated Health Programme, Maternal and Child Survival Programme and other federal and state allocations to the health sectors to make better the health conditions of its citizens. If these health programmes and policy measures were properly targeted, their failure to increase health status is a clear indication that its nexus with productivity should be adequately studied to come up with good policy recommendations. The National Bureau of Statistics (NBS, 2017) argued that the reason why these numerous policies did not achieve their objective of improving population health is due to lopsided policies in support of one side of the economy and ignoring the

informal sector with over 70% of the entire population. For instance, the National Health Insurance Scheme (NHIS) covers only the federal government workers neglecting the state and the entire informal sector.

The aim of this study is to identify how health status is a requirement or necessary condition for increases in production or input to production function and its impact on industrial productivity. Additionally, the goal is to assess how a health position can lead to industrial productivity, its challenges and prospect.

2. LITERATURE REVIEW

Not much concentration had been focused in the past on the effect of health status on industrial performance. These problems have begun to receive attention in recent studies, but many researchers did not agree on the connections that occur among the core variables or come to a specific conclusion. For instance, Arthur (2013) examined the impact on health outcomes in sub-Saharan Africa between 1995 and 2011, with the Grossman (1972) health capital model. Fixed effect model was also employed with the Generalized Least Squares Estimator and annual data from 45 countries in sub–Saharan Africa. Results showed that health expenditure is related to an improvement in life expectancy and it plays a part in the reduction in under5 mortality and infant mortality rate in sub–Saharan African countries. In addition, the study also found that advancement in health outcomes contributes to growth in the economy of sub–Saharan African countries. Variables, for example, disease prevalence (Malaria, Tuberculosis and HIV/AIDS), poor access to good water, income and immunization against early diseases contributes to poor health outcomes in the region. In a related study, Kulkarni (2016) applied the panel data regression with a fixed-effects model to determine the disparities in health care systems of emerging economies of BRICS, China, Brazil, India, the Russian Federation and South Africa. Findings showed that there is a positive relationship between health outcome and GDP per capita, out-of-pocket expenditure and adult literacy rate. Positive elasticity exists between age dependency ratio, public health expenditure with infant mortality rate, while female participation rate and environmental pollution have a negative relationship with health outcomes.

Studies have illustrated the link between health and output. Kirsten (2010) examined the nexus between health and productivity in the workplace by providing insight into the current state of workplace health promotion and health management. Chronic disease combined with economic pressure has proven to be a major challenge for both employers and employees. While a global growth trend has been observed in the promotion of workplace health, companies with an active and integrated approach to workplace health remain small. The investigation indicates that the current occupational health services strategy is not enough to solve the existing problems. Improving employee health can only be achieved in a sustainable way if all health-related services in the enterprise are combined. This is an affirmation of the outcome of the study by Ullah, Malik and Hassan (2019) on the role of health status on workers' productivity in Pakistan by

employing Auto-Regressive Distributed Lag (ARDL) with data from 1980 to 2010. Results showed that a 1% improvement in health status leads to a 13.39% increase in workers productivity and a 1% increase in education will increase workers productivity by 0.18%.

In their part, Cole and Neumayer (2006) argued that overall factor productivity (TFP) is an important mechanism by which health affects growth. They first estimated TFP on the basis of production function and then estimate the determinants of TFP, paying specific attention to three health indicators that are particularly problematic in developing regions: malnutrition, malaria and water-borne diseases. They found the effects of poor health on overall productivity to be negative, significant and robust through a wide variety of specifications. Alvi and Ahmed (2014) also investigated the impact of health and education on TFP with panel data from 1990-2010 for 37 developing and developed countries. Applying the two-step approach and Cobb-Douglas production function, determinants of total factor productivity to estimate the indicators of health and education, the random and fixed effects modelling approach was also applied. Findings showed that the indicator of health has a positive, robust and significant impact on TFP. These findings reconfirm the need for improved health of the general populace to ensure sustainable growth and development, especially for the developing world.

In a study by Makute and O'Hare (2015), health expenditure has a significant impact in ameliorating health outcomes in sub–Saharan Africa and increases in the quality of governance improve the general effect of public spending on health outcomes in countries with high-quality management. The evidence is in tandem with Piabuo and Tieguhong (2017) on health expenditure between the countries in the CEMAC sub-region and five other African countries that have attained the Abuja Declaration with data from the World Development Indicators database (2016). Panel Ordinary Least Square (POLS), Fully Modified Ordinary Least Square (FMOLS) and Dynamic Ordinary Least Square (DOLS) were explored for the analysis. Findings support that health expenditure in both samples has a positive and significant impact on economic growth. A change in the unit of health expenditure could increase GDP per capita by 0.38 and 0.3 units for African and CEMAC countries and a significant difference of 0.08 units amidst the two samples. Additionally, long-run relation exists between health expenditure and economic growth for both categories of countries.

In Ghana, Compah-Keyeke, Gyimah and Azinim (2013) examined the relationship between public spending and health status with an under-5 mortality rate as an indicator of health status. Their analysis found income per capita to be a significant determinant of health status. Results further revealed that national health insurance policy is a positive determinant of health status and education is imperative for its enlightenment and sustenance. In another study, Boachie and Ramu (2015) found a declining infant mortality rate to be influenced by public health spending. This was made known in

their study on the impact of public health spending on health status for the period of 1990 – 2012. Their result discloses that public health care expenditure is associated with improvement in health status through the reduction in infant mortality.

In Nigeria, Bakare and Olubokun (2011) inquired into the relationship between health care expenditures and economic growth using the multiple regression of the ordinary least square. Their findings showed a significant and also positive relationship between health care expenditure and economic growth and recommended that the country's policymakers should consistently increase the budget allocated for health annually. Ogundipe and Lawal (2011) also investigated the effect of health expenditure on economic growth with the OLS. They observed a negative impact of total health expenditure on growth contrary to findings of Bakare *et al* (2011). In a similar study, Oni (2014) found that labour force productivity and total health expenditure including gross capital formation are key determinants of economic growth. Furthermore, the life expectancy rate has a negative effect on growth for the period under study.

With the aid of a simultaneous regression model, Obienyi, Yuni, Ojike and Uwajumogu (2018) investigated the effect of health outcomes on labour productivity and their impact on industrial output in Nigeria. Their result showed that health outcome significantly and positively impacts labour productivity and labour productivity significantly impacts industrial output. The result of labour productivity is in line with the findings by Ugwu (2015) which investigated the effect of health capital on labour productivity using the neoclassical growth framework approach and data covering the period 1970-2013. The result indicated that increased health and education expenditure improves the health of labour force which in turn has an effect on labour productivity in the country.

Improvement in health status is in part determined by investment in health such as expenditure. Yaqub, Ojapinwa and Yussuff (2012) studied the effectiveness of public health expenditure by regressing data from public health expenditure on government variables as captured by corruption perception index on an infant, under-5 mortalities and life expectancy using the ordinary least squares and two-stage least squares. Results showed that public health expenditure has a negative effect on infant and under-5 mortalities when indicators of government are included. This is an indication that corruption is a hindrance to the improvement of health status in Nigeria. Another study was investigated by Edeme, Emecheta and Omeje (2017) on the effect of public health expenditure on health outcome as captured by life expectancy and infant mortality. Their result showed that public health and health outcomes have a long-run equilibrium relationship and increased expenditure improves life expectancy and reduces infant mortality rates. On the other hand, Ogunjimi and Adebayo (2018) examined the relationship between health care spending, health outcomes and economic growth in Nigeria from 1981 to 2017 by adopting the Toda-Yamamoto causality framework to ascertain their relationships. The results show a one-way

causality from health expenditure to infant mortality, real GDP to life expectancy and maternal mortality, unidirectional causal relationship from real GDP to health expenditure. The study recommended joint efforts by the government to increase the expenditure on health in accordance with the WHO's recommendation that all countries should fund their health sector with at least 13 per cent of their annual budget. Orji, Ogbuabor, Mba and Anthony-Orji (2021) also found that health expenditure by the government reduces under-5 mortality and HIV prevalence reduces life expectancy and recommends need for government to target expenditure at areas that will enhance health outcomes continuously. Other studies that have also investigated the nexus between health and other variables and found different results include Orji et al (2022), Orji et al (2020), Nwanosike, et al (2015), Orji and Okechukwu (2015), Orji, et al (2014)

Some of these studies are on child health, and government health expenditures which alone may not unravel the country's health position problem because it is left with the weakest level of government based on their corruption perception index. Others could not unmask the issues involved in the rate of diseases or their morbidity level in the country and their nexus with industrial productivity. Studies in this area appear to be leaving gaps and inconclusive and require the attention of expanding the focus to other areas of health in Nigeria. This will serve as a guide to policymakers, government and entrepreneurs on required structural change in health status or conditions for rapid industrial performance.

3. METHODOLOGY

The Model

Following Grossman (1972), Orji, Ogbuabor, Mba and Anthony-Orji (2021) and the modified Solow growth model which incorporates human capital and efficiency theories, then the theoretical models developed for the study emphasizes a functional relationship between health status and industrial productivity.

Grossman's health demand model (1972) foundation is on the theory of human capital that states how an increase in the stock of knowledge or human capital improves productivity in the market economy. By implication, the theory put forward the need to spend on health and education in an economy to improve their outcome which will give rise to increased higher gross national product.

We follow Orji, Ogbuabor, Mba and Anthony-Orji (2021) and specify to achieve the objective of the study as follows:

$Y = f(M, Z)$ ……1

Equation 1 is a health production function, Y represents the health output, M, the vector of health inputs and Z, the vector of exogenous variables.

To estimate the impact of health status on industrial productivity in Nigeria, we, therefore, specify the model as follows:

$INDP = f$ (LEX, MORB, MORT, IMR, LAP, RGDP, LTR,) ……2

Where:

INDP = Industrial productivity **(t**he efficiency in industrial production and the

relationship between output and the amount of factor input used. It measures the yearly index of industrial productivity in the economy).

LEX: Life Expectancy (estimates the average number of additional years that a person of a given age can expect to live given the current mortality and morbidity conditions).

MORB = Morbidity, which is the status of being ill or unhealthy. It is the burden of disease on the individual. (Morbidity rate measures the portion of the population that is unhealthy and expressed in a unit of a thousand individuals).

MORT: Mortality Rate (refers to the incidence of deaths or the number of deaths in the population. Usually expressed as the number of deaths per 1000 persons per year).

IMR: Infant Mortality Rate (this is the death among children before one year of age expressed per 1,000 live births. It considers the impact of socio-economic and environmental factors on the health of mothers and infants, as well as the effectiveness of health systems).

LAP: Labour productivity (this is the productivity from the labour force employed in the industrial sector of the economy).

RGDP: Real Gross Domestic Product **(t**his measures the value of economic output adjusted for price changes).

LITR: Literacy Rate (this represents the rate of people who are able to read and write, productive and is proxy by gross secondary school enrolment ratio)

Econometrically, equation 2 can be specified as follows:

$INDP_t = \beta_0 + \beta_1 LEX_t + \beta_2 MORB_t + \beta_3 MORT_t + \beta_4 IMR_t + \beta_5 LAP_t + \beta_6 RGDP_t + \beta_7 LITR_t + \mu t$……3

Where μt =Stochastic error term (unobserved variables), $\beta_1 - \beta_7$ are parameters of the model to be estimated, t = Time, β_0 is the intercept and β_1 to β_7 are the coefficients of the slope.

3.1 Data and Analytical Method

The study utilized secondary data from 1980 to 2020 sourced from the Central Bank of Nigeria (CBN) statistical bulletin (various years), United Nations (World Population Prospects), World Health Organization (WHO), the World Development Indicators (WDI), National Bureau of Statistics (NBS) data abstract (various years), CIA World Factbook, a Mundi Online Index (MOI).

4. RESULTS AND DISCUSSION

The study employed the Augmented Dickey-Fuller (ADF) (1981) unit root test equation with the hypothesis as follows:

$H_0: \delta = 0$ (Variable has unit root i.e., time series is non-stationary)

$H_1: \delta < 0$ (Variable do not have unit root i.e., time series is stationary)

Decision Rule:

(i) If t^*> ADF critical value in absolute values, reject the null hypothesis

(i) If t^*< ADF critical value in absolute terms, do not reject the null hypothesis.

Table 1. Unit root result for the variables

	ADF			Philip-Perron		
Variable	Level	1st difference	Order of integration	Level	1st difference	Order of integration
IMR	-3.1395***		I(0)	-	-4.8154***	I(0)
INDP	-2.3321	-4.7904**	I(1)	-2.5020	-4.7906*	I(1)
LAP	-1.0629	-1.9103**	I(1)	-0.4048	-1.9139**	I(1)
LEX	-4.0738**	-	I(0)	-4.5097**	-	I(0)
LTR	-2.1027	-7.1307**	I(1)	-2.1447	-7.1307**	I(1)
MORB	-2.0606	-2.8639**	I(1)	-0,4408	-2.9075	I(1)
MORT	-7.5390***	-	I(0)	-3.7409**	-	I(0)
RGDP	3.7489	-3.9299**	I(1)	3.9342	-3.3712**	I(1)

Result and Discussions of Unit Root Test

The result of the study shows that the variables have a mixed order of integration. Infant mortality rate, life expectancy and mortality rate are integrated of order zero, that is (i.e.), I(0), while industrial productivity, labour productivity, literacy rate, morbidity and real gross domestic product are integrated of the first-order one, I(1). This shows that there exists a unit root problem for some variables and hence, the need to perform a co-integration test to ascertain the long-run relationship status of the variables. Since the order of integration is mixed with (I(0) and I(1)), the autoregressive distributed lag bound test procedure prescribed by Shin and Smith (2001) is adopted to examine the existence of long-run equilibrium relationship of the variables and further used to estimate the parameters of the model.

Therefore, a cointegration test (that is a unit root test of the residuals) is required. Cointegration is focused on testing the long-term relationship of variables.

Table 2. ARDL bound test result for industrial productivity

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	21.39064	10%	1.92	2.89
K	7	5%	2.17	3.21
		2.5%	2.43	3.51
		1%	2.73	3.9

Source: Computed by the authors using data for analysis

The result of the bound test demonstrates that there is a long-run relationship between the variables of the estimate. This claim is supported by the value of the F-bound test statistic (21.39) which is greater than the critical values of F* at a 5 per cent significant level both within the I(0) and I(1) bounds. Consequently, the study affirms the prevalence of the long-run relationship among the variables of the estimate, hence, proceeds to estimate the parameters of the model following the ARDL procedure.

Table 3. Short Run Error Correction Regression
D(INDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEX)	2.264473	0.179088	12.64447	0.0000
D(LEX(-1))	-3.660205	0.227419	-16.09452	0.0000
D(MORT)	-1.296118	0.111015	-11.67511	0.0000
D(IMR)	0.035303	0.005959	5.923957	0.0004
D(IMR(-1))	-0.076708	0.006131	-12.51101	0.0000
DLOG(LAP)	-2.979289	0.299378	-9.951582	0.0000
DLOG(RGDP)	3.973851	0.299384	13.27343	0.0000
D(LTR)	-0.130440	0.010142	-12.86127	0.0000
D(LTR(-1))	-0.033600	0.010624	-3.162567	0.0133
CointEq(-1)*	-0.406926	0.071701	-5.675318	0.0007
R-squared	0.969831	Mean dependent var	-0.012967	

Adjusted R-squared	0.952862	S.D. dependent var	0.050757
S.E. of regression	0.011020	Akaike info criterion	-5.894496
Sum squared resid	0.001943	Schwarz criterion	-5.410613
Log-likelihood	86.62845	Hannan-Quinn criter.	-5.755156
Durbin-Watson stat	2.124590		

Source: Computed by the authors using data for analysis

The result in table 3, shows that a negative relationship exists between life expectancy and industrial productivity at the first-lagged period against the prediction of the theory. Though the relationship is statistically significant, the sign of the coefficient contradicts the *a priori* expectation. However, at the current period, the coefficient is correctly signed and significant at a five per cent level. The magnitude of the parameter of life expectancy at the period indicates that one-year addition to life expectancy will cause industrial productivity to improve by 2.26 per cent in the short run within the current period. On the other hand, in the first-period lag, a year increase in life expectancy will surprisingly cause industrial productivity to decline by 3.66 per cent in the short run. This collaborates the findings of Kumar and Kober (2012) as well as Bloom, Canning and Sevilla (2001) on the relationship between life expectancy and total factor productivity.

The result also revealed a negative and statistically significant relationship between mortality rate and industrial productivity at a five per cent level within the short-run period in line with the theoretical prediction. The size of the parameter of mortality rate at the current period suggests that one per cent growth in the number of deaths per 1000 individuals will prompt approximately a 1.30 per cent decline in industrial productivity in the short run. The statistical significance of the variable (mortality rate), shows that its effect on the nation's industrial productivity is essential, thus, has to be given adequate consideration while making decisions concerning industrial productivity.

At the current period, the result shows that infant mortality has a positive and significant effect on industrial productivity in Nigeria. The sign of the parameter of infant mortality of the current period conflicts with the a priori expectation. It demonstrated that rising infant mortality promotes industrial productivity in Nigeria in the short run. However, the correct sign was obtained in the first-period lag which indicated an inverse relationship between infant mortality and industrial productivity at a five per cent significance level. The statistical significance of the variable in both periods within the short run shows the key role it plays in the determination of industrial productivity in Nigeria in the period.

Though the sign of the coefficient of labour productivity indicates a negative relationship with industrial productivity at the current period, statistically significant at a five per cent level. The current period sign and size reveals that growing labour productivity has a plummeting effect on industrial productivity. This shows that despite the essential role of labour productivity in

influencing industrial productivity level in the short run, its current state or degree is insufficient to produce the desired effect. This is however due to the fact that the mechanized system of production is still at its lowest ebb in the country, and the crude means of production currently practiced has not influenced or contributed meaningfully to industrial productivity. Furthermore, the result shows that an improved level of economic growth promotes industrial productivity at the current level in the short run. This validates the theoretical proposition of a positive relationship between economic growth and industrial productivity. The magnitude of the coefficient suggests that a one per cent improvement in the level of economic growth will stimulate about 3.97 per cent growth in industrial productivity within the short-run period. Additionally, the sign of the parameter of literacy rate though statistically significant contradicts the theoretical proposition at the current period as well as the first-period lag. The parameter estimate indicates that improvement in literacy rate in both periods will cause a decline in industrial productivity. Specifically, a unit percentage improvement in literacy rate has a 0.13 and 0.03 per cent decreasing effect on industrial productivity in the current and one-period lag, respectively, in the short run. This may be attributed to the high rate of unemployment which does not give immediate opportunities to a number of literates to contribute positively to the industrial sector of the economy. Additionally, the literacy rate plays a significant role in the level of industrial productivity in the short-run period.

The coefficient of the error correction mechanism shows that the short-run model is well behaved given that it is statistically significant, correctly signed and fractional. This confirms the outcome of the ARDL bound tests which indicated the existence of a long-run relationship among the variables. The size of the coefficient (0.40) portends that the speed of adjustment is relatively slow given that only 40 per cent of the short-run disequilibrium will be corrected in a given period in the long run. The adjusted R-squared of 0.95 shows that the model is a good fit since about 95 per cent of changes in the level of industrial productivity in the short run is caused by changes in the explanatory variables. Thus, the short-run result is stable and reliable for policy formulation and economic forecast.

Table 4. Estimated long-run coefficients of the model

INDP

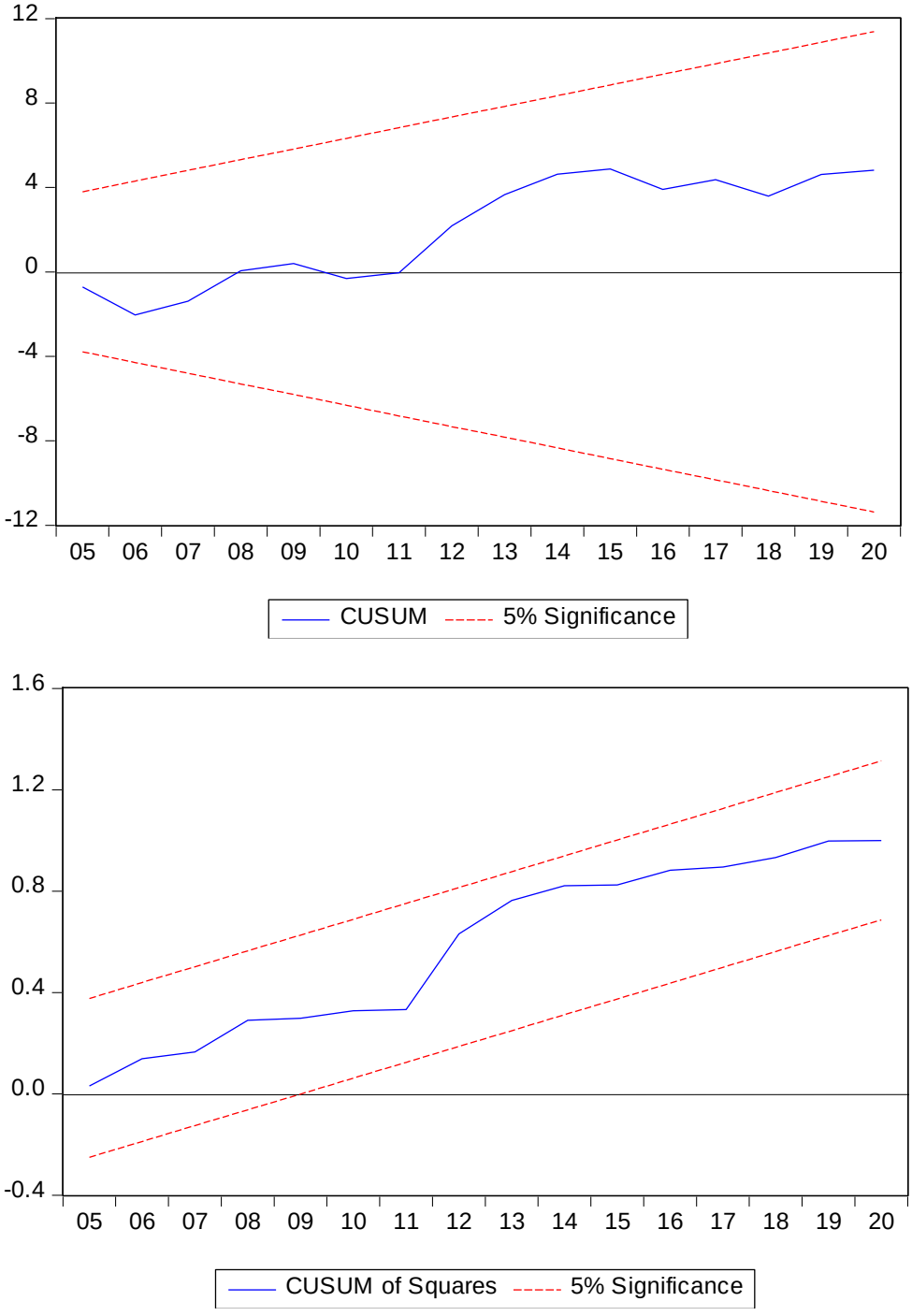
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEX	-0.724080	0.315654	-2.293905	0.0510
MORB	-1.035730	0.400469	-2.586295	0.0323
MORT	-1.174555	0.311362	-3.772311	0.0054
LOG(RGDP)	1.027992	0.885112	1.161427	0.2789
IMR	0.063333	0.012790	4.951808	0.0011

LOG(LAP)	1.105560	0.645033	1.713960	0.1249
LTR	-0.094381	0.050130	-1.882721	0.0965
C	45.92420	21.15807	2.170529	0.0618

The outcome of the long run result in table 4 showed that a negative but significant relationship exists between life expectancy and industrial productivity in the long run. This result is consistent with the findings of the short-run estimation at the first lagged period. It shows that one year of addition to life expectancy will reduce industrial productivity by 0.72 per cent in the long run. This is due to the inability of the ageing workforce to productively engage in the production process which will invariably translate to a reduction in industrial productivity. The long-run relationships between mortality rate, morbidity rate and industrial productivity are negative and statistically significant according to the prescription of economic theories. The magnitude of the coefficients explains that a one per cent increase in mortality rate and morbidity rate will bring about a 1.03 per cent and 1.17 per cent increase reduction in industrial productivity, respectively in the long run. The established long-run relationship between mortality rate and industrial productivity, in the long run, conforms with the outcome of the short-run estimation. Though the long run estimation suggests that economic growth stimulates industrial productivity, its impact is statistically trivial, unlike the short-run effect. The situation may be attributable to inconsistency in the rate of economic growth experienced in the country in recent years. Infant mortality and literacy rate are other explanatory variables that are statistically significant with the coefficients of 0.06 and -0.09, respectively. This signifies that an increase in infant mortality and literacy rate by one per cent will trigger about the growth of 0.06 per cent and a reduction of 0.09 per cent respectively in industrial productivity in the long run. The values of the t-statistic of mortality rate, morbidity rate, infant mortality and literacy rate show that these variables play important role in the determination of the industrial productivity of the country in the long run.

The test of stability indicated in figures 3 shows that the variables of the estimates are stable. This is because of the swing of the trend within the cusum and cusum of square bound of ±5 at five percent significance level. Thus, the model is stable and reliable for policy formulation and economic forecast.

Figure 3: Dynamic Cusum and Cusum of Squares Test



5. CONCLUSION

This research has supplied dependable proof on the effect of health outcomes on industrial productivity in Nigeria for the period 1990 through 2020 with the use of the autoregressive distributed lag (ARD model.

The conclusion, therefore, is that in both short-run and long-run periods, changes in mortality rate, morbidity rate, infant mortality, literacy rate and life expectancy significantly affect the level of industrial productivity in Nigeria. However, in the long run, while economic growth and labour productivity positively affect industrial productivity, their impact on the dependent variable was abysmal. This contradicts the short run significant relationship established between the above-stated explanatory variables. Thus, the 2001 declaration by the African Union agreement that member countries should allocate at least 15 per cent of their budget to the health sector should be implemented. This will assist in health financing rather than relying only on out-of-pocket expenditure and promote the health of the workforce of the economy.

5.1 POLICY RECOMMENDATIONS

Health indicators are found to have a significant impact on industrial productivity in Nigeria. Due to the findings from the result, the following recommendations are made to both in the short and long run. First, there's a need for the government at all levels to subsidize medical services as well as not only increase funding of the health sector but ensure that allocated funds reach the target population through effective monitoring and appraising of the operations of the health sector. This will assist in reducing mortality and morbidity rates and improve industrial productivity.

In addition, reproductive health education should be incorporated into the education curriculum to adequately educate citizens or females of the reproductive age on antenatal and post-natal care measures that will check the rate of infant mortality.

Furthermore, education should be subsidized so as to encourage the less privileged to partake. This, the government can achieve by increasing the sector budget and partnering with the private sector in providing essential entrepreneurial skills that will directly boost productivity. This will invaluably raise the literacy level of the economy and contribute positively and significantly to the industrial productivity in Nigeria.

In conclusion, since productivity growth is synonymous with health, or that health is a prerequisite, sufficient and necessary condition for improved productivity, there should be constant training and re-training of employees on health education through education-driven public-private partnership behaviour change activities that will translate to a productive workforce and increase in industrial productivity.

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