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Research Paper

Wage Structures and Industrial Productivity In Nigeria

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ABSTRACT: *This study examined the impact of wage structures on the industrial productivity in Nigeria. In a bid to bring uniqueness into the research work, real wages and two major control variables (Information technology and Research and Development) were used to investigate their impacts on the productivity growth in both manufacturing and services sectors. The study employed Autoregressive Distributed Lag Model as the estimation techniques. Findings from the study revealed that there is a long-run relationship between the explanatory variables (Real wages, IT and R&D) and the productivity growth in both manufacturing and services sectors. The study also showed that real wages impacted positively and significantly on manufacturing productivity growth only in the short-run, while the real wages have positive and significant impacts on the services productivity growth only in the long-run. In addition, both Information Technology and Research and Development have positive and significant impacts on the productivity growth in both manufacturing and services sectors.*

KEYWORDS*: Real Wages, Manufacturing Productivity, Services Productivity, Information Technology, Research and Development.*

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I. INTRODUCTION

Industrial productivity is a major factor that determines the industrial competitiveness. Given a higher productivity, an industry is able to produce goods and services at a lower cost, sells products that aligns with the demand requirements in terms of price, quality and quantity, and at the end makes better profit with which the firm can effectively thrive (Latruffe, 2010). In general, an increase in industrial productivity implies that the country produces more output for a given level of input, thereby generating gains that increase incomes, improve living standard and enhance a better quality life.

The structure of wages accrued to the workers has a significant effect on the industrial productivity and it serves as an important factor that determines the household income and welfare. The productivity growth of an industry is often dependent on the labour productivity which is the total output produced by a firm relative to the number of workers employed. In this case, labour productivity is majorly determined by the wage structure in an industry. Wage structure is an established system of pay between group of workers or pattern of payments made according to wage scale, increment to wages, bonus piece work, wage differentials and wages coefficients (Martins, 2008).

There is a link between the wage structure and industrial productivity of any country. According to Akerlof (1982) and Akerlof and Yellen (1986) in the postulation of their Efficiency Wage Theory, they posited that increment in the wage levels of workers stimulate them to increase productivity in appreciation to high incentives provided for them by their employers, and this will further enhance a robust relationships between employers and employees.

Nigerian government in its bids to enhance industrial productivity and strengthen the industrial sector as a key driver of growth and development, has introduced some policies and strategies which include: import substitution strategy, export promotion strategy, Nigerian indigenization policy, trade and financial liberalization and structural adjustment programme (Okoye, Nwakobey and Okorie, 2016). Despite the adoption and implementation of these strategies and policies, the industrial sector contributions to Gross Domestic Product have remained dwindling and poor over the years. For instance, the industrial sector contributions to GDP stood at 20.6% and 20.2% in 2007 and 2008 respectively, but later fell to 16.9% in 2009. Meanwhile, the sector's contribution to GDP rose to 22% and 24% in 2010 and 2011 respectively before declining to 23.7%, 21.9%, 20.6%, 16.0% and 14.2% in 2012, 2013, 2014, and 2016 respectively (CBN, 2017).

In similar manner, wage policy in Nigeria has been subjected to series of review by different commissions which include: Wage Board and Industrial Council Act 1974, National Minimum Wage Act 1981, National Minimum Wage Decree No. 43 of 1988, National Salaries, Incomes and Wages Commission Decree No. 99 of 1993, National Salaries, Income and Wages Commission (Amended) Decree No. 17 0f 1999, National Minimum Wage Act 2000, National Minimum Wage (Amended) Act 2003 and The National Minimum Wage (Amended) Act 2010 which was commissioned by the Justice Alfa Belgore Committee (Judes and Ernest, 2015). In spite of the implementation of these wage policies over the years, Nigeria was ranked among the most wage unequal country in the world which has inflicted negative impact on the industrial productivity in Nigeria (UNDP, 2009). It is against this backdrop that this study aims to explore the impact of wage structure on the productivity growth of industry in Nigeria.

A large number of research works have examined the impact of wage structures on the industrial productivity, for instance, Ho and Vap (2001); Cardoso, Guimarães and Varejão (2010); Meager and Speckesser (2011); Matthew and Azuh (2013). But these past studies have focused more on the manufacturing productivity-wage relationships, while the impact of wage structure on the growth of productivity in the service sector have not been fully addressed particularly in Nigeria. Meanwhile, a number of economic analysts have argued that developing economies that want to boost and enhance productivity need to put more effort into developing their service sector (Ghani, 2010; Ghani and O'Connel, 2014; Romer, 2012.

This is as a result of the fact that service sector through the help of ICT stimulates and enhances productivity growth more than the manufacturing sector particularly in the area of digitalized services (Haskel and Westlake, 2017). This study is therefore unique in the sense that it examines the impact of wage structure on the growth of productivity in both manufacturing and service sector. In addition, this research work is quite different from the past studies because it incorporates other explanatory variables such as Information technology (IT) and Research and Development (R&D) as other factors that determine the growth of productivity in the manufacturing and service sector a part from the wage structures.

The remaining part of the paper include section two which discusses a brief review of literature, section three captures the research method while section four presents the results and discussion of findings. Section five discusses the conclusion and policy recommendation of the study.

II. LITERATURE REVIEW

Ho and Vap (2001) used the Engle-Granger Cointegration test to examine both the long-run and short-run dynamics of wage formation in the Malaysian manufacturing industry for 13 selected sub-sectors of the industry. The finding of the study revealed that there is a positive long-run relationship between labour productivity and real wages, and a negative relationship between unemployment and real wages and no significant impact of union density on real wages. The study further revealed a negative relationship between real wages and labour productivity which implies that the labour productivity gains did not bring about higher wages in the short-run.

Cardoso, Guimarães and Varejão (2010) examined the relationship between labour productivity and real wages at individual level in Portugal manufacturing sectors. By using administrative longitudinal employer-employee data, the study showed that wages and manufacturing productivity increase in similar paces only in early years of employment and therefore, as prime ages approaches, wage increase lag behind productivity gains. The study indicated that the older workers are worthy of their pay as their contribution to the firm level of productivity exceeds their contribution to wage bill.

Meager and Speckesser (2011) used GDP per hour as a measure of labour productivity to investigate the relationship among the real wages, manufacturing productivity and employment in Europe. The study revealed a greater variation of labour productivity with an increase ranging from 3 per cent in Italy to 128 per cent in Estonia over the period, though wages did not increase as much as manufacturing productivity and employment did.

Tamasauskiene and Stankaityte (2013) investigated the relationship between wages and labour productivity in Lithuania. The results of the study revealed regional dissimilarities of labour productivity are greater than wages. Also, Strauss and Wohar (2017) showed that there is long-run relationship between real wages and productivity of the manufacturing sector in the United States over the period of 1956-1996.

Meghan (2018) investigated the relationship between wages and productivity for some industrialized countries. The aim of the study was to differentiate between conventional and efficiency wage behaviors. The results of the study revealed that efficiency wages were paid in Canada, Italy and the UK. However, Sweden, United State and France showed no efficiency wage settings. The study further showed that the economic institutions such as worker unions played an important role on the wage-productivity settings for the selected OECD countries.

Aminu (2010) employed the probit model to examine the determinants of earnings in wage employment in Nigeria. The results of the study revealed that the level education attained by employed

household member, either male or female is the main determinant of labour market participation. The study further showed that return to education and experience is quite different for male and female. The study therefore concluded that the main determinant of wage comprises of the educational levels of the labour force, geographical location and experience of the individuals in the household.

Matthew and Azuh (2013) used secondary and primary data to assess whether or not the trade liberalization process has any effect on both the reduction in the wage differential between registered non-registered workers. Results of the study revealed that the fall in the wage gap between registered and non-registered workers in the manufacturing sector was affected by trade-related variables.

Jonah and Yousuo (2013) employed a logit model to examine the effects of wage differentials on lbour turnover. Their primary data contained 840 employees of both private and public workers. Findings from their study showed that there is a negative relationship between were differential and the labour turnover. Their result implies that as state workers' wages increased, the probability of a state worker leaving to federal civil services indicated to fall by 0.29.

III. RESEARCH METHOD

3.1 Theoretical Framework

The analysis of the impact of wage structures on the industrial productivity is hinged on the Cobb-Douglas production function to represent production in both manufacturing and services sectors. Capital (K_t) and total labour input (L_t^*) of the firm and time t are combined with the level of technology *A* to produce output *Y*. For the purpose of this study, this research work followed the revised version of Cobb-Douglas Production function propounded by Mahlberg, Freund, Cuaresma, and Prskawetz, (2013) by incorporating Z_t^*. This is quite necessary so as to include:(1) real wages per total employees and some other control variables such as: (2) Information Technology expenses and (3) Research and Development expenses in the basic model. The revised model as propounded by Mahlberg et al (2013) is presented as follows:

$Y_t = AK_t\ \alpha L_t^*\ \beta Z_t^*$

3.2 Model Specification

Based on the theoretical proposition of Cobb-Douglas production function which was revised by Mahlberg et al (2013), the model for this research work is therefore presented in two equation forms. The first equation represents the manufacturing sector while the second one represents the services sector. The two models are presented as follows:

$$Manuprod_t = \alpha + \alpha_1 Rwage_t + \alpha_2 IT_t + \alpha_3 R\&D_t + \varepsilon_t \quad \text{.....1}$$

$$Serviceprod_t = \beta + \beta_1 Rwage_t + \beta_t IT_t + \beta_t\ R\&D_t + \varepsilon_t \quad \text{.....2}$$

Where:
Manuprod = Manufacturing Productivity Index
Serviceprod = Services productivity Index
Rwage = Real Wage
IT = Information Technology expenses
R&D = Research and Development expenses

3.3. Sources of Data

The data set for this research work consists of annual time series data between the period of 1990 and 2016. Data on manufacturing and services productivity indices are sourced from United Nations Conferences on Trade and Development (UNCTAD) statistical bulletin. Data on Real Wages (RWage), Information Technology (IT) expenses and Research and Development (R&D) expenses are sourced from World Bank data base.

IV. RESULTS AND DISCUSSIONS

4.1 Unit Root Test Results

This section tested the time series properties of variables in order to understand the individual nature of the variables. This was done by carrying out a unit root test on each variable. This study therefore employed Philip-Peron unit root test to ascertain the order of integration of variables.

Table1: Philip-Peron Unit Root test

Variables	T-Statistics	P-Value	Order of Integration
Manuprod	-4.83241	-2.20464***	I(1)
Serviceprod	-3.00841	-2.36211***	I(1)
Rwage	-5.51812	-3.11246***	I(1)
IT	-3.46210	-2.08914***	I(1)

R&D	-4.33412	-3.88140***	I(1)

Source: Author's Computation
(***) denotes 1% level of significance. Each model contains trend and constant term

Table 1 above showed the result of the Philip-Peron unit root test for this research work. The results revealed that both Information Technology (IT) and Research and Development (R&D) attained their stationarity at level I(0). The other variables such as Manufacturing productivity Index (Manuprod), Services Productivity Index (Serviceprod) and Real Wage (Rwage) were stationary after the first difference I(1). This implies that any shock or disturbance to these variables will not be sustained for a long period of time.

4.2 Results of Cointegration test

Due to the combined order of integration i.e I(0) and I(1) for the time series properties of the variables, the Autoregressive Distributed Lag Model (ARDL) and Bound test is therefore appropriately employed to assess the presence of cointegration among the variables as shown in the table 2 below:

Table 2: Pesaran Autoregressive Distributed Lag (ARDL) Bound Test Results for Manufacturing Sector

T-Statistics	Value	K
F-Statistics	5.214341	6

Critical Value Bounds

Level of Significance	I(0)	I(1)
10%	1.32	2.51
5%	2.71	3.51
2.5%	2.84	3.82
1%	2.92	4.01

Source: Author's Computatio

The result of the Autoregressive Distributed Lag (ARDL) Bound test in the table 2 above exhibited that the computed F-statistics value of 5.214341 is greater than the upper bound values at any level of significance. The study therefore rejected the null hypothesis and accepted that there is long-run relationship between manufacturing productivity index and the explanatory variables (Rwages, IT and R&D) during the period under review.

Table 3: Pesaran Autoregressive Distributed Lag (ARDL) Bound Test Results for Services Sector

T-Statistics	Value	K
F-Statistics	4.16421	6

Critical Value Bounds

Level of Significance	I(0)	I(1)
10%	1.84	2.14
5%	1.96	2.52
2.5%	2.83	3.12
1%	2.91	3.65

Source: Author's Computation

Likewise, the results in the table 3 above equally showed that F-statistics value of 4.16421 is greater than the upper bound value at all the level of significance, which indicates that there is a long-run relationship between the services sector productivity index and the explanatory variables (Rwages, IT and R&D).

4.3. Long and Short-run Estimation Regression Results for Manufacturing and Services Sectors

Due to the existence of long-run relationship between the productivity index of the two sectors and the explanatory variables, the study therefore proceeds to testing for the long and short-run regression.

Table 4: Autoregressive Distributed Lag (ARDL) Cointegration Regression Results for Manufacturing Sector

Variables	Short-run Model			
Manuprod	Coefficient	Std Error	T-statistics	Propability
D(Rwage)	0.54204	0.021724	1.80414	0.0042
D(IT)	0.31421	0.124043	2.04181	0.2416
D(R&D)	0.20564	0.214611	2.11426	0.1341
ECM	-2.34463	0.304912	-4.42871	0.0009
	Long-run Model			
Rwage	0.29481	0.14234	2.43103	0.1403

IT	1.34106	1.28451	2.12462	0.0064
R&D	0.98142	2.04143	1.80214	0.0121

Source: Author's Computation
R-Squared = 0.78417, Prob (F-Statistics) = 0.00214, Durbin-Watson Stat. = 1.23861

Table 4 above exhibited the Autoregressive Distributed Lag (ARDL) Cointegration regression results for the manufacturing sector. The results are segmented into two sections, the short and long-run model. The first section showed the variables in their differenced forms which indicates short-run relationship. The second segment exhibited the variables in their non-differenced forms which implies the long-run relationships. Results from the short-run model confirmed that Real Wage (Rwage) has positive and significant impact on the growth of productivity in the manufacturing sector while other explanatory variables such as IT and R&D have positive but insignificant impacts on the manufacturing productivity index in Nigeria during the period under review. But results from the long-run model revealed that Real Wage (Rwage) exerted positive but insignificant impact on the manufacturing productivity index while IT and R&D have positive and significant impacts on the manufacturing productivity index.

Results of the Error Correction Mechanism is correctly signed as its coefficient is negative (-2.34463) and the P-value (0.0009) is less than 5% level of significance. This result implies that the ECM is able to correct any deviation of the short-run back to the long-run equilibrium. The computed adjusted R-squared value of 0.78417 showed that the model in this study meets the requirement for goodness of fit. The computed value exhibited that 78% of the total variation in the growth of manufacturing productivity is accounted for by all the explanatory variables while 22% of the changes in the manufacturing productivity index are due to the influence of other parameters not featured in the model. In addition, the probability value of F-statistics (0.00214) which is less than 5% level of significance showed that the control of all explanatory variables on manufacturing productivity index is statistically significant. The result implies that all explanatory variables have a collective impact on the manufacturing productivity index. The Durbin-Watson showed the absence of auto-correlation with the value of 1.23861.

Table 5: Autoregressive Distributed Lag (ARDL) Cointegration Regression Results for Services Sector

Variables	Short-run Model			
Serviceprod	Coefficient	Std Error	T-statistics	Propability
D(Rwage)	0.40299	0.146521	2.16722	0.1413
D(IT)	0.17842	0.382901	1.34117	0.1107
D(R&D)	0.24640	0.210916	2.11034	0.2091
ECM	-2.20331	0.121461	-3.46712	0.0041
	Long-run Model			
Rwage	1.14230	0.24981	1.79814	0.0092
IT	2.34141	1.65041	1.36914	0.0017
R&D	0.66403	1.75311	2.43191	0.0141

Source: Author's Computation
R-Squared = 0.81412, Prob (F-Statistics) = 0.0000, Durbin-Watson Stat. = 1.21345

Table 5 above showed the Autoregressive Distributed Lag (ARDL) Cointegration regression results. Results from the short-run model revealed that all the explanatory variables (Rwage, IT and R&D) have positive but insignificant impacts on the growth of productivity in the services sector. But in the case of long-run model, all the explanatory variables (Rwage, IT and R&D) have positive and significant impacts on the service productivity index in Nigeria during the period under review.

Similar to the results from the manufacturing sector, the ECM satisfied the required condition in which the coefficient is negative (-2.20331) and the P-value (0.0041) is less than 5% level of significance. This indicates that the ECM can correct any form disequilibrium in the model. Also, the adjusted R-squared showed that 81% of the total variation in the service productivity growth is accounted for by all the explanatory variables while 19% of the changes in service productivity growth are attributed to the control of other factors not captured in the model. The probability value of F-statistics (0.0000) showed that all the explanatory variables jointly affect the growth of productivity in the services sector. The Durbin-Watson value of 1.21345 exhibited the absence of auto-correlation in the model.

4.4 Discussion of Findings

In order to test the stationarity of all the variables and to avoid spurious regression in the study, Philip-Peron unit root test was used to confirm the order of integration of the variables. The results revealed that both IT and R&D are stationary at level I(0) while Manuprod, Serviceprod and Rwage attained their stationarity after the first difference I(1). This result implies that any shock or disturbance to the variables will not be sustained for a long period of time. Also, the mixed order of integration for the variables justified the adoption of

Autoregressive Distributed Lag (ARDL) Bound test. The results of the Pesaran Autoregressive Distributed Lag (ARDL) Bound test revealed that there is co-movement between the growth of productivity in the two sectors (Manufacturing and Services sectors) and the explanatory variables (Rwage, IT and R&D)

Findings from the results of Autoregressive Distributed Lag (ARDL) Cointegration regression revealed that real wage (Rwage) has positive and significant impact on the manufacturing productivity growth only in the short-run. This finding might be attributed to the fact that jobs of workers in the manufacturing sector are easily and quickly measured in the short-term. The finding is consistent with the assertions of Biesebroeck (2015) who posited that the productivity-wages relationship is positive and largest for the manufacturing sectors where earnings are directly based on production and where productivity is easily and quickly evaluated.

However, findings from the result of Autoregressive Distributed Lag (ARDL) Cointegration regression confirmed that Real wage has positive and significant impact on the service productivity growth only in the long-run. The reason for this finding might be hinged on the fact that jobs in the services sector mostly require higher education levels which give room for the educated workers in this sector to exploit their long-term acquired skilled, training and education to enhance and stimulate productivity growth.

Findings from the result of ARDL cointegration regression revealed that Information Technology (IT) and Research and Development (R&D) both have positive and significant impact on the growth of productivity in both manufacturing and service sector only in the long-run. This finding might be attributed to the fact that workers in both manufacturing and services sectors might take a very long period of time to learn and adapt to new technology employed by their employers, and this may also take a long time for the new technology and the research and development to be translated to productivity (Rose and O'Relly,1998).

V. CONCLUSION AND POLICY RECOMMENDATION

Based on the results and findings in this study, this research work therefore concludes as follows: First, there is a log-run relationship between the real wage and the productivity growth in both manufacturing and services sectors. Second, there is also a long-run relationship between the two major variables (Information Technology and Research and Development) and the productivity growth in both manufacturing and services sector. Third, real wage has positive and significant impacts on manufacturing productivity growth only in the short-run while it has positive and significant impact on service productivity growth only in the long-run. Fourth, both Information Technology and Research and development have positive and significant impacts on the productivity growth in both manufacturing and services sectors only in the long-run.

In this regard, this study therefore recommends that Nigerian government should increase real wages of workers and equally promote a robust investment in Information Technology and Research and Development so as to enhance and stimulate highest productivity in both manufacturing and services sectors.

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