The Nigerian Journal of Energy & Environmental Economics
Department of Economics,
Nnamdi Azikiwe University, Awka,
Anambra State, Nigeria.

Web:www.aeeeng.org *ISSN 2006-8395*

UPWARD REVIEW OF MINIMUM WAGE AND LABOUR PRODUCTIVITY IN NIGERIA

By
[*1]Uyoyouoghene Ologbo; [1]Okafor, Samuel Oseloka;
[1] Maduka, Olisaemeka Dennis; & [1] Eze, Anoke Eze
[1]Department of Economics, Nnamdi Azikiwe University, Awka, Nigeria
[*] **Corresponding Author: mr.uyomi@gmail.com**

Abstract

The Nigerian labour market has shown profound features in recent times, including general decline in national productivity. This trend has continued to generate several dissenting debates, one of which is the implication of minimum wage legislation for the labour market. In contributing to this debate, this study examined the impact of minimum wage on labour productivity. Given that there is dearth of empirical evidence on the impact of minimum wage on labour productivity, this study utilized time series data spanning from 1990 to 2020 to analyse the impact. To account for potential endogeneity in the estimation environment, the study utilized generalized method of moment (GMM) for estimating the hypothesized models. The results indicate that minimum wage legislation engenders productivity gain both in the year of announcement and in the long run. It further reveals that oil revenue, technological advancement, real gross domestic product and firms' profit are positively related to labour productivity. However, capital stock exerts negative effect on labour productivity. Based on the findings, the study recommends that minimum wage legislation could be used as a tool for reducing wage dispersion and to channel productivity gains into higher wages.

Keywords: Minimum wage, Labour Productivity, GMM

JEL Codes: C36, E24, J24

1. Introduction

Labour productivity is a measure of the total output (measured in terms of gross domestic product, GDP) produced per unit of labour (measured in terms of the number of employed individuals or hours worked) during a specific time period in the labour market. Labour productivity is widely regarded as a crucial economic factor by most economists. It is a measure that shows a country's economic development, rivalry and quality of living. According to neoclassical thinking, work is

remunerated based on its marginal output. Put simply, as the marginal product of work rises, economists anticipate a similar increase in the pay rate per unit of labour. Nevertheless, the theoretical impact of increasing the wage rate on worker productivity remains questionable (Reserve Bank of Australia, 2023).

Recent studies revealed that the minimum wage can lead to increased labour productivity at the business and overall economic levels, in addition to mitigating wage dispersion and directing productivity increases towards higher wages. Akerlof (1982) proposed a hypothesis stating that employees regularly exert greater effort in response to higher compensation, which is commonly referred to as the efficiency wage theory. As researchers have shown, increase in productivity is as a result of firms adopting more capital-intensive production technologies. In general, raising the minimum wage may cause more productive businesses to displace the least productive ones and improve the efficiency of the remaining businesses. These systems have the potential to raise labour productivity overall. For instance, it has been noted that in China, increasing minimum wages at the city level have a negative impact on the likelihood that low-productive businesses would survive. That being said, as employment and productivity rose in the enterprises that survived, there was no adverse employment consequence. Therefore, it is possible that the minimum wage encouraged incumbent businesses to become more competitive by allowing more productive businesses to displace the least productive ones (International Labour Organisation [ILO], 2023). In contrast, Ehrenberg and Smith (2020) observed that an increase in salaries might result in a decrease in overall labour productivity due to the tendency of high-wage workers to seek more leisure time.

Ehrenberg and Smith (2020) posited that the impact of minimum wage on worker productivity may vary compared to that of a general pay rise, as not all categories of employment experience advantages from minimum wage legislation. O'mahony and Timmer (2019) also opined that if minimum wage increases labour productivity, it may not lead to decline in demand for labour. Their argument is anchored on the assumption that employers of labour are more concerned about what labour can produce rather than mere consideration of wage rate. In other words, employers do not consider wage rates in isolation; they also consider what the labour who receives the wage rate produces *vis a vis* the wage rate received.

Minimum wage law in Nigeria is an integral component of the country's income policy. Income policy is commonly employed as a key element of the macroeconomic policy framework in Nigeria to enhance welfare and reduce poverty. The Nigerian policy arena is mostly focused on discussions over the merits of implementing minimum wage legislation. Studies such as Ojo (2008); Owoye (2014) argued that minimum wage legislation, which typically leads to an increase in nominal wage, is justified as a way to align wages and salaries with the rising cost of living. However, Folawewo (2007); Fapohunda, Atika and Lawal (2018) maintained that wage hikes are consistently accompanied by the possibility of downsizing in both government and private sectors, and in certain instances, these threats have resulted in significant layoffs in the civil service. Folawewo (2007) contend that minimum wage hikes in Nigeria frequently give rise to inflationary pressures, subsequently prompting labour unions to demand ongoing raises in wages and salaries. Minimum wage legislation has been a common occurrence in Nigeria since the implementation of the National Minimum Wage Act 1981 (No. 6 of 1981). Starting with a base pay of ₦125 in 1981, the wage rate has increased to ₦250 in 1990, ₦7,500 in 1999, ₦18,000 in 2011, and the minimum wage legislation has become firmly established in Nigeria, with ₦30,000 being the designated amount in 2019 after nearly 8 years of ₦18,000 as minimum wage since 2011 (ILO, 2019). It is a common thing to review minimum wage every 5 year in order to meet with the current economic reality. However, labour productivity gains are essential to ensure that legislated wages are sustainable, but the increased decline in employment in Nigeria has remained an object of worry and concern, both to economists and to policy makers.

Although, conscientious research efforts have been directed toward determining the implication of minimum wage legislation for employment in Nigeria, these efforts have not yielded the desired results on the effect of minimum wage legislation on labour productivity. Moreover, the use of nominal minimum wage in minimum wage studies in Nigeria by Fajana (1999); Folawewo (2007); Fapohunda et al. (2018); has been faulted. Pigou in 1937 had argued that, it is the real wage rather than nominal wage that influences demand for labour as well as labour productivity (Katz & Krueger, 2016). For this reason, there is need to re-examine the effect of minimum wage on demand for labour

using the real minimum wage instead of nominal wage.

Moreover, given that wage function has been proven by econometricians to suffer from endogeneityproblem, estimations based on the usual traditional estimation techniques may be undermined and therefore could produce unreliable estimates. Therefore, this study employed the technique of generalized method of moment (GMM), which is considered efficient in dealing with econometric issues involving endogeneity.

2. Review of Empirical Literature

There is a dearth of studies on the relationship between minimum wage and worker productivity. Notwithstanding, studies in this area are not entirely new. A recent study carried out by Coviello, Deserranno and Persico (2022) revealed that there was an improvement in productivity among sales people in a retail chain due to the implementation of a minimum wage policy. In this particular case, the compensation structure consisted of a fixed base pay in addition to a commission based on performance. Furthermore, even in environments where employees get a consistent hourly salary, it is understood that both the employer and colleagues have the ability to evaluate and gauge the efficiency of individual workers to varying degrees. The significance of the effort margin as a potential reaction to changes in minimum wage is determined by the capacity to differentiate between workers with low and high productivity, rather than the pay structure itself. Furthermore, agricultural labourers, who are the specific focus of the minimum wage, are a pertinent but insufficiently researched demographic. Olanrenwaju (2021) studied the impact of wage structures on industrial productivity in Nigeria between 1990 and 2016. The study employed autoregressive distributed lag model and the result revealed that real wages has positive and significant impact on productivity growth in Nigeria.

Isuku, Nwafor and Olaniyi (2021) investigated the impact of minimum wage on productivity growth in South-West Nigeria. The research design adopted was ex-post facto and 1000 sample sizes was drawn from 20 industries for the study. Findings revealed that wage rate determination determines labour productivity to some extent. Trenovski et al. (2021) studied the impact of minimum wage on labour productivity in some selected South-Eastern European countries. The study employed panel regression analysis to estimate the panel data that span over the period of 2004 and 2017. From the result of the findings, it was

revealed that statutory minimum wage had strong positive impact on labour productivity in North Macedonia, Albania and Serbia, while the impact in Bulgaria, Croatia and Romania was weak and negative. Bossler et al. (2020) investigated the effects of German minimum wage on productivity, profitability and investments, using difference-in-difference estimation method. The result of the study revealed that German minimum wage reduces productivity, profitability and investments.

Senasi (2020) assessed the perception of workers on minimum wage impacts on labour productivity in Malaysia. Both qualitative and quantitative data analysis techniques were employed and the findings revealed that there is strong correlation between income received by the employees and their level of productivity. Ku (2018) quantifies the impact of the January 2009 minimum wage rise on the productivity of temporary workers employed on a daily basis, namely tomato pickers at a major Florida farm, by comparing their production levels before and after the wage increase. Utilising the difference-in-difference (DiD) methodology, the study revealed that workers with lower levels of productivity had a greater increase in productivity compared to those with higher levels of productivity. However, the research methodology adopted in this study only provides relative estimates of the productivity improvement, specifically comparing low-productivity workers to high-productivity people. Roberto and Rodrigo (2018) analysed the effects of the minimum wage on a firm's productivity. The study used data from Chilean manufacturing plants and covered the period of 1992 to 2005. The methodology employed was difference-in-difference approach and the findings revealed that an increase in minimum wage had negative effect on total factor productivity in Chile. Collins (2017) used descriptive analysis to examine if productivity increased as a result of an increase in minimum wage in England. The findings from the study revealed that raising minimum wage had negative effect on productivity. It was further revealed that increased minimum wage led to high costs of goods and services.

Riley and Bondibene (2015) reviewed the implementation of the National Minimum Wage in Britain and how it impacted on productivity in the area. Using the technique of difference-in-difference, it was found that corporations reacted to these rises in employment expenses by increasing worker productivity. These increases in labour productivity were neither as a result of reduction in the number of employees nor the

substitution of capital for labour. Rather, they were linked to enhancements in overall productivity, which aligns with organisational restructuring, training initiatives, and the adoption of efficiency-based wage policies in response to rising labour expenses resulting from minimum wage adjustments. Aras (2015) carried out research on the effect of minimum wage level on labour efficiency in Organization for Economic Cooperation and Development (OECD) countries from 1995 to 2011. The parameters of the model were estimated using panel data and the result showed that minimum wage had statistical significance with labour productivity. Mayneris, Sandra and Zhang (2014) analysed data from over 160,000 manufacturing enterprises in China and the findings revealed that when minimum wage at the local level increased, the likelihood of survival for less productive firms decreased. Surviving enterprises experienced an increase in pay expenses without any adverse effects on employment. The authors attribute this finding to the notable enhancement in productivity among the remaining entities, enabling companies to accommodate the increased personnel expenses without adversely affecting their workforce or profitability. Their conclusion was that an increase in minimum wage enables more efficient enterprises to replace the least efficient ones and compels existing firms to enhance their competitiveness.

3. Research Methods

3.1. Model Specification

To determine the effect of minimum wage review on labour productivity, the model has been specified following Mayneris et al. (2018). The model is as follows:

$$LP = F(MIW, CAPS, X) \quad (3.1)$$

Where, LP refers to labour productivity, CAPS refers to capital stock and X refers to other variables that affects labour productivity such as youth demand for labour (YLD), adult demand for labor (ALD), and total demand for labour (TLD). The model of Mayneris et al. (2018) which is adapted in this study is therefore modified and this current study's model is presented as:

$$LP_t = \Omega_1 + \alpha_1 MIW_t + \alpha_2 CAPS_t + \alpha_3 SED_t + \alpha_4 RGDPG_t + \alpha_6 OILR_t + \alpha_7 TEC_t + \alpha_8 FPROF_t + \varepsilon_t \quad (3.2)$$

Where, LP = labour productivity; MIW = minimum wage; CAPS = capital stock; SED minimum wage year dummy (SED) to capture the instantaneous effect of the minimum wage in the year of announcement; RGDP = real

GDP growth; OILR = oil revenue; TEC = technology; FPROF = firm's profit; Ω_1 is the intercept coefficient; α_i is the slope parameter and ε_t is the stochastic error term which is assumed be independently normally distributed ($iid \sim N(0,\sigma)$.

One major concern in estimating the models in Equations 3.1 and 3.2 is the endogeneity problem. Endogeneity is expected to emanate from measurement error and unobserved factors that affect minimum wage. The measurement error may emerge from two sources. The researchers recognize minimum wage in the year of enactment. However, most times, minimum wage implementation is associated with a drag making it difficult to truly ascertain when economy-wide implementationbegins. Second, in most cases, minimum wage implementation is not overwhelming. The private sector may not adopt the legislation. Even within the public sector, some states may not implementexactly the same approved amount with the Federal Government. This raises serious concern. The major problem is that $\square_{1\square}$ and $\square_{2\square}$ may be correlated with MIW thereby violating the exogeneity assumption.

Endogeneity, as defined by Griffifth et al. (2017), encompasses cases when an explanatory variable is associated with the error term. Regrettably, academics undertaking non-experimental studies typically overlook the issue of endogeneity, which hinders the ability to make policy recommendations. In addition to measurement error, correlation between the explanatory components and the error term might result from an unobserved or omitted variable confusing the regressors and regressand, or when there is simultaneity in a model. The generalised method of moment (GMM) is a highly effective instrumental variable strategy frequently employed to tackle this issue. The researchers employed Gaussian Mixture Models (GMM) to estimate the models, therefore addressing the issue of endogeneity.

3.3. Estimation Technique and Procedures

The main estimation technique in this study is GMM. However, before estimating the models specified in Equation 3.2, the following econometric procedures were employed. First, the time series were tested for stationarity using augmented Dicker-Fuller test (ADF) and Philip Peron (PP). Second, the time series were tested for cointegration using Philip-Qualiaris (PQ), while error correction was estimated using Engel-Granger procedure before the baseline and the GMMmodels were then estimated.

4. Presentation and Interpretation of Results

4.1. Descriptive Statistics

To ascertain whether or not a data set has a normal distribution, descriptive statistics were computed. Descriptive statistics of mean(M), minimum (Min), maximum (Max), standard deviation (SD) and median (Md) are presented in Table 4.1:

Table 4.1: Results of Descriptive Statistics

	LP	MIW	SED	RGDPG	OILR	CAPS	FPROF	TEC
Mean	2.608	1.920	0.226	4.789	3.203	1.033	1.774	-2.008
Median	2.601	2.021	0.000	3.785	3.504	1.082	1.781	-2.014
Max	2.7889	2.325	1.000	33.736	3.948	1.238	1.803	-1.6008
Min	2.459	1.021	0.000	-1.800	1.857	0.738	1.728	-2.7643
Std. Dev.	0.121	0.332	0.425	6.361	0.656	0.147	0.025	0.279
Skewness	0.146	-1.619	1.312	3.136	-0.734	-0.259	-0.741	-0.634
Kurtosis	1.422	4.767	2.720	15.022	2.125	1.635	2.033	3.219
J-B	3.327	17.585	8.989	237.482	3.775	2.754	4.048	2.132
Prob.	0.189	0.0002	0.011	0.000	0.151	0.252	0.132	0.344
Sum	80.862	59.523	7.000	148.436	99.294	32.019	54.984	-62.255
Sum Sq.	0.441	3.303	5.419	1213.824	12.774	0.650	0.019	2.332
Obs.	31	31	31	31	31	31	31	31

Source: Computed by the Researchers using Eview 10.1

Table 4.1 shows that the mean value of minimum wage is 1.920 while RGDPG had the highest mean value of 4.789. The standard deviation for all the variables shows low values and it implies that the variations are as low as possible, that is, the estimates are close to their true values. The skewness around their mean values gives negative values for real minimum wage, oil revenue, capital stock, firms' profits and technology; while labour productivity, seasonal dummy and RGDPG are positively skewed. For Kurtosis, the values for LP, SED, OILR, CAPS and FPROF are less than 3, meaning that the distribution is flat. Also, the distribution of TEC is long-tailed since the kurtosis value is equal to 3. The kurtosis values for MIW and RGDPG are greater than 3 and it means that the distribution is more peaked than normal. Furthermore, the probability value of the Jarque-Bera reveals that MIW, SED and RGDPG are not normally distributed since the probability value of Jarque-Bera is lower than 0.05. However, LP, OILR, CAPS, FPROF and TEC are normally distributed owing to the fact that the probability values are greater than 5%.

4.2. Unit Root Test

Augmented Dicker-Fuller (ADF) and Phillip-Perron (PP) tests of unit root were used to determine the stochastic traits of the time series and the results are presented in Table 4.2.

Table 4.2: Results of Unit Root Test

Variables	ADF Test		Philip-Perron Test	
	ADF statistics	**Order of Integration**	**PP statistics**	**Order of Integration**
Minimum wage (MIW)	-8.671***	I(1)	-8.452	I(1)
Real GDP	-26.355***	I(1)	-25.872***	I(1)
Oil Revenue (OILR)	-8.027***	I(1)	-8.109***	I(1)
Seasonal Dummy (SED)	-4.278***	I(1)	-4.479***	I(1)
Capital Stock (CAPS)	-5.097***	I(1)	-5.208***	I(1)
Productivity of Labour (PROL)	-6.837***	I(1)	-6.425**	I(1)
Firm profit (FPROF)	-4.599	I(1)	-5.139***	I(1)
Technology (TEC)	-6.837***	I(1)	-6.425**	I(1)

Source: Researchers' Computation using Eview 10.1

Both ADF and PP tests indicate that the time series are integrated of order one. In other words, the series are difference stationary. These findings support Kim and Schmidt (1993) assertion that timeseries are realization of stochastic processes.

4.3. Cointegration Test

To test for cointegration among the time series, Phillip-Quliaris cointegration framework was employed. For the null hypothesis of no cointegration to be rejected, the Phillip-Quliaris cointegration matrix must reveal at least one cointegrated relationship.

Table 4.3: Results of Philip-Quliaris Cointegration Test

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*	Remarks
MIW	-13.65209**	0.0323	-28.7421***	0.0022	Cointegrated
OILR	-20.55028***	0.0001	-27.1289**	0.0492	Cointegrated
SED	-11.13635**	0.0517	-39.0052***	0.0011	Cointegrated
CAP	-18.97623***	0.0016	-52.0186***	0.0000	Cointegrated
LPRO	-76.01704***	0.0000	-66.67750	0.0000	Cointegrated
FPROF	-4.096862	0.9434	-20.73914	0.9512	Not Cointegrated
TEC	-16.21856	0.0088	-45.62870	0.0000	Cointegrated
RGDP	-4.209910	0.9268	-20.19715	0.9637	Not cointegrated

Source: Estimated Using Eview 10.1

A relationship is said to be cointegrated if the probability of both tau-statistic and z-statistics are at least less than 0.05. This suggests that the time series are cointegrated. That is, there is long run relationship among labour productivity, minimum wage, and the control variables.

4.4. Error Correction Mechanism

This study primarily examined long-term relationships, utilising the error correction model to assess how the variables adapt to long-term equilibrium by considering short-term dynamics. The outcome of the Engel-Granger Error correction approach indicates that any differences seen in the short term between the cointegrated processes are rectified over time to achieve a state of stable equilibrium.

Table 4.4: Result of Error Correction Model Estimates

	Labour Productivity
Variables	Short run estimates
D(LPRO (-2))	0.07612***
D(RMW(-1))	0.015469***
D(RGDP(-1))	0.067240*
D(OILLR(-1))	-0.176585***
D(CAPS(-1))	0.050932***
D(SED(-2)	-0.003234
D(FPROF(-1))	-0.471436*
D(TEC(-1))	0.232927*
ECM(-1)	-0.29897**
R-sqaured	0.7123
Obs	31

Source: Estimated Using Eview 10.1

The error correction term (ECT) is negative and statistically significant for labour productivity equations. The statistical significance of the negatively signed error correction term (ECT) further indicates that there is co-integration among the variables under investigation. The ECT is -0.298 and it suggests that about 29.8% of last year's disequilibrium is corrected in the current year.

4.5. Test of Endogeneity and Instruments

Technically, endogeneity can be caused by measurement error, omitted variable bias as well as simultaneity. In this study, we suspect real minimum wage to be affected by measurement error. Usually, when a researcher suspects endogeneity problem, the Durbin-Wu-Hausman test is carried out to establish whether there is truly an endogeneity problem or not. The null hypothesis of no endogeneity is rejected if the p-value of all the statistics is less than 0.05. Otherwise, we accept that the variable(s) is/are truly exogenous. The result of Durbin-Wu-Hausman test is summarized in Table 4.5. From the results, the null hypothesis of no endogeneity is rejected. Thus, we conclude that there is endogeneity problem

.

Table 4.5: Endogeneity Test

Null: Variables are exogenous			Remarks
	Score/coefficient	p- value	
Durbin, χ^2	5.0289	0.0182	
Wu-Hausman, F-stat	4.699	0.0211	Reject H_0
Robust score, χ^2	3.9089	0.0406	
Robust regression, F-stat	4.3098	0.0259	

Source: Estimated Using Eview 10.1

Given that the null hypothesis of no endogeneity is rejected, Staiger and Stock (2017) noted that the option available to the researcher is to use instrumental variable (IV) procedure for the estimation. However, Staiger and Stock (2017) further provides that the researcher must be painstaking in choosing the instrument to be used. The requirement for the instruments to be used includes fulfilment of condition which requires the instrument to be uncorrelated with the error term. Second, there must be a (high) correlation between the instrument and the actual minimum wage. In order to ascertain the validity of the instruments, we utilized the Stock and Yogo (2005) test. In case the test statistics surpass the crucial threshold, the null hypothesis regarding the weak instrument could be rejected by the Wald test of significance.

Table 4.6: Test of Instrument Validity

	5%	10%	20%	30%
Relative bias	15.204	11.112	6.484	6.561
Nominal 5 per cent Wald test (size)-GMM	26.527	15.625	11.618	12.938
Overall F-statistics	3008.982 (p = 0.0000)			
Test of Over identifying Restriction				
	χ^2	Prob (χ^2)		
Sargan test-	0.078	0.598		
Hansen test	0.079	0.682		

Source: Estimated Using Eview 10.1

Table 4.6 shows that the p-value is 0.0000 and the overall F-statistic is 3008.982. At the 5% significance level, this implies that the null hypothesis of a weak instrument cannot be accepted. We performed a limiting test on over identification in order to corroborate our findings. The Sargan and Hansen test statistic which follow X^2 distribution are also reported. An instrument could be regarded as weak, and therefore not fit for use in the estimation if the Sargan and Hansen statistics are statistically significant. Since neither the Sargan nor the Hansen statistics show statistical significance, we can conclude that the selected variables are not weak. The technique used in this study is the generalized method of moments (GMM).

4.6. Impact of Minimum Wage on Labour Productivity

Table 4.7: Results on the Effect of Minimum Wages on Labour Productivity

LPRO	Baseline Regression		GMM Estimates	
	Coefficient	Standard error	Coefficient	Standard error
MIW	0.2742***	0.0449	0.2608***	0.0747
CAPS	-0.3099***	0.0949	0.2948***	-0.1199
SED	0.3259***	0.0596	0.3100***	0.1113
RGDP	0.6095***	-0.1745	0.5798**	-0.2509

OILR	0.2234***	0.0904	0.2125**	0.0962
TEC	0.4236***	0.0566	0.4029***	0.1002
FPROF	0.0278**	0.0120	0.0264**	0.0131
C	0.9876***	0.2531	0.9394***	0.3611
R^2	0.429		0.710	
DW	0.782		1.812	
Obs	31	31	31	31

Source: Estimated Using Eview 10.1

The model of labour productivity was estimated in line with objective 3. Identification and instrumentation were done using GMM due to endogeneity problem associated with MIW. However, we presented both the estimates for the baseline regression using OLS and that of the GMM. The results indicate that labour productivity is a positive function of MIW. The coefficients for MIW and SED are 0.2608 and 0.3100 indicating that raising MIW by one unit would raise labour productivity by 0.2608 units. Results also indicate that labour productivity would increase by 31% in the first two years following new minimum wage legislation. Also, the coefficient for firms' profit is 0.0264, suggesting that raising firms' profit byone unit could raise labour productivity by 0.0264 unit. This is intuitive in the sense that when a firms' profit increases, it provides more incentives for workers which will in turn have positive effect on workers' productivity. Other coefficients include 0.2948 for CAPS, 0.5798 for RGDP, 0.2125 for OILP and 0.4029 for TEC.

4.7. Post Estimation Tests

4.7.1. Serial Correlation Table 4.8: Breusch-Godfrey Serial Correlation LM Test

	LP	
Test Statistic	Value	Probability
F-statistic	0.6100	0.5531
Obs*R-squared	1.0003	0.3219

*Null Hypothesis: The residuals are not serially correlated

Source: Estimated Using Eview 10.1

Table 4.8 shows the result of the Breusch-Godfrey Serial Correlation LM Test. The test hypothesis is null and states that residuals are not statistically correlated. This hypothesis cannot be rejected in all the models. Thus, we conclude that there is no case of serial correlation in the residual of all the estimated models.

4.7.2. Heteroscedasticity Test

Table 4.9: Heteroskedasticity Test: ARCH

	LP	
Test Statistic	Value	Probability
F-statistic	0.0890	0.9351
Obs*R-squared	0.4978	0.6312

*Null Hypothesis: The residuals are homoscedastic

Source: Estimated Using Eview 10.1

Table 4.9 presents the result of the heteroskedasticity test. The heteroskedasticity test was implemented using the ARCH test approach. It can be seen from Table 4.9 that there is no heteroskedasticity in the estimated models. This follows from the fact that the probability value ofthe F-statistic and Obs*R-squared for all models are greater than 0.05 in all cases. Thus, the null hypothesis that the residuals are not heteroskedastic stands accepted. The absence of heteroskedasticity and autocorrelation indicate that the t-statistics on which hypothesis testing were based are indeed unbiased, consistent, and efficient. They are therefore fit for inferences.

4.8. Discussion of Findings

An under explored component of minimum wage law in Nigeria is the relationship between minimum pay and workforce productivity. Our research revealed a positive correlation between minimum wage and worker productivity. The increase in minimum wage leads to even greater productivity gains, both at the firm level and across the entire economy. For instance, Ehrenberg and Smith (2019) found that at the

organisational level, employees may be incentivized to exert greater effort. Additionally, employees may choose to extend their tenure with their firm, therefore acquiring significant expertise and fostering a culture of productivity-boosting training between employers and employees. Minimum wages can lead to the replacement of less productive enterprises with more productive ones at the overall level, while also causing surviving firms to become more efficient. In Canada, Brochu and Green (2013) discovered that the implementation of minimum wage laws may result in a decrease in the rate at which young people with poor education voluntarily leave their jobs or are laid off in the year following an increase in the minimum wage. Dube, Lester, and Reich (2017) documented a comparable outcome in the United States. According to them, the increase in productivity might result from a decrease in employee turnover, which in turn leads to improved training efficiency among workers. Doucouliagos and Stanley (2019) proposed an alternative explanation for productivity improvement, suggesting that it may result from increased efficiency in capital utilisation following pay increases. According to their perspective, gains in productivity may occur when employment decreases as a result of the minimum wage. This happens when businesses replace labour with capital and adopt industrial methods that need more capital. Additionally, they deduce that an increase in minimum wage facilitates the replacement of less productive enterprises by more productive ones, while also compelling existing firms to enhance their competitiveness.

5. Conclusion and Policy Recommendations

This study examined the impact of minimum wage on labour productivity in Nigeria, taking into account the current situation. The investigation was conducted utilising the GMM framework. We employed the system GMM methodology to address the issue of endogeneity related to the wage rate. However, before constructing the long-run model, statistical features and the time series aspects of the data were investigated. In order to assess the time series characteristics, we conducted a unit root test utilising the Augmented Dicker-Fuller and Phillip-Perron techniques. The obtained results imply that the time series are manifestations of stochastic processes. Subsequently, an analysis was conducted to determine the cointegrating features of the time series in order to establish the presence of a long-term link among the variables. The findings

derived from the Phillip-Qualiaris approaches indicate that the time series exhibit cointegration and demonstrate a long-term link between the variables. In a similar vein, the findings also indicate that an increase in the minimum wage results in a corresponding rise in workers' productivity. From the findings obtained, the study concludes that upward review of minimum wage enhances productivity gain both in the year of announcement and in the long run. Based on the findings of this study, it is recommended that federal government should use minimum wage review as a policy instrument for reducing wage dispersion and to channel productivity gains into higher wages. In most developing economies, low wages or wages below the marginal product of labour dominates the economy. This is accentuated by scarcity of well-paying jobs. Thus, minimum wage could be used to correct markets imperfections where equilibrium wages settled below marginal product of labour, perhaps, due to weak bargaining power of its labour force. secondly, employers of labour should adopt minimum wage as tool for raising the demand for their output and productivity of labour. Firms are therefore encouraged to focus on paying efficiency wages, since its more rewarding than otherwise.

References

Akerlof, G. (1982). Labor contracts as partial gift exchange. *Quarterly Journal of Economics, 97,* 543-569.

Aras, E. (2020). The effect of minimum wage level on labour efficiency: An analysis on OECD cou0ntries. *Journal of International Management, Education and Economics Perspectives, 3*(2), 1-11.

Bossler, M., Gurtzgen, N., Lochner, B., Betzl, U., & Feist, L. (2020). The German minimum wage: Effects on productivity, profitability, and investments. *Jahrbucher fur Nationalokonomie und Statistik, 240*(2-3), 321-350.

Brochu, P. & Green, D., A. (2015). The impact of minimum wages on quit, layoff and hiring rates, *IFS Working Paper* 06/15

Collins, C. (2017). Raising the minimum wage: An economic gain. *The Park Place Economist, 25*(1), 130-132.

Coviello, D., Deserranno, E., & Persico, N. (2022). Minimum wage and individual worker productivity: Evidence from a large U.S retailer. *Journal of Political Economy, 130*(9), 2315-2360.

Croucher, R., & Rizov, M. (2012). The impact of minimum wages on quit, layoff and hiring rates.

Doucouliagos, H.; and Stanley, T.D. (2019). Publication selection bias in minimum wage research? A meta-regression analysis. *British Journal*

of Industrial Relations, 57(2), 406 426.

Dube, A., Lester, T., W. & Reich, M. (2017). Minimum wage shocks, employment flows and labour market frictions, *IRLE Working Paper* No. 127-12.

Ehrenberg, R. G. & Smith, R. S. (2019). *Modern Labor Economics: Theory and Public Policy*, 11th Edition, Pearson.

Fajana, F. O. (1999). Employment and wage changes in the Nigerian manufacturing industry. *The Nigerian Journal of Economics and Social Studies*, 31(3), 363-374

Fapohunda, T. M., Atika. S. O. & Lawal, I. O. (2018). Minimum wage implementation and management in a post-recession economy: The Nigerian experience. *European Scientific Journal, 13*(7), 18 -35.

Folawewo, A. O. (2007). *Macroeconomic effects of minimum wage in Nigeria: A general equilibrium analysis.* Paper presentation at the CSEA Conference 2007: Economic Development in Africa, Oxford, 19 - 20 March

Griffith, D. A., Hoppner, J. J., Lee, H. S, & Schoenherr, T. (2017). The influence of the structure of interdependence on the response to inequity in buyer-supplier relationships. *Journal of Marketing Research, 54*(1), 124-137.

Harasztosi, P. & Lindner, A. (2019). Who pays for the minimum wage? *American Economic Review*, 109(8), 2693-2727.

International Labour Organization (2023). *Minimum wages and productivity: A brief review of the literature.* https://www.ilo.org/global/topics/wges/minimum-wages/monitoring/WCMS_476157/lang--en/index.htm

International Labour Organization (2019). *National minimum wage (Amendment) Act 2019: Explanatory memorandum.* https://www.ilo.org/

Isuku, E. J., Nwafor, E. I., & Olaniyi, O. A. (2021). Wage rate determination and labour productivity in Southwest, Nigeria. *Nigerian Journal of Industrial Education and Labour Relations, 5*(1&2), 114-129.

Katz, L. F., & Krueger, A. B. (2016). The effect of the minimum wage on the fast food industry. *Industrial and Labor Relations Review*, *60*(1), 6-21.

Kim, K., & Schmidt, P. (1993). Unit root tests with conditional heteroskedasticity. *Journal of Econometrics, 59*, 287-300.

Ku, H. (2020). *Does minimum wage increase labour productivity? Evidence from Piece Rate Workers*. Mimeo.

Mayneris, F., Sandra P., & Zhang, T. (2018). Improving or disappearing: Firm-level adjustments to minimum wages in China. *Journal of Development Economics*, 135, 20-42.

O'mahony, M., & Timmer, M.P. (2019). Output, input and productivity measures at the industry level. *Economic Journal*, 129(538), F374–F403.

Ojo. O. (2008). Trade unionism in an austere economy: The Nigerian experience. *The Manpower Journal*, 17(2), 190-221

Olanrewaju, S. M. (2021). Wage structures and industrial productivity in Nigeria. *Journal of Research in Humanities and Social Science, 9*(7), 19-25.

Owoye, O. (2014). Wage determination and strike activity in Nigeria. *Journal of African Economies,* 13(3), 447–480.

Pigou, A. C. (1937). A minimum wage for agriculture. *The Nineteenth Century,* (74), 1167-1184.

Reserve Bank of Australia (2023). *Productivity*. https://www.rba.gov.au

Riley, R., & Bondibene, C. (2015). The impact of the national minimum wage on UK businesses. *Report to the Low Pay Commission. National Institute of Economic and Social Research and Centre for Macroeconomics.*

Roderto, A., & Rodrigo, F. (2018). Minimum wage and productivity: Evidence from Chilean manufacturing plants. *Economic Development and Cultural Change, 67*(1), 193- 224.

Senasi, V. (2020). Workers' perception towards minimum wage impacts on labour productivity in Malaysia. *American Journal of Humanities and Social Sciences Research, 4(11), 238-248.*

Staiger, D., & Stock, J.H. (1997). Instrumental variables regression with weak instruments. *Econometrica, 65*(3), 557-586.

Stock, J. H., & Yogo, M. (2005). Testing for weak instruments in linear IV regression, in (Andrews, D.W.K., and J.H. Stock Eds.). *Identification and inference for econometric models: Essays in honour of Thomas Rothenberg.* Cambridge University Press.

Trenovski, B., Kozheski, K., Tasheska, B., & Peovski, F. (2021). The minimum wage impact on labour productivity: The case of selected South-Eastern European countries. *Management Research and Practice, 13*(3), 32-42.