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DETERMINANTS OF LABOUR PRODUCTIVITY IN NIGERIA

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Abstract

This study examined the determinants of labor productivity proxied with human capital development index, capital intensity, wage rate, per capita income, globalization index, governance and usage of information and communication technology. Thus, empirical model is estimated using Vector Auto Regressive (VAR) technique. The study spans from 1990 to 2018. The findings show that human capital development index, capital intensity, wages, per capita income, globalization index, governance and application of ICT collectively influenced productivity of labour. The VAR estimates showed that human capital development index, capital intensity, wages, globalization index and governance had positive effect on labour productivity while per capita income and ICT usage had negative effects on labour productivity. This study therefore, recommends that Nigeria should take advantage of the 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 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 national productivity of labour, as well as ensuring accountability of public funds.

Key words: *Labour, productivity, human capital, wages, ICT, governance*

Introduction

Labour productivity refers to the output value each person creates from a given input in the production process. In other words, labour productivity is monetary value contributed per worker to the total economic output. 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). Hence, with her large labour force and natural resource endowment, a country like Nigeria is expected to have greater productivity than the less resource endowed countries. During the past years, actions aimed at improving the productivity of labour have been included in various national development plans in the country due to the fact that the ability to harness its rich-resource endowment depends on the capacity of its labour force. This clearly shows that sustainable economic development over a long-run period of time cannot be achieved if available labour is not employed in the production process to add value to the natural resources at its disposal. Human resource has a strategic role for productivity increase of any economy, and this makes labour superior in the industrial competition (Razak, Osman, Yusof, Naseri & Ali, 2014).

With the effective and optimum uses of labour, all the merits supplied by the productivity growth can be obtained. Unfortunately, the Nigerian situation is miles away from what is expected. Notwithstanding the level of abundant resources in terms of labour and raw materials, labour productivity have been unsatisfactory, falling below those of some developing countries with smaller resources and 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. In fact, this scenario negates the term "giant of Africa" often used to describe Nigeria. Figure 1 below presents the growth rate of labour productivity in Nigeria (1991-2018).

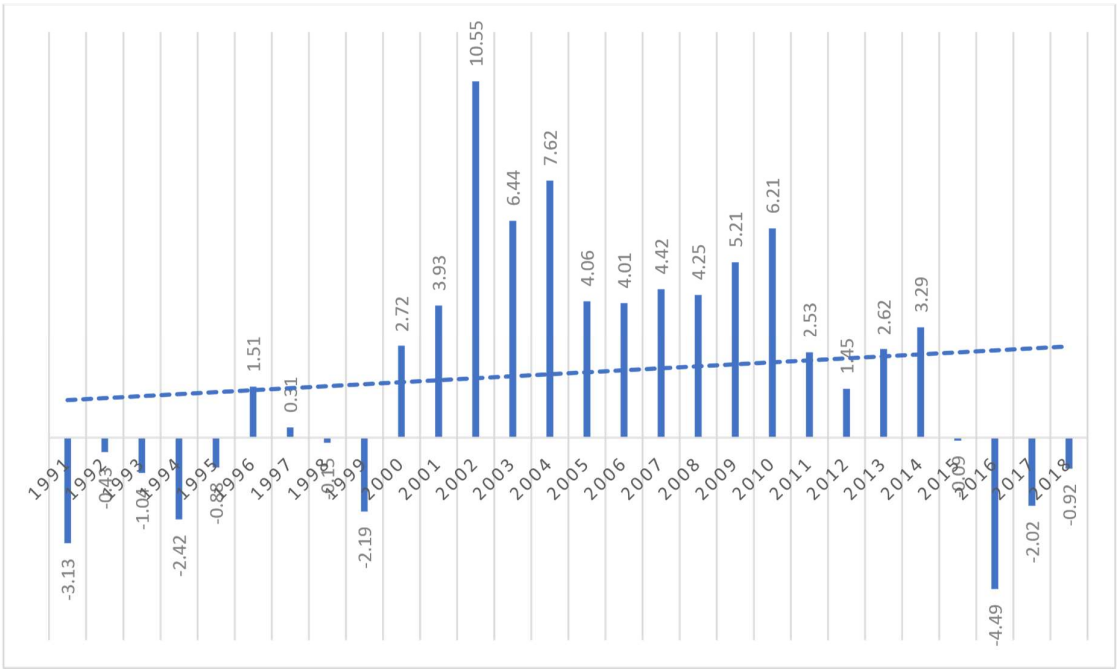


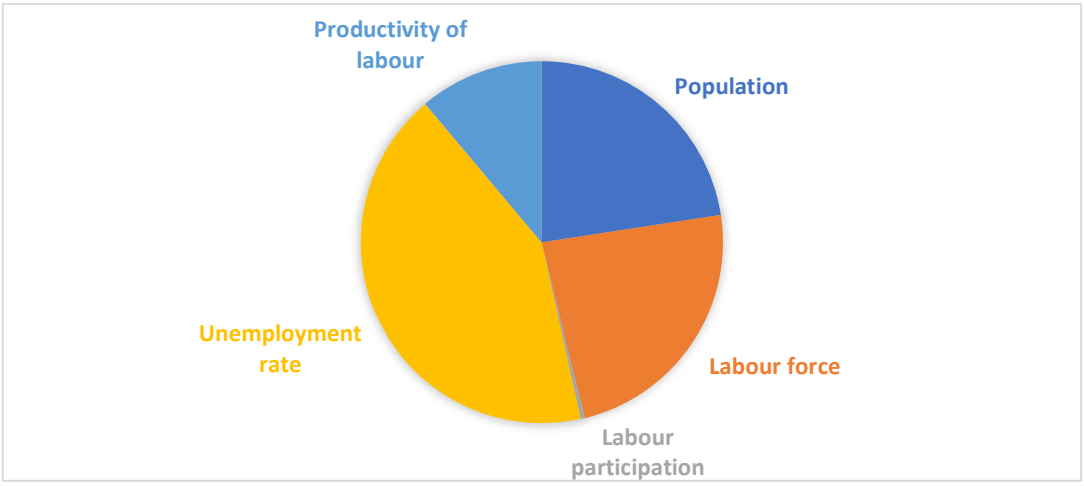
Figure 1: Growth rate of labour productivity in Nigeria (1991-2018);
Source: Authors Computation

The Nigerian labour market has experienced problems ranging from unemployment, downsizing by employers of labour, inconsistent government policies, low employment generation capacity and imbalance between demand and supply of labour. As at 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, the large proportion of Nigeria's labour force appears to have been consistently underperformed in terms of productivity of labour. Figure 2 below 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 productivity of labour could be due to the 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 productivity of labour is low.

Figure 2: Profile of Nigeria's labour force (2010-2019); Source: Authors Computation

As predicted by Bloom & Humair (2010) cited in Umoru & Yaqub (2013), the problem of unsatisfactory productivity of labour might persist over a long period if the government fails to put proper policies in place to save Nigeria from the predicament. Data and projections (see Table 1 below) reveals a realistic guide and forecast to the unemployment situation and job requirements in Nigeria between 2010 and 2030. Looking at policies aimed at addressing low



labour productivity in Nigeria is rather difficult in the 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 government was to engage unemployed youths in public programs such as the 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 creation of immediate jobs via public works in the private sector towards 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

Reports from the United Nations Development Programme (UNDP) shows that labour productivity in Nigeria is lower than those 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 productivity of labour in a wealthy nation like Nigeria? The answers are not far-fetched. Recently, studies had identified level of human capital development, availability of capital, ability to acquire and apply technology, standard of living of employees, state of governance and globalization as critical factors strongly influencing labour productivity in Nigeria. For instance, human capital development which entails 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 availability of the necessary capital required to facilitate a production process accelerates 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 higher productive capacity of labour (Sengupta, 2017). On the other hand, Mallick (2014) advocated that through globalization, there is enhanced labour productivity through acquisition and/or spillover effect of advanced and new information, communication and technology (ICT) system from developed countries to less developed countries through FDI. It is also stated that there exist greater productive in well-governed countries than countries where governance is poor (Elham, 2020).

Disappointingly, Nigeria is faced with a relatively low productivity of labour for several reasons. First, both present and previous government has not been able to sufficiently fund domestic production due to dependence on foreign made products and revenue from crude oil exports. This implies that with increasing appetite for foreign made goods amidst the fall in oil price ensued by loss of government revenue, resulting to lack of capital to fund domestic production. Again, production processes in Nigeria is still done in an old-fashioned pattern; even when new technologies are made available, a vast proportion of the labour lack the requisite knowledge to use them (Awotunde, 2018; Onwuchekwa & Ohachosim, 2017; Umoru & Yaqub, 2013). Also, in Nigeria, inflation rate is ever increasing more than the average wage rate and this cannot guarantee a good standard of living for the large labour force.

These problems have deepened macroeconomic instability which has automatically hindered Nigeria from tapping into the productive potentials of globalization (Onyele & Ikwuagwu, 2020). Though, labour productivity responds to many factors but 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.

The main objective of this study is to examine determinant of labor productivity in Nigeria. The specific objectives are to evaluate the effect of 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 on the productivity of labor in Nigeria.

Conceptual Review

Theoretically, the endogenous growth model (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).

Another strand of theory explaining the determinants of labour productivity is the efficiency wages theory which avers that 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).

Again, there is a school of thought that due to globalization, there is rapid achievement of technology diffusion through foreign direct investment (Barrel & Pain, 1997; Barro, 1990). Hence, trade liberalization would trigger foreign competition, improved domestic productivity and increased capital mobilization as well as human transfer of modern technology which will encourage efficiency in the process of resource allocation and economic productivity (Mallick, 2013). 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 productivity of labour (Lam, 2015). Also, the neoclassical growth model had 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 & Na (2018) showed that capital flows to resource scarce economies can revive the productivity of labour.

From another perspective, Smith emphasized role of government regulations, policies and institutions in advancing 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 productivity in the long-run. Additionally, Barro (1990) stated that maintenance of rule of law and improvement in government policies could exert significant positive influence on economic productivity. Likewise, Khan & Ajmal (2015) affirmed that unsound policies that extend unrestricted authority to the governing elite over the allocation of resources could lead to unproductivity of labour.

Empirical Review

In this light, myriads of empirical studies found a significant relationship between wages and productivity of labour (Elham, 2020; Onwuchekwa & Ohachosim, 2017). On the other hand, Powell, Montgomery & Cosgrove (1994); Krueger & Summers (1987) found that 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 demand for labour and employment level declined, which automatically made people desire to retain their jobs and improve productivity even with lower wage rate (Romei, 2017; Trpeski, Eftimov & Cvetanoska, 2016). Also, Tsoku & Matarise (2014) found that wages and labour productivity are positively related in the short-run but strongly dependent on capital/labour ratio in the long-run.

Many empirical studies share the view of the EGM (Nuttee, Thamma-Apiroam & Santipolvut, 2019; Awotunde, 2018; Heshmati & Rashidghalam, 2016; Micallef, 2016). However, Nurudeen & 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 & Mehin (2010) found that human capital and labour productivity were negatively related due to inadequate and improper training by firms, hence workers lacked the ability to effectively exhibit the required skills needed to adopt and put modern technology to work. Nevertheless, it might take a longterm 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.

Methodology

In this study secondary data were used. The time series data cover a period of 29 years, from 1990 to 2018. The data were obtained from World Development Indicators (WDI) and the International Labour Organization Statistics (ILOSTAT) database.

Model Specification

This study followed the methodological approach used by Elham (2020) to analyze determinants of productivity of labour. The study used annual time series data that spanned from 1990 to 2018. The model applied by Elham (2020) was based on the Cobb Douglas production function as denoted by equation (1) below:

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

Where,

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

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

$$\frac{Y}{L} = f\left(\frac{K}{L}, \frac{L}{L}\right) = f\left(\frac{K}{L}\right) \qquad (2)$$

Hence, productivity of labour (Y/L) is the value of output (measured by real GDP) produced per worker. Hence, equation 2 implies that productivity of labour (Y/L) is a function of capital intensity per labour (K/L). Adding other factors affecting productivity of labour as captured in Elham (2020); Kang & Na (2018) and Mallick (2013), the model for this study was developed.

The function presented in equation (2) is thus stated in equation (3) below:

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

Where, LBP = labour productivity ($\frac{Y}{L}$); HCI = human capital development index; CAP = capital intensity $\left(\frac{K}{L}\right)$; 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) below:

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

Where,

β_0 = denotes the constant,

β_1 - β_7 = coefficients of the explanatory variables, and

μ_t = Error term

Table 2 below contains the descriptions of the model variables:

Table 2: Description of variables and sources of data

Variable	Description	Source of Data
Labour productivity (LBP)	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. Higher ratio entails availability for productivity.	World Development Indicator (WDI)
Average wage rate (AWR)	Labour productivity to a large depends on wages paid to workers. A worker who receives sufficiently high wages will ensure an adequate standard of living would be more productivity.	International Labour Organization (ILO), ILOSTAT database.
Per capita income (PCI)	PCI is a variable that measures standard of living of a country. It is measured as GDPto-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 ease in transferring resources from resourceabundant 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 study applied the multivariate regression technique in a Vector Autoregressive (VAR) model which was used to show the linear interdependencies among the variables. It is proven that the VAR model is useful especially for giving descriptions to the dynamic behaviour of economic time series and for forecasting. The impacts of VAR models are often summarized with impulse response functions and forecast error variance decompositions. The VAR method of data analysis places a theoretical emphasis on the structural relationship, but simply connotes the specification of a set of variables that are seen to have logical relationship and considered as part of an economic system. The VAR model is used for estimating systems that contain interrelated time series data and for analyzing the dynamic impact of random disturbances in the system. Equation (5) below shows the restricted standard form of a VAR model with lag order k:

$$[LBP_t HCI_t CAP_t AWR_t LNPCI_t GLB_t GOV_t ICT_t] =$$

$$\sum ki{-}1\ [g_{3i}h_{3i}a_{4i}b_{3i}c_{3i}d_{3i}e_{3i}f_{3i}g_{3i}h_{3i}a_{5i}b_{5i}c_{5i}d_{5i}e_{5i}f_{5i}g_{5i}h_{5i}a_{6i}b_{6i}c_{6i}d_{6i}e_{6i}f_{6i}g_{6i}h_{6i}a_{7i}b_{7i}c_{7i}d_{7i}e_{7i}f_{7i}g$$

$$+ [\ {}_{1t}\ {}_{2t}\ {}_{3t}\ {}_{4t}\ {}_{5t}\ {}_{6t}\ {}_{7t}\ {}_{8t}] \qquad (5)$$

Where,

$a_{ij}b_{ij} \ldots g_{ij}h_{ij}$ = Coefficients of LBP_t, HCI_t, CAP_t, AWR_t, $LNPCI_t$, GLB_t, GOV_t, ICT_t

$_t$ = are stochastic terms

$t - i$ = lagged values of the series

Before the VAR estimation, the data were tested for stationarty 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 (6) below:

$$\Delta y_t = \beta_0 + \beta_1 t + \beta\lambda y_{t-1} + \sum p_{j-1} \quad \delta_j \Delta y_{t-j} + \mu_t \qquad (6)$$

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

Stationarity 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 3 below:

Table 3: ADF unit root test results

Variables	ADF test @ Level	First difference	Second difference	PP test @ Level	First difference	Second difference	Order of integration
LBP	-2.0015	-1.8871	-5.0722	-2.0088	-1.9072	-6.3772	I(2)
	{0.5743}	{0.6333}	{0.0023}	{0.5715}	{0.6231}	{0.0001}	
HCI	-2.2938	-5.1787		-2.3901	-5.2048		I(1)
	{0.4244}	{0.0014}		{0.3762}	{0.0014}		
CAP	-2.5545	-4.1621		-2.6631	-4.0584		I(1)
	{0.3019}	{0.0148}		{0.2579}	{0.0186}		
AWR	-1.5290	-3.9689		-1.3668	-4.0261		I(1)
	{0.7938}	{0.0226}		{0.8486}	{0.0200}		
LNPCI	-2.0388	-4.5610		-2.2100	-4.5559		I(1)
	{0.5557}	{0.0060}		{0.4661}	{0.0061}		
GLB	-0.6548	-4.3386		-0.6548	-4.3386		I(1)
	{0.9676}	{0.0100}		{0.9670}	{0.0100}		
GOV	-2.2474	-4.1116		-2.2474	-4.3386		I(1)
	{0.4469}	{0.0196}		{0.4469}	{0.0100}		
ICT	-2.5753	-4.8543		-0.7151	-14.854		I(1)
	{0.1930}	{0.0011}		{0.9994}	{0.0000}		

Source: Authors Computation

Table 3 above shows that the ADF and PP test were consistent. Both tests suggest that LBP was integrated at order 2, that is, second difference while HCI, CAP, AWR, LNPCI, GLB, GOV and ICT were all stationary at first difference. As the series are a mixture of I(1) and I(2), it then excludes the presence of cointegration (Johansen & Juselius, 1990). Since there were no traces of long-run relationship, the study proceeded with the Vector Autoregressive (VAR) 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 1, which is the best fit as shown in Table 4 below:

Table 4:

Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-102.0395	NA	3.58e-07	7.859967	8.240597	7.976330
1	89.96560	260.5784*	4.62e-11*	-1.283257*	2.142412*	-0.235996*

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.

VAR Granger Causality/Block Exogeneity Wald Tests

Having ascertained the optimal lag length, the VAR Granger Causality/Block Exogeneity Wald tests was carried out as presented in Table 5 below:

Table 5: VAR Granger Causality/Block Exogeneity Wald tests

Variable	LBP	HCI	CAP	AWR	LNPCI	GLB	GOV	ICT
LBP	--	0.8610	0.5878	0.6250	0.1273	0.4709	0.2376	3.0998
		{0.3535}	{0.4432}	{0.4292}	{0.7211}	{0.4926}	{0.6259}	{0.0783}
HCI	0.6647	--	2.9954	***14.3949***	0.3549	0.5136	0.3876	0.4811
	{0.4149}		{0.0835}	***{0.0000}***	{0.5514}	{04736}	{0.5335}	{0.4879}
CAP	2.7629	0.1386	--	4.2941	0.5341	1.6896	0.1972	1.3763
	{0.0965}	{0.7096}		{0.0382}	(0.4649}	{0.1936}	{0.6569}	{0.2407}
AWR	1.4447	0.9594	0.0052	--	2.4717	1.6169	0.1213	0.4692
	{0.2294}	{0.3273}	{0.9421}		{0.1159}	{0.2035}	(0.7276}	{0.4933}
LNPCI	***4.3115***	0.7611	0.1525	***7.5812***	--	1.4837	1.9771	0.0501
	{0.0379}	{0.3830}	{0.6961}	***{0.0059}***		{0.2232}	{0.1597}	{0.8228}
GLB	3.0685	0.0694	0.0038	0.0087	0.0004	--	1.9927	0.0738
	{0.0798}	{0.7922}	{0.9505}	{0.9255}	{0.9828}		{0.1581}	{0.7859}
GOV	3.8071	1.8180	0.1919	0.6494	***25.1058***	3.6310	--	0.0002
	{0.0510}	{0.1775}	{0.6613}	{0.4203}	***{0.0000}***	{0.0567}		{0.9873}
ICT	3.1325	0.9010	***4.6830***	0.1011	3.1311	0.1381	0.0030	--
	{0.0767}	{0.3425}	***{0.0305}***	{0.7504}	{0.0768}	{0.7102}	{0.9563}	
All	*46.0953*	*5.9196*	*18.3890*	*22.6487*	*39.2828*	*21.2170*	*10.0774*	*5.4444*
	{0.0000}	*{0.5492}*	*{0.0103}*	*{0.0020}*	*{0.0000}*	*{0.0035}*	*{0.1842}*	*{0.6059}*

Source: Authors Computation

The VAR Granger Causality/Block Exogeneity Wald tests were used to ascertain the nature of causality between changes in the variables. With the productivity of labour (LBP) as the dependent variable, there was causality between the natural logarithm of per capita income (LNPCI) and the dependent variable; also, the combination of all the independent variables caused changes in the dependent variable. Having Human Capital development Index (HCI) as the dependent variable, there was no causality between the independent variables and the dependent variable; also, the combination of all the endogenous variables did not cause changes in the dependent variable. Using Capital Intensity (CAP) as the dependent variable, only ICT usage caused changes in the dependent variable but a combination of the explanatory variables Granger caused changes in CAP. With Average Wage Rate (AWR) as the dependent variable, HCI and LNPCI Granger caused changes in AWR and a mix of all the independent variables caused changes in AWR. Also, with LNPCI as the dependent variable, only Governance (GOV) Granger caused changes in LNPCI, the combination of the entire endogenous variable contributed to the changes in LNPCI. None of the independent variables Granger caused changes in Globalization (GLB) but a combination of the explanatory variables Granger caused changes in GLB. It was also observed that GOV and ICT was not Granger caused by any of the endogenous variables even a combination of the variables did not contribute to the variation.

Impulse Response Functions (IRF)

The IRF was applied to trace the responses of LBP to shock to one endogenous variable in the VAR model. This analysis was based on Cholesky approach which uses the inverse of the Cholesky factor of the residual covariance matrix to orthogonalize impulses was adopted as reported by Figures 2a – 2g. The Figures focused on responses of LBP to its determinants such, human capital development index (HCI), capital intensity (CAP), average wage rate (AWR), natural log of per capita income (LNPCI), globalization (GLB), governance (GOV) and ICT usage. Hence, the graphs were used to show how LBP responded to unexpected innovation or changes in the explanatory variables.

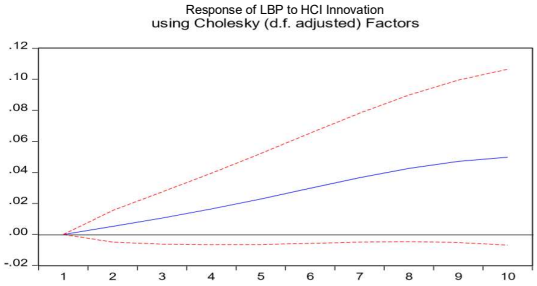


Figure 2(a)

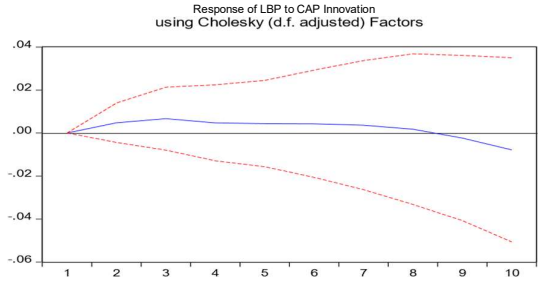


Figure 2(b)

Figure 2(a) indicates that LBP responded positively to a change in HCI. In line with Awotunde (2018); Heshmati & Rashidghalam (2016) it implies that human capital development will encourage higher productivity of labour. From Figure 2(b), it is seen that LBP responded positively to CAP within the first eight periods but this response turned negative in the last two periods which suggests that changes in capital intensity might cause low productivity of labour at some point. This lends credence to Elham (2020); Nuttee, Thamma-Apiroam & Santipolvut (2019); Micallef (2016) availability of capital spurs productivity of labour.

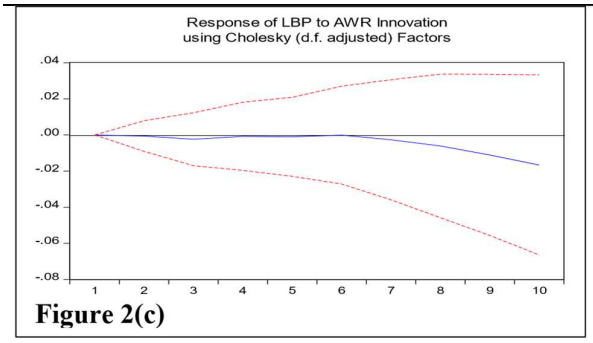


Figure 2(c)

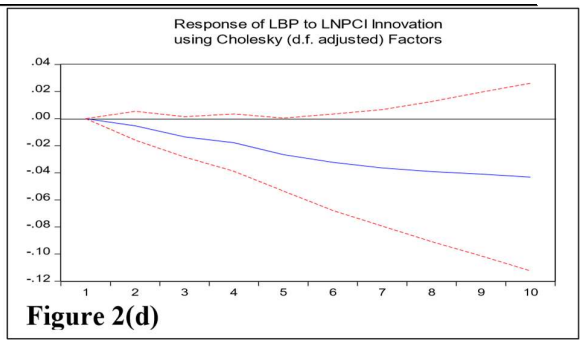


Figure 2(d)

Figure 2(c) shows that changes in AWR led to a persistent decline in LBP. This result is in consonance with our *a priori* expectation that unexpected shock to wages could lower productivity. In consonance with Romei, (2017); Trpeski, Eftimov & Cvetanoska (2016) as well as Tsoku & Matarise (2014), this implies that a negative change in wages could discourage supply of labour, hence low productivity of labour. On the other hand, Figure 2(d) indicates that the response of LBP to changes in LNPCI was negative throughout the time horizon. This could be attributed to low GDP amidst exponential increase in Nigeria's population, leading to lower standard of living which has disrupted productivity of labour in the country.

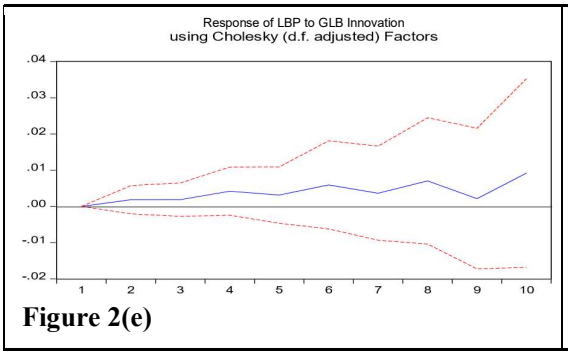


Figure 2(e)

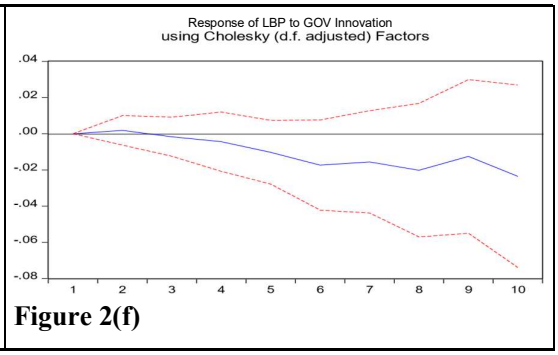


Figure 2(f)

Figure 2(e) indicated that LBP responded positively to changes in GLB. However, the positive response of LBP varied within the time horizon but remained positive. As stated by Onyele, Opara & Ikwuagwu (2017); Lipovina-Božović & Ivanović (2018), these fluctuations could be due to contagion effects of global economic crisis such as the 2008 global financial crisis. Likewise, this view is supported by Mallick (2013) who affirmed that globalization leads domestic productivity as modern technologies are transferred from developed countries to developing countries. On the other hand, LBP persistently responded negatively to GOV probably due to the height of bad governance inherent in Nigeria. This is in consonance with Khan & Ajmal (2015) who stated that unsound policies that extend unrestricted authority to the governing elite over the allocation of resources could make a nation suffer from corrupt practices, which consequently results to low productivity of labour.

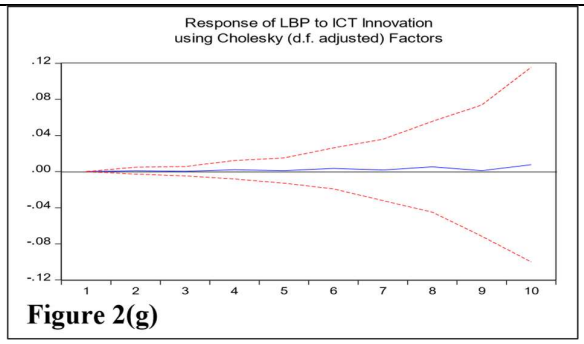


Figure 2(g)

In Figure 2(g), there is a slight positive response of LBP to change in ICT throughout the period. This could be plausibly due to the lack of well-trained and educated labour force that possibly lacked the ability and technical knowledge to apply such ICT system in economic production.

Summary of the VAR Estimates

The VAR estimates were presented in Table 6. The VAR model shows a very good statistical fitness judged by the high adjusted R-squared and F-statistic values. Based on the high adjusted R-squared and F-statistic, it was implied that the relationship among the variables was well explained by the VAR model.

Table 6: VAR estimates
Standard errors in ( ) & t-statistics in [ ]

	LBP	HCI	CAP	AWR	LNPCI	GLB	GOV	ICT
LBP(-1)	0.795512	0.093075	0.570059	-0.748973	0.377403	-4.743808	1.605543	43.25184
	(0.10615)	(0.10031)	(0.74349)	(0.94735)	(1.05736)	(6.91285)	(3.29348)	(24.5661)
	[7.49400]	[0.92791]	[0.76673]	[-0.79060]	[0.35693]	[-0.68623]	[0.48749]	[1.76063]
HCI(-1)	0.172776	0.704570	2.568788	7.175224	1.257470	-9.890061	-4.093447	34.01693
	(0.21191)	(0.20024)	(1.48422)	(1.89117)	(2.11078)	(13.7999)	(6.57468)	(49.0405)
	[0.81532]	[3.51865]	[1.73074]	[3.79407]	[0.59574]	[-0.71667]	[-0.62261]	[0.69365]
CAP(-1)	0.053067	-0.011233	0.437400	0.590410	0.232403	2.702451	-0.439922	-8.667562
	(0.03193)	(0.03017)	(0.22360)	(0.28491)	(0.31800)	(2.07903)	(0.99051)	(7.38819)
	[1.66222]	[-0.37237]	[1.95613]	[2.07224]	[0.73083]	[1.29986]	[-0.44414]	[-1.17316]
AWR(-1)	0.018842	0.014509	0.007981	0.723415	0.245488	1.298132	-0.169415	-2.485143
	(0.01568)	(0.01481)	(0.10980)	(0.13990)	(0.15615)	(1.02086)	(0.48637)	(3.62781)
	[1.20197]	[0.97952]	[0.07269]	[5.17092]	[1.57216]	[1.27160]	[-0.34833]	[-0.68502]

Table 6: VAR estimates
Standard errors in ( ) & t-statistics in [ ]

	LBP	HCI	CAP	AWR	LNPCI	GLB	GOV	ICT
LBP(-1)	0.795512	0.093075	0.570059	-0.748973	0.377403	-4.743808	1.605543	43.25184
	(0.10615)	(0.10031)	(0.74349)	(0.94735)	(1.05736)	(6.91285)	(3.29348)	(24.5661)
	[7.49400]	[0.92791]	[0.76673]	[-0.79060]	[0.35693]	[-0.68623]	[0.48749]	[1.76063]
LNPCI(1)	-0.030837	-0.012242	-0.040626	-0.364916	0.172600	1.177996	-0.647878	-0.769661
	(0.01485)	(0.01403)	(0.10401)	(0.13253)	(0.14792)	(0.96710)	(0.46075)	(3.43676)
	[-2.07644]	[-0.87242]	[-0.39059]	[-2.75340]	[1.16682]	[1.21807]	[-1.40613]	[-0.22395]
GLB(-1)	0.005291	-0.000752	0.001313	-0.002525	0.000649	0.544355	0.132277	-0.189888
	(0.00302)	(0.00285)	(0.02115)	(0.02695)	(0.03008)	(0.19668)	(0.09370)	(0.69894)
	[1.75173]	[-0.26344]	[0.06207]	[-0.09367]	[0.02159]	[2.76773]	[1.41165]	[-0.27168]
GOV(-1)	0.013499	0.008815	0.021233	0.049757	0.345297	-0.858536	0.790582	-0.025534
	(0.00692)	(0.00654)	(0.04846)	(0.06174)	(0.06891)	(0.45055)	(0.21465)	(1.60110)
	[1.95118]	[1.34835]	[0.43817]	[0.80587]	[5.01058]	[-1.90554]	[3.68307]	[-0.01595]
ICT(-1)	-0.001973	-0.001000	-0.016900	-0.003165	-0.019652	0.026984	0.001895	0.566164
	(0.00112)	(0.00105)	(0.00781)	(0.00995)	(0.01111)	(0.07261)	(0.03459)	(0.25804)
	[-1.76990]	[-0.94925]	[-2.16403]	[-0.31809]	[-1.76950]	[0.37162]	[0.05477]	[2.19414]
C	-0.342827	-0.088212	-0.931825	4.355386	-0.751813	2.594736	2.569127	17.79947
	(0.13963)	(0.13194)	(0.97794)	(1.24607)	(1.39077)	(9.09266)	(4.33200)	(32.3124)
	[-2.45531]	[-0.66860]	[-0.95285]	[3.49529]	[-0.54057]	[0.28537]	[0.59306]	[0.55086]
R_2	0.995135	0.957031	0.905981	0.988907	0.923824	0.951276	0.628918	0.883229
Adj. R^2	0.993087	0.938938	0.866394	0.984236	0.891750	0.930760	0.472673	0.834062
F-statistic	485.8210	52.89702	22.88587	211.7248	28.80292	46.36861	4.025209	17.96389

Source: Authors Computation

Conclusion and Recommendations

Conclusion

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 vector auto-regressive (VAR) model to investigate the determinants of labour productivity in Nigeria. Results showed that productivity of labour was more responsive to the combinations of the endogenous variables than the individual variables as shown by the VAR Granger Causality/Block Exogeneity Wald tests and Impulse Response Functions respectively. However, productive of labour responded positively to changes in human capital development index and ICT but its response to capital intensity varied with time but responded negatively to wage rate, governance and per capita income (measure of standard of living) in Nigeria. Based on the results, this paper concludes that interactions between several variables such as human capital development index, capital intensity, wages, standard of living, degree of globalization index, governance and ICT are relevant to determine productivity of labour in Nigeria.

Recommendations

Based on the empirical evidence emanating from the study, the followings are recommended:

1) It is crucial that Nigeria builds capacity through investments in human capital by ensuring that the labour force is well-educated and trained in order to enhance its productivity which would further boost the overall economy.
2) There is 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 public-private partnership.
3) Also, policy makers 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 Nigeria government.
4) With the negative response of labour productivity to low per capita income, there is 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 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 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.

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