RETHINKING THE DETERMINANTS OF LABOUR PRODUCTIVITY IN NIGERIA: A QUEST FOR LABOUR EFFICIENCY AND LOW COST PER UNIT OF OUTPUT

[1]Odili Okwuchukwu, [2]Chukwuka, Ekene Udoka, [3]Paul Ede Ugwu & [4]Kingsley Onyekachi Onyele

[1,3&4]Department of Banking and Finance, College of Management Sciences, Michael Okpara University of Agriculture, Umudike, PMB, 7267, Umuahia, Abia State, Nigeria.[1]

[2]Department of Industrial Relations and Personnel Management, Michael Okpara University of Agriculture, Umudike, PMB, 7267, Umuahia, Abia state, Nigeria.[2]

Corresponding's 1Email: palmereck@gmail.com , [2]chukwukaekene2012@gmail.com, 3ugwu.paul@mouau.edu.ng & [4]onyelekingsley@mouau.edu.ng

Abstract

This paper examined the determinants of labour productivity in Nigeria over the period 1990 to 2020 by looking at the factors that influence labour output and reduces the cost of production per unit. Determinants of labour productivity were represented by the human capital development index, capital intensity, wage rate, per capita income, globalization index, governance and usage of information and communication technology. The auto-regressive distributed lag (ARDL) model was used for the data estimation and analysis. From the results, it was found that the explanatory variables, human capital development index, capital intensity, wages, globalization index, governance and application of ICT exerted negative effects on labour productivity in the short run, while, per capita income had a positive effect. In the long run, human capital development, capital intensity, per capita income and information and communication technology usage appeared to have the most significant effect on labour productivity in Nigeria. The study recommends that Nigeria should take advantage of globalization to attract foreign resources and knowledge to enhance the efficiency of labour in the country. Consequently, there is a need for trade liberalization that will permit new technology and innovation transfer needed for the upgrade of workers' skills. It further recommends improvement in public administration, institutional reforms and application of appropriate policies and regulations towards promoting and enhancing workers' wages and encourages them to acquire more knowledge through training, seminars and conferences.

Keywords: *Labour, efficiency, productivity, human capital, wages, ICT, governance*

Introduction

Human resource has a strategic role in the productivity increase of any economy, and this makes labour superior in the industrial competition (Razak, Osman, Yusof, Naseri & Ali, 2014). With effective, efficient and optimum uses of labour, all the merits supplied by productivity growth can be obtained. Labour efficiency is the ratio between the actual output produced and the standard output. Labour efficiency relates to labour productivity in that the efficiency of labour determines its output. Labour productivity measures the rate of output per worker in relation to the set

standard or expected output. The increase in interest in the efficiency of labour is motivated by the need to bring down the unit costs of products of firms (Fallahi, Sojoodi & Salannia, 2011). With increasing globalization and expansion of competition in industrial products, labour output more than before has become determining factor in the competitiveness of industries in domestic and foreign markets (Fellahi, Sojoodi & Salannia, 2011). They expressed the fact that high labour ***productivity*** means lower per unit cost and, therefore, the ability of the firm to match prices on the global markets.

Nigeria is well-known for its large population, vast economy, natural resources endowment as well as manpower which explains why it is branded "the giant of Africa" (UNDP, 2019). During the past years, actions aimed at improving the productivity of labour have been included in various national development plans in the country because the ability to harness its rich-resource endowment depends on the efficiency of its labour force. This clearly shows that sustainable economic development over a long-run period cannot be achieved if available labour is not employed in the production process to add value to the natural resources at its disposal. Notwithstanding the level of abundant resources in terms of labour and raw materials, labour productivity has been unsatisfactory, falling below those of some developing countries with smaller resources and a low labour force. To give a glimpse of labour productivity in Nigeria, data sourced from the World Bank (see, globaleconomy.com) shows that the growth rate of labour productivity (GDP-to-labour force ratio) ranged from -3.13% to 3.93% between 1991 and 2001, hit 10.55% in 2002 and persistently declined, reaching negative values from 2013 to 2018. This scenario negates the term "giant of Africa" often used to describe Nigeria. Figure 1 presents the trend of labour productivity in Nigeria (1990-2020).

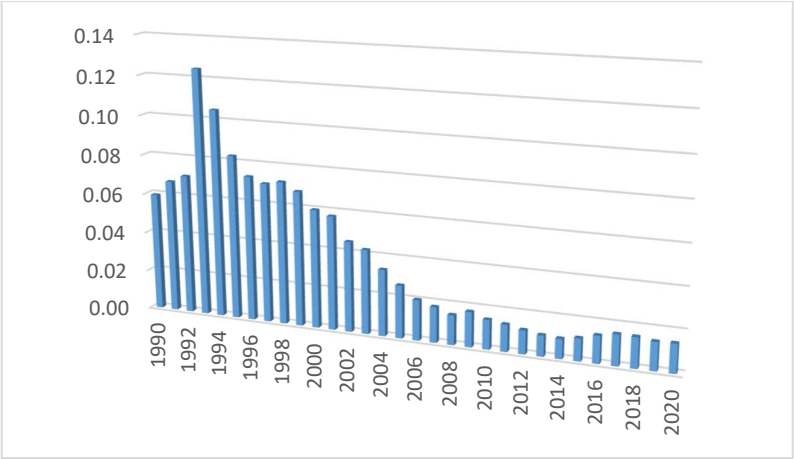

Figure 1: Labour productivity in Nigeria (1990 - 2020)
Source: Authors' computation

The Nigerian labour market has experienced problems ranging from unemployment, downsizing by employers of labour, inconsistent government policies, low employment generation capacity and an imbalance between the demand and supply of labour. As of 2019, it was estimated that the Nigerian labour force was about 62.47 million which qualified it as the largest workforce within the African continent (NBS, 2019). However, a large proportion of Nigeria's labour force appears to have consistently underperformed in terms of productivity of labour. Figure 2 shows that between 2011 and 2019 productivity of labour increased slowly notwithstanding the rapid increase in population and labour force in the country. The slow increase in the productivity of labour could be due to rising unemployment and low labour participation rates. The National Bureau of Statistics (NBS) report shows that out of an average population of 176.73 million people, only 55.25 million constituted the entire labour force out of which 55.12% (about 30.45 million) were economically active between 2010 and 2019. This implies that labour has been underemployed in Nigeria and the productivity of labour is low.

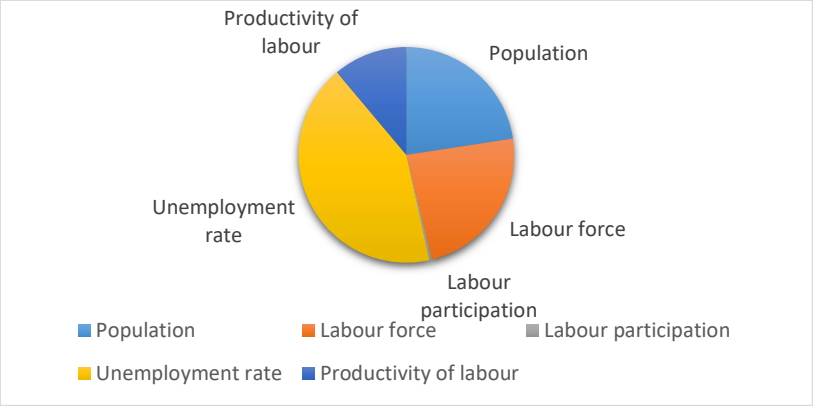

Figure 2: Profile of Nigeria's labour force (2010-2020)
Source: National Bureau of Statistics

The data and projections (see Table 1) reveal a realistic guide and forecast for the unemployment situation and job requirements in Nigeria between 2010 and 2030. Looking at policies aimed at addressing low labour efficiency in Nigeria is rather difficult in light of the rising rate of unemployment as approximately 1.8 million Nigerians enter the labour market each year (NBS, 2019). The initial response of the government was to engage unemployed youths in public programs such as Operation Feed the Nation as well as the Directorate of Food, Road and Rural Infrastructure (DIFRRI) which availed immediate and direct jobs to qualified individuals interested in agribusiness which automatically increased labour productivity in the agricultural sector in the mid-1980s (Falusi, 2014). Afterwards, better-planned and coordinated approaches followed in three major categories, namely; labour demand,

labour supply and labour market interventions. Strategies for labour demand hinged on the creation of immediate jobs via public works in the private sector towards the enhancement of skills as well as entrepreneurship. Strategies for labour supply focused on training and education of potential workforce while the labour intervention strategy was bent on enhancing labour market activities by striking a balance between demand and supply of labour (Falusi, 2014).

Table 1: Projected Nigerian Job Requirements, 2010-2030

Year	Working Age Population	Unemployment rate (%)	Jobs Needed	Between Years	Jobs to be Added
2010	85,525,401	20.00	52,358,719		
2015	97,731,223	15.00	63,570,579	2010-2015	11,211,860
2020	111,088,8501	10.00	76,509,768	2015-2020	12,939,189
2025	125,325,513	8.00	88,233,036	2020-2025	11,723,268
2030	140,036,212	7.00	99,661,452	2025-2030	11,428,415

Source: NBS, 2019

A report from the United Nations Development Programme (UNDP) shows, that labour productivity in Nigeria is lower than that of South Africa and Ghana (UNDP, 2019). This implies that a large proportion of Nigeria's labour force is not fully engaged in economically productive activities, which could account for the persistent increase in unemployment and underemployment in the country. Then, one may ask; what factors are undermining the productivity of labour in a wealthy nation like Nigeria? The answers are not far-fetched. Recently, studies had identified the level of human capital development, availability of capital, ability to acquire and apply technology, the standard of living of employees, state of governance and globalization as critical factors strongly influencing labour efficiency in Nigeria. For instance, human capital development which entails the accumulation of knowledge, skills as well as expertise generates greater labour productivity amidst motivations through the desired wage level (Heshmati & Rashidghalam, 2016; Kaimbo, 2015). Nuttee, Thamma-Apiroam & Santipolvut (2019) averred that the availability of the necessary capital required to facilitate a production process accelerates the productivity of labour. Labour productivity is a function of the standard of living (measured by per capita GDP), as one with insufficient income would lack essential commodities like food, clothing, shelter, health services and even entertainment which are essential to the higher productive capacity of labour (Sengupta, 2017). On the other hand, Mallick (2014) advocated that through globalization, there is enhanced labour productivity through the acquisition and/or spillover effect of

advanced and new information, communication and technology (ICT) systems from developed countries to less developed countries through FDI. It is also stated that there exists greater efficiency in well-governed countries than in countries where governance is poor (Elham, 2020).

Though labour productivity responds to many factors some factors such as working environment, firm policies, payment delay, relaxation allowances, job security, work satisfaction, outdated equipment, etc. are characterized by subjective and non-precise indicators or proxies. Hence, the study used more precise and objective variables such as the human capital development index, capital intensity (total capital-to-labour ratio), average wage rate, per capita income (a measure of standard of living), globalization index, and governance and ICT usage. The paper is organized into five (5) sections. Section one has introduced the study while section two reviews the existing literature on determinants of labour productivity. Section three covers the sources of data, model and methodological approach to the investigation. Section four is devoted to the results and discussion of findings while section five concludes the paper.

Review of related literature

Conceptual reviews

Determinants of Labour Productivity

Due to globalization, there is a rapid achievement of technology diffusion through foreign direct investment (Barrel & Pain, 1997; Barro, 1990). Hence, trade liberalization would trigger foreign competition, improved domestic production and increased capital mobilization as well as the human transfer of modern technology which will encourage efficiency in the process of resource allocation and economic productivity (Mallick, 2014). Furthermore, the classical Ricardian theory stated that differences in technology among countries could lead to comparative advantage. The Hecksher-Ohlin model theorized that comparative advantage could be generated from differences in factor endowments, but both the classical Ricardian and Hecksher-Ohlin models reached a consensus that globalization has a prominent role to play when it comes to the productivity of labour (Lam, 2015).

Also, the neoclassical growth model considered capital mobilization as a crucial factor towards enhancing productivity. Likewise, Awotunde (2018) asserted that greater capital formation could improve and stimulate higher productivity. Similarly, Kang and Na (2018) showed that capital flows to resource-scarce economies can revive the productivity of labour.

From another perspective, Smith emphasized the role of government regulations, policies and institutions in advancing the economic productivity of a country (Smith, 1776). He emphasized that some policies and regulations made by the government

might not drive domestic productivity. Similarly, Barro (1990) stressed that government policies and institutions are seen to play a crucial role in enhancing labour efficiency in the long run.

Barro (1990) stated that the maintenance of the rule of law and improvement in government policies could exert a significant positive influence on economic productivity. Likewise, Khan and Ajmal (2015) affirmed that unsound policies that extend unrestricted authority to the governing elite over the allocation of resources could lead to the unproductivity of labour.

Human Capital and Labour Productivity

Nurudeen and Usman (2010) discovered an inverse relationship between human capital development and labour productivity due to poor financing of the Nigerian education sector. Similarly, Fallahi, Sakineh and Mehin (2010) found that human capital and labour productivity were negatively related due to inadequate and improper training by firms, hence workers could not effectively exhibit the required skills needed to adopt and put modern technology to work. Nevertheless, it might take a long term for human capital development to positively influence labour productivity which could be a plausible reason for the contradictory results obtained in some prior empirical studies. Also, in the short-term, training could meet other purposes like career prospects, salary and even working position rather than labour productivity.

Theoretical Framework

Endogenous Growth Model (EGM)

Theoretically, the EGM postulates that through adequate investments in human capital, infrastructures and research & development sustainable economic productivity will be achieved without relying on exogenous factors (Romer, 1990). Many empirical studies share the view of the EGM (Nuttee, Thamma-Apiroam & Santipolvut, 2019; Awotunde, 2018; Heshmati & Rashidghalam, 2016; Micallef, 2016).

Efficiency of Wages Theory

Another strand of theory explaining the determinants of labour productivity is the efficiency wages theory which avers that a higher wage rate would accelerate the opportunity cost of job loss and automatically would motivate workers to enhance productivity (Kumar, Webber & Perry, 2009; Gordon, 1997). In this light, myriads of empirical studies found a significant relationship between wages and the productivity of labour (Elham, 2020; Onwuchekwa & Ohachosim, 2017). On the other hand, Powell, Montgomery & Cosgrove (1994); Krueger & Summers (1987) found that a higher wage rate that is greater than the market clearance level is unlikely to achieve the desired level of labour productivity. Under perfect

competition, the classical economic theory ascertained that wages are paid according to the marginal productivity of labour. However, following the 2008 financial crisis, both demands for labour and employment levels declined, which automatically made people desire to retain their jobs and improve productivity even with lower wage rates (Romei, 2017; Trpeski, Eftimov & Cvetanoska, 2016).

Empirical Review

Studies have been found in the banking sector which provides the branch level analysis by using the data envelopment analysis (DEA) technique (Paradi & Zhu, 2013). Analysis by Das *et. al.* (2009) identifies bank branches that operate at very low levels of labour-use efficiency and possible candidates for increased supervision and control.

Mačiulytė-Šniukienė and Gaile-Sarkane (2014) have evaluated the impact of the development of ICT on labour productivity in EU-27 states using the data from 2000 to 2011. Whether or not productivity and labour efficiency increase as a result of IT investment has been the subject of considerable debate (Badescu and Garcés-Ayerbe, 2009). If an innovative enterprise adopts more and more capital-intensive techniques, it might experience growth of only sales turnover and investment but not employment.

Also, Tsoku & Matarise (2014) found that wages and labour productivity are positively related in the short run but strongly dependent on the capital/labour ratio in the long run. Wage rates might affect productivity because a better-paid labour force is likely to be happier and to work more effectively (Opsahl & Dunnette, 1970). Employee satisfaction with pay and promotion may be expected to increase quality, productivity and hence customer satisfaction.

Methodology

In this paper, secondary data were used. The time series data cover a period of 31 years, from 1990 to 2020. The data were obtained from World Development Indicators (WDI) and the International Labour Organization Statistics (ILOSTAT) database. This paper followed the methodological approach used by Elham (2020) to analyze determinants of labour productivity. The model applied by Elham (2020) was based on the Cobb-Douglas production function as denoted by equation (1):

$$Y = f(K, L) \qquad (1)$$

Where,

Y = total domestic output; K = amount of capital; and L = labour

Using equation 1 to derive the function for the productivity of labour, both sides of the equation were divided by "L" to give equation (2):

$$Y/L = f(K/L, L/L) = f(K/L) \qquad (2)$$

Hence, the productivity of labour (Y/L) is the value of output (measured by real GDP) produced per worker. Hence, equation 2 implies that the productivity of labour (Y/L) is a function of capital intensity per labour (K/L). The model for this study was developed by looking at the factors that influence labour productivity. The function presented in equation (2) is thus stated in equation (3):

$$LBP = F(HCI, CAP, AWR, LNPCI, GLB, GOV\ and\ ICT) \qquad (3)$$

Where, LBP = labour productivity ($^{Y}/_{L}$); HCI = human capital development index; CAP = capital intensity $\left(^{K}/_{L}\right)$; AWR = Average wage rate; LNPCI = Natural logarithm of GDP per capita; GLB = Globalization index; GOV = Governance; ICT = Information and communication technology usage.

The econometric form of equation (3) was denoted by equation (4):

$$LBP_t = \beta_0 + \beta_1 HCI_t + \beta_2 CAP_t + \beta_3 AWR_t + \beta_4 LNPCI_t + \beta_5 GLB_t + \beta_6 GOV_t + \beta_7 ICT_7 + \mu_t \qquad (4)$$

Where,
β_0 = denotes the constant, β_1 - β_7 = coefficients of the explanatory variables, and μ_t = Error term

3.1 Variables Description

Table 3.1: Description of variables and sources of data

Variable	Description	Source of Data
Labour efficiency (LBE)	Labour productivity is a measure of real economic output per labour. It entails the value of output per worker.	World Development Indicator (WDI)
Human capital development index (HCI)	HCI represents a composite index that measures average achievements in three aspects of human development - a healthy life, knowledge and a decent standard of living which are essential to greater productivity of labour.	World Development Indicator (WDI)
Capital intensity (CAP)	Capital intensity refers to the amount of available fixed or real capital in relation to labour. A higher ratio entails availability for productivity.	World Development Indicator (WDI)
Average wage	Labour productivity to a large depends on wages paid to workers. A worker who receives sufficiently high wages will ensure	International

rate (AWR)	an adequate standard of living and would be more productive.	Labour Organization (ILO), ILOSTAT database.
Per capita income (PCI)	PCI is a variable that measures the standard of living of a country. It is measured as the GDP-to-total population ratio.	World Development Indicator (WDI)
Globalization Index (GLB)	The globalization index covers aspects of economic, social, and political globalization. Higher values denote greater globalization. With globalization, there is the ease in transferring resources from resource-abundant countries to resource-scarce countries.	World Development Indicator (WDI)
Governance (GOV)	Governance was measured by the civil liberty index which evaluates freedom of expression and belief, associational and organizational rights, rule of law, as well as personal autonomy and individual rights. The rating ranges from 1 (strong liberties) to 7 (no liberties).	The global economy database: https://www.theglobaleconomy.com/ Nigeria/civil_liberties/
Information & communication technology (ICT)	ICT was measured by growth in the number of internet users. Internet users refer to individuals who use internet facilities in Nigeria.	The global economy database: https://www.theglobaleconomy.com/ Nigeria/Internet_users/

Source: Authors compilation

Analytical Technique

The Autoregressive Distributed Lag (ARDL) method was applied to test the cointegration. By including sufficient lags, the ARDL model captured the data-generating process in general to a specific framework and assimilates the short-run dynamics using the error correction model (ECM) without losing the long-run details. The dynamic ARDL model based on Pesaran, Shin & Smith (2001) is as specified in equation 5:

$$\Delta LBP_t = \delta_o + \sum_{i=1}^{p} \delta_1 \Delta LBP_{t-i} + \sum_{i=1}^{p} \delta_1 \Delta HCI_{t-i} + \sum_{i=0}^{p} \delta_2 \Delta CAP_{t-i} + \sum_{i=0}^{p} \delta_3 \Delta AWR_{t-i} + \sum_{i=0}^{p} \delta_4 \Delta LNPCI_{t-i} + \sum_{i=0}^{p} \delta_5 \Delta GLB_{t-i} + \sum_{i=0}^{p} \delta_6 \Delta GOV_{t-i} + \sum_{i=0}^{p} \delta_7 \Delta ICT_{t-i} + \beta_1 LBP_{t-1} + \beta_2 HCI_{t-1} + \beta_3 CAP_{t-1} + \beta_4 AWR_{t-1} + \beta_5 LNPCI_{t-1} + \beta_6 GLB_{t-1} + \beta_7 GOV_{t-1} + \beta_8 ICT_{t-1} + \mu_t \quad (5)$$

Once cointegration is established, the short-run dynamic parameters are obtained and allied with long-run estimates by estimating an ECM of the form:

$$\Delta LBP_t = \delta_o + \sum_{i=1}^{p} \delta_1 \Delta LBP_{t-i} + \sum_{i=0}^{p} \delta_2 \Delta HCI_{t-i} + \sum_{i=0}^{p} \delta_3 \Delta CAP_{t-i} + \sum_{i=0}^{p} \delta_4 \Delta AWR_{t-i} + \sum_{i=0}^{p} \delta_5 \Delta LNPCI_{t-i} + \sum_{i=0}^{p} \delta_5 \Delta GLB_{t-i} + \sum_{i=0}^{p} \delta_6 \Delta GOV_{t-i} + \sum_{i=0}^{p} \delta_7 \Delta ICT_{t-i} + \theta ecm_{t-i} \quad (6)$$

Where δ indicates the short-run dynamics, θ represents the parameter for speed adjustment and $t-1$ is the one-period-lagged error correction model/term. A change in the dependent variable does not depend on past errors if this coefficient is insignificant. The coefficient of θ ranges from -1 to 0, where 0 implies no convergence toward equilibrium and -1 implies perfect convergence. That is, any shock is perfectly adjusted in the next period if the value is -1. All the other things were already defined earlier.

Before the ARDL estimation, the data were tested for stationarity using the Augmented Dickey-Fuller (ADF) and Philip_Perron (PP) techniques of unit root testing (Dickey & Fuller, 1979; Phillips & Perron, 1988). This very stage is crucial because most time series data contain unit root and any regression analysis involving such data will likely yield spurious output. The general model for the ADF test is represented by equation (7):

$$\Delta y_t = \beta_0 + \beta_1 t + \beta \lambda y_{t-1} + \sum_{j-1}^{p} \delta_j \Delta y_{t-j} + \mu_t \quad (7)$$

Where,
y_{t-1} = lagged value of y_t at first difference
Δy_{t-j} = change in lagged value
δ = lag length
Δy_t = First difference of y_t
μ_t = error term

Results and Discussions
Diagnostic Test
Stationary Tests
This study investigated the time series properties of the data using the Augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) tests to ascertain the order of

integration of the series. The results of the ADF and PP tests are presented in Table 4.1:

The following hypotheses were tested for the ADF and PP unit root tests:
$\boldsymbol{H_o}$**:** Presence of unit root
H_{01} Unit root does not exist

Table 2: ADF unit root test results

	Augmented Dickey-Fuller (ADF)		Phillip-Perron (ADF)		Order of
Variables	Level	First diff.	Level	First diff.	integration
LBP	-2.6778{0.2519}	-5.8002{0.0003}	-2.7045{0.2419}	-6.0992{0.0001}	I(1)
HCI	-1.6671{0.4371}	-2.4878{0.0148}	-2.3901{0.3762}	-4.5451{0.0059}	I(1)
CAP	-4.1847{0.0156}	--	-4.9550{0.0021}	--	I(0)
AWR	-2.6181{0.2757}	-3.9956{0.0203}	-2.7940{0.2101}	-3.9956{0.0203}	I(1)
LNPCI	-2.2870{0.4278}	-4.7466{0.0078}	-2.4473{0.3438}	-4.7304{0.0037}	I(1)
GLB	-0.2832{0.9873}	-6.0205{0.0002}	-0.7887{0.9556}	-6.0038{0.0002}	I(1)
GOV	-2.9974{0.1494}	-3.4988{0.0159}	-2.8801{0.1825}	-8.0572{0.0000}	I(1)
ICT	-1.0160{0.9998}	-7.5366{0.0011}	-1.5203{0.4839}	-7.4706{0.0000}	I(1)

Source: Authors' computation

Table 4.1 showed that the variables are of both I(0) and I(1) and none was identified to be of I(2). Using the ADF and PP unit root tests, the p-values of LBP, HCI, CAP, AWR, LNPCI, GLB, GOV and ICT were found to be integrated of order I(1) while CAP turned out to be integrated of order I(0). Following the variables' mixed order of integration, the ARDL approach was preferred for the estimation.

VAR Lag Order Selection Criteria

The VAR order selection criteria were used in selecting the best lag interval. The option has a vector containing the selected lags from the different criteria. The AIC (Akaike information criteria) which has the lowest value of the lag selection criteria was selected. Consequently, the selected lag period is 2, which is the best fit as shown in Table 3:

Table 3: Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-150.4423	NA	7.69e-06	10.92705	11.30424	11.04518
1	53.09340	280.7389	6.03e-10	1.303903	4.698569	2.367070
2	220.7602	138.7587*	1.57e-12*	-5.845529*	0.566617*	-3.837325*

Source: Authors' Computation

Note: * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion.

Hypotheses Test

ARDL Estimation

The approach developed by Pesaran, Shin & Smith (2001) was used for the bounds test (cointegration or long-run relationship). Table 4 shows the outcome of the bounds test applied to the estimated equation to check for cointegration among the model variables. The null hypothesis of the absence of cointegration was rejected at both 1% and 5% levels, where the F-Statistic value 10.066 was observed to be greater than I(1) bounds at both 1% and 5% levels.

Table 4: Bounds Test Results

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	16.06648	5%	2.17	3.21
k	7	1%	2.73	3.9

Source: Authors' Computation

The long-run estimates of the ARDL model were presented in Table 5:

Table 5: Long-run estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HCI	-0.245635	0.089080	-2.757469	0.0202
CAP	-0.018081	0.007686	-2.352352	0.0405
AWR	-0.002008	0.004019	-0.499575	0.6282
LNPCI	0.018239	0.008129	2.243573	0.0487
GLB	-0.005477	0.003007	-1.821743	0.0985
GOV	-0.001145	0.010430	-0.109792	0.9147
ICT	-0.003505	0.001183	-2.963174	0.0142
C	0.374104	0.206425	1.812303	0.1000

Source: Authors' computation

The long-run estimated coefficients show that labour productivity (LBP) was hindered by the level of HCI, CAP, AWR, GLB, GOV and ICT while LNPCI was found to cause an increase in LBP. The coefficient of HCI implies that LBP decreased by 0.245635 due to the status of human capital in Nigeria which could be attributed to the poor state of the education and health sectors of Nigeria occasioned by insufficient budgetary allocation (Umoru & Yaqub, 2013). The negative coefficient of CAP indicates that LBP decreased by 0.018081 due to the level of capital intensity probably due to poor capital allocation or low capital mobilization occasioned by the vagaries of macroeconomic fundamentals (Elham, 2020). The estimated coefficient of AWR, which turned out negative, shows that the rate of change in the average wage rate caused LBP to decline by 0.002008 which could imply that the wage rate in Nigeria has not been encouraging labour productivity. The LNPCI emerged with a positive coefficient which implied that labour

productivity would maintain an upward trend up to 0.018239 as long as per capita income is increasing, indicating that a better standard of living triggers higher productivity of labour. The negative coefficient of globalization (GLB) is indicative of the fact that LBP decreased by 0.005477 with a higher globalization wave, implying that the unproductivity of labour in Nigeria could be due to brain drain as workers have continued to leave the shores of Nigeria for overseas for better working conditions. Governance (GOV), on its own, turned out negative, showing that labour productivity was reduced by 0.001145 amidst bad governance as experienced in Nigeria over the years. Regarding ICT, it was found that labour productivity declined by 0.003505 due to the number of people using information and communication technology, indicating that low ICT usage makes labour unproductive.

Among the determinants of labour productivity highlighted in this study, it was found that HCI, CAP, LNPCI and ICT were the most significant determinants in the long run. The summary of hypotheses testing has been done in Table 6 based on the following decision rule:

A variable is adjudged significant if its probability value is less than 0.05. A variable is considered insignificant if its probability value is greater than 0.05.

Table 6: Summary of hypothesis testing

Variable	Null hypothesis	Probability	Decision
HCI	Human capital development has no significant effect on labour productivity	0.0202 < 0.05	Significant
CAP	Capital intensity has no significant effect on labour productivity	0.0405 < 0.05	Significant
AWR	The average wage rate has no significant effect on labour productivity	0.6282 > 0.05	Insignificant
LNPCI	Per capita income has no significant effect on labour productivity	0.0487 < 0.05	Significant
GLB	Globalization has no significant effect on labour productivity	0.0985 > 0.05	Insignificant
GOV	Governance has no significant effect on labour productivity	0.9147 > 0.05	Insignificant
ICT	Information and communication technology has no significant effect on labour productivity	0.0142 < 0.05	Significant

Source: Compiled by authors

Having ascertained the long-run relationship among the variables, the study proceeded to estimate the error correction mechanism (ECM) and the short-run dynamics. The estimated coefficient of the ECM (-0.565857) is negative and statistically significant at a 1% level. ECM is one period-lagged error correction

model/term. The coefficient of ECM shows a relatively fast convergence of the variables to the equilibrium. The value of the ECM implies that approximately 57% of the disequilibrium in the system was adjusted each year. Thus, it takes about 1.77 years (i.e. 1/ECM) for the LBP model to reach its long-run equilibrium which justifies the lag length of two (2) selected for the study.

Table 7: Error Correction Mechanism

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LBP(-1))	-0.730503	0.065673	-11.12326	0.0000
D(HCI)	-0.013960	0.019015	-0.734141	0.4797
D(HCI(-1))	0.102644	0.033951	3.023303	0.0128
D(CAP)	0.023817	0.001808	13.17617	0.0000
D(AWR)	-0.004154	0.001079	-3.848727	0.0032
D(LNPCI)	0.012008	0.002568	4.676231	0.0009
D(GLB)	0.013356	0.000739	18.07743	0.0000
D(GOV)	0.009663	0.001566	6.171618	0.0001
D(ICT)	-0.000949	0.000141	-6.708441	0.0001
D(ICT(-1))	-0.004657	0.000283	-16.44112	0.0000
ECM(-1)	-0.565857	0.035074	-16.13310	0.0000
R-squared	0.959571			
Adjusted R-squared	0.937110			
Durbin-Watson stat	2.508212			

Source: Authors' computation

Apart from LNPCI and ICT, the short-run coefficients of other variables' coefficients turned out different from the signs observed in the long run. This shows that the determinants of labour productivity have time-varying effects. The time-varying effects imply that the independent variables do not affect the dynamics of labour productivity at the same time but they differ from time to time.

Stability Diagnostic Test

The stability diagnostic tests of the ARDL model are presented in Table 4.7:

Table 8: Stability Diagnostic Tests of the ARDL Model

Test	F-statistic	P-value
Serial correlation LM test	4.661533	0.1167
Heteroskedasticity test: Breush-Pagan-Godfrey	0.503460	0.9015
Jarque-Bera normality test	1.561932	0.4579

Source: Authors' computation

Table 8 indicates the stability diagnostic test results. The values of the F-statistic and their corresponding p-value of the serial correlation LM test show that the null hypothesis of no serial correlation cannot be rejected, meaning that the ARDL model has no problem with serial correlation. The Heteroskedasticity test (Breush-Pagan-Godfrey) shows that the model does not suffer from Heteroskedasticity as the p-value of the F-Statistic was more than 5%, implying that the null hypothesis of no Heteroskedasticity cannot be rejected. Similarly, the result of the Jarque-Bera normality test indicates that the null hypothesis of normality cannot be rejected. Other than the above-mentioned tests, the CUSUM and QUSUMSQ techniques have also been applied based on the ECM model which was estimated. The following Figure 3 reveals that both the series are lying inside their critical bounds at a 5% significance level. This verifies the stability of the ECM model with respect to all involved variables and also indicates that there are no structural breakpoints in the estimated model.

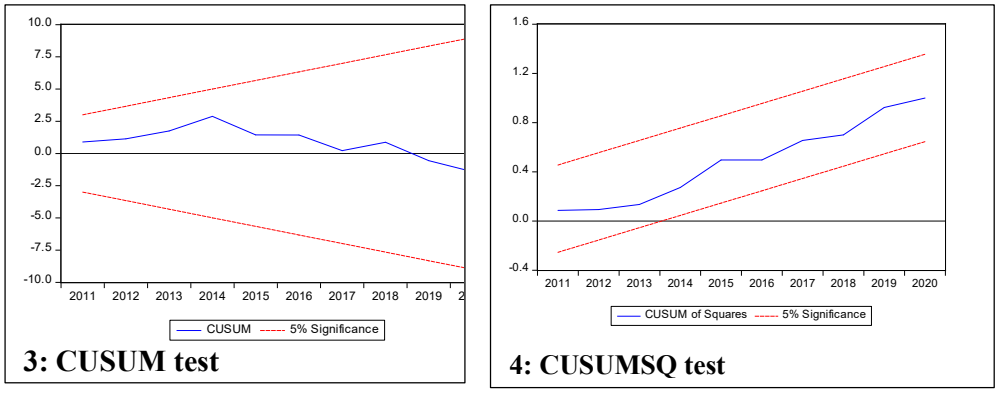

Figure 3: CUSUM test

Conclusion and Recommendations

Achieving sustainable productivity of labour has long been regarded as a cornerstone for economic growth and development in every nation. However, the productivity of labour has historically been low in Nigeria due to the lack of human capital development index, poor governance, poor standard of living and low wages. This study applied the auto-regressive distributed lag (ARDL) model to investigate the determinants of labour productivity in Nigeria. Results showed that the productivity of labour was more responsive to human capital development, capital intensity, per capita income and information and communication technology usage in the long run. However, labour productivity was positively affected by per capita income but negatively affected by human capital index, capital intensity, wage rate, globalization, governance and information and communication technology in the long run. From the short-run estimation, it was found that the coefficients of LNPCI

and ICT remained as observed in the long-run but all other coefficients changed, implying that the observed determinants of labour productivity varied with time. Based on the results, this paper concludes that the explanatory variables used in this study, especially human capital development, capital intensity, per capita income and information and communication technology usage are significant long-run determinants of labour productivity in Nigeria. The findings from the analysis could be used for the betterment of labour productivity in Nigeria based on the following recommendations:

1) Nigeria must build capacity through investments in human capital by ensuring that the labour force is well-educated and trained to enhance labour efficiency which would further boost the overall economy.
2) There is a need to ensure adequate capital mobilization which would trigger higher labour productivity. Hence, it is recommended that the government build capacity towards ensuring sufficient capital accumulation through a public-private partnership.
3) Also, policymakers should aim at developing policies that would ensure that wages paid to workers are commensurate with the work done as this would encourage workers to do better. This may imply an upward review of the minimum wage of ₦30,000 currently paid by the Nigerian government.
4) With the negative response of labour productivity to low per capita income, there is a need to ensure equitable distribution of productive resources that would engage the Nigerian population in economically productive activities.
5) Nigeria should take advantage of the current globalization waves to attract foreign resources and knowledge to enhance labour productivity in the country as well as compete in the international labour market. Consequently, there is a need for trade liberalization that will permit new technology and innovation transfer needed for the upgrade of workers' skills.
6) There should be improvements in public administration, institutional reforms and application of appropriate policies and regulations towards promoting and enhancing national productivity of labour, as well as to ensure that all resources are efficiently and effectively employed in pursuit of this objective.
7) To facilitate high labour productivity, there is a need to make available adequate and modern technology and also to educate the labour force on how to apply such technology and innovations in ICT and other areas of productivity.

References

Awotunde, I. (2018). Capital accumulation and labour productivity growth in Nigeria. *International Journal of Economics and Financial Research, 4*(6), 171-179.

Badescu, M. & Garcés-Ayerbe, C. (2009). The impact of information technologies on firm productivity: empirical evidence from Spain. *Technovation*, *29*(2), 122-129.

Barrel, R. & Pain, N. (1997). Foreign direct investments, technological change and economic growth within Europe, *Economic Journal*, *107*(3), 243-265.

Barro, R. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, *98*(2), 103-125.

Das, A., Ray, S. C. & Nag, A. (2009). Labor-use efficiency in Indian banking: a branch-level analysis. *Omega*, *37*(2), 411-425.

Dickey, D. A. & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of American Statistical Association, 74*(1), 427-431.

Elham, M. Y. (2020). The determinants of labor productivity in Jordan during the period 1980-2017. *International Journal of Business and Economics Research*, *9*(1), 21-28.

Fallahi, F., Sakineh, S. & Mehin, A. N. (2010). Determinants of labor productivity in Iran's manufacturing firms: with emphasis on labor education and training. *MPRA Paper*, 27447, University Library of Munich, Germany. https://mpra.ub.unimuenchen. de/27447/1/MPRA_paper_27447.pdf.

Falhahi, F., Sojoodi, S. & Aslaninia, N.M (2011). Determinants of labour productivity in Iran's manufacturing firms: with emphasis on labour education and farming, paper presented at International Conference on Applied Economics (ICOAE), 169-178.

Falusi, A. O. (2014). Employment generation for poverty reduction in Nigeria: issues for consideration. Presented at the 21st Celebration of the Development Policy Centre in Memory of Professor Ojetunji Aboyade, 9th September.

Gordon, R. J. (1997). Productivity, wages and price inside and outside of manufacturing in the U.S., Japan, and Europe. *National Bureau of Economic Research Working Paper*, 2070, 1-73. https://www.nber.org/papers/w2070.

Heshmati, A. & Rashidghalam, M. (2016). Labour productivity in Kenyan manufacturing and service industries, IZA Discussion Papers, No. 9923, Institute for the Study of Labor (IZA), Bonn.

Johansen, S. & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with application to demand for money. *Oxford Bulletin of Economics and Statistics*, *52*(3), 169-210.

Kaimbo, N. (2015). Determinants of labour productivity in Zambia's manufacturing firms. Published Thesis, University of Zambia.

Kang, Y. & Na, K. (2018). Determinants of labor productivity in emerging markets: evidence from pre- and post-financial crisis Mexico. *Gadjah Mada International Journal of Business, 20*(3), 259-276.

Khan, A. & Ajmal, S. (2015). Role of management in motivating labor to improve labor productivity. *Journal of Advanced Management Science, 3*(3), 179-185.

Krueger, A. B. & Summers, L. H. (1987). Reflections on the inter-industry wage structure. *NBER Working Paper*, 48-81. Retrieved from: https://www.nber.org/papers/w1968

Kumar, S., Webber, D. J. & Perry, G. (2009). Real wages, inflation and labour productivity in Australia. Department of Business Economics, Auckland University of Technology, New Zealand, 1-15.
https://mpra.ub.unimuenchen.de/19293/1/MPRA_paper_19293.pdf.

Lam, T. D. (2015). A review of modern international trade theories. *American Journal of Economics, Finance and Management*, *1*(6), 604-614.

Mačiulytė-Šniukienė, A. & Gaile-Sarkane, E. (2014) 'Impact of information and telecommunication technologies development on labour productivity', *Procedia – Social and Behavioral Sciences*, *110*, 1271-1282.

Mallick, J. (2014). *Globalization and Labour productivity in OECD regions.* Faculty of Economics and Administration, University of Pardubice.

Micallef, B. (2016). Determinants of labour productivity in Malta: evidence from a firm-level survey, *Economics and Sociology*, *9*(4), 27-40. Retrieved from: DOI:10.14254/2071-789X.2016/9-4/2

National Bureau of Statistics (2019). Labour force statistics: unemployment and underemployment reports, *1*, 1-76.

Nurudeen, A., & Usman, A. (2010). Government expenditure and economic growth in Nigeria: 1970-2008: a disaggregated analysis. *Business and Economic Journal, 4*(2), 1-11.

Nuttee, S., Thamma-Apiroam, R. & Santipolvut, S. (2019). Determinants of labor productivity in Northeast Thailand. *Journal of Applied Economic Sciences, 14*(1), 252-268.

Onwuchekwa, F. C. & Ohachosim, C. I. (2017). Determinants of labour efficiency in Nigeria: a cross company study of manufacturing firms. *Research Journal of Finance and Accounting, 8*(23), 30-35.

Opsahl, R. L. & Dunnette, M. D. (1970). The role of financial compensation in industrial motivation. *Management and Motivation*, Kingsport Press Inc.

Paradi, J. C. & Zhu, H. (2013). A survey on bank branch efficiency and performance research with data envelopment analysis. *Omega*, *41*(1), 61-79.

Pesaran, M., Shin, Y. & Smith, R. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289-326. https://doi.org/10.1002/jae.616

Phillips, P. C. B. & Perron, P. (1988). Testing for a Unit Root in Time Series Regression. *Biometrika, 75*(2), 335 -346.

Powell, I., Montgomery, M. & Cosgrove, J. (1994). Compensation structure and establishment quit and fire rates. *Industrial Relations: A Journal of Economy and Society*, *33*(2), 229-248.

Razak, M., Osman, I., Yusof, M., Naseri, R. & Ali, M. (2014). Factors affecting labor productivity in Malaysia: an overview. *International Journal of Economics, Commerce and Management, 2*(10), 1-13.

Romei, V. (2017). How wages fell in the UK while the economy grew. Financial Times. https://www.ft.com/content/83e7e87e-fe64-11e6-96f8-3700c5664d30?mhq5j=e2.

Romer, P. M. (1990). Endogenous technological change. *Journal of Political Economy,* 9(8), 71-102.

Sengupta, K. (2017). Health and its impact on labour productivity and labour market. *International Journal of Health and Medicine, 2*(1), 13-16.

Smith, A. (1776). *The wealth of nations*. Great Britain: United Kingdom: Edward Elgar Publishing Limited.

Trpeski, P., Eftimov, L. & Cvetanoska, M. (2016). Labor productivity and real wages in Macedonia: an overview before and after the global economic crisis. *European Scientific Journal*, *12*(10), 1-14.

Tsoku, J. T. & Matarise, F. (2014). An analysis of the relationship between remuneration (real wage) and labour productivity in South Africa. *Journal of Educational and Social Research*, *4*(6), 1-10.

UNDP (2019). Inequalities in human development in the 21st century. *Briefing note for countries on the 2019 Human Development Report.*

Umoru, D. & Yaqub, J. (2013). Labour productivity and health capital in Nigeria: the empirical evidence. *International Journal of Humanities and Social Science, 3*(4), 199-221