



Wage Rate, Inflation and Labour Productivity in Nigeria: Evidence from an ARDL Bounds Testing Approach

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DOI: <https://doi.org/10.68050/JAMS.2026.677>

Received: 28 September 2026; Accepted: 05 October 2026; Published: 13 October 2026

ABSTRACT

Although Nigeria's statutory minimum wage has been significantly increased since 2011, there is limited understanding of how minimum wage increases affect labour productivity or contribute to inflation. This study applies ARDL(1,2,3,3,3) bounds-testing to statistical data for 1981-2024 obtained from the National Bureau of Statistics and the Statistical Bulletin of the Central Bank of Nigeria to link the statutory minimum wage with labour productivity measured as labour force participation rate and to link minimum-wage growth with consumer price inflation in another autoregressive distributed lag model in log inflation. The bounds F-statistic (13.94) is above the 1% upper bound and the t-test on the lagged dependent variable is inconclusive, meaning that evidence of a long-run relationship is supporting but not decisive; the error correction term is -0.136 ($p = 0.0408$), indicating slow adjustment. Coefficients are semi-elasticities: a 10% increase in the minimum wage results in participation increasing by approximately 0.043 percentage points in the year of the change and 0.082 percentage points in the following year, but decreasing by 0.076 percentage points in the long run (which is statistically indistinguishable from zero at $p = 0.6014$). There is no significant relationship between the growth in minimum wages and inflation (joint $p = 0.1423$). The results provide no evidence that minimum-wage increases permanently affect labour productivity – though caution should be exercised when interpreting the results, given the step pattern of the wage series and the proxy for the participation rate.

Keywords: Efficiency Wage Theory, Statutory Minimum Wage, Cost-Push Pressure, Real Wage, Labour Productivity

INTRODUCTION

But labour productivity has not gone along the same trajectory as organised labour in Nigeria, which has achieved successive increments for the national minimum wage from ₦18,000 in 2011 to ₦30,000 in 2019 and ₦70,000 in 2024. Productivity is a key factor influencing living standards and long-term growth (Babasanya et al., 2020) – if this is not improved, firms' unit labour costs will increase, and over time the economy as a whole will be put under inflationary pressures. It is not inevitable that there is a wage–productivity connection. Efficiency wage theory suggests that above market-clearing wage rates will increase effort, because there is more to lose from quitting and more reason to stay with an above-market-paying firm (Shapiro & Stiglitz, 1984), though evidence on this is mixed. Productivity increased following minimum-wage hikes at a U.S. retailer absent higher resignations (Coviello et al., 2021), and among workers closer to the minimum-wage (Ku, 2020), while German firms did not respond with either higher productivity or increased investment (Bossler et al., 2018), and Chinese firms either increased output per worker or pulled out of the market (Mayneris et al., 2018).

This relationship has not been tested in any Nigerian study using national wage and productivity data. There are studies that have focused on human capital (Okowa & Vincent, 2019; Ologbo et al., 2024) and political instability (Mike et al., 2024) as determinants of productivity but not a study that has focused on the wage itself. Recent evidence is sceptical: Onwuka et al. (2025) do not detect any significant minimum-wage effect on the Nigerian labour market after accounting for the effects of inflation and population growth and Kışlacık and Ecevit (2026) confirms efficiency wage theory for Türkiye using ARDL method but finds that the productivity pay-off is not just determined by the level of the wage.

The second gap is related to the feedback from wages to prices. Wage growth outstripping productivity and capital investment increases unit costs, part of which is shifted on to the consumer. Alaloul et al., 2021, followed this cost-push channel in Malaysian construction, where the construction workers were paid higher but the real wage did not keep up with the inflation. The Nigerian studies mostly focus on productivity through manufacturing output or GDP (Afolabi & Laseinde, 2019; Ogundipe & Olarewaju, 2020), and wage–productivity studies are from Malaysia, China, Germany, the United States and the United Kingdom (Alaloul et al., 2021; Bossler et al., 2018; Coviello et al., 2021; Mayneris et al., 2018; Rizov et al., 2016), and their relevance to the Nigerian context of wage bargaining and inflation is uncertain.

The study thus has two goals, each of which uses a different model. The first is an attempt to measure the short-term and long-term relationship between the statutory minimum wage and the labour force participation rate, an indicator of labour productivity, after controlling for inflation, real GDP and population growth (Model 1, Equation 2). The second is to examine how minimum-wage growth is related to consumer price inflation, in a separate model with inflation as the dependent variable (Model 2, Equation 6). The dissertation underlying the paper included a specification of a mediation model (inflation mediates the effect of wages on productivity) which the paper does not estimate.

The study makes three contributions. First, it is one of the first to use ARDL bounds testing procedure for the Nigerian wage–productivity relationship, spanning three last minimum-wage reviews for more than 44 years, which distinguishes between short-run and long-run association of wage–productivity relationship rather than lumping both relationships into one coefficient. Second, it applies the efficiency wage analysis, which is mostly used in advanced and middle-income economies, to a labour market characterized by high inflation, a large informal sector and wages that are politically determined. Third, it sheds light on the ongoing minimum wage debate in Nigeria, including by conducting an independent assessment of minimum wage changes on inflation.

LITERATURE REVIEW

Theoretical Review

This study is based on the efficiency wage theory which is one of the exceptions to the competitive prediction of wage convergence to the market-clearing level (Shapiro & Stiglitz, 1984). Any payments above that level may be profitable, since higher wages make it more expensive for workers to lose their jobs and increase their effort, and decrease turnover and monitoring costs. Highly-paid employees are also able to afford necessities without resorting to borrowing and businesses that provide a high wage bill are also able to keep the trained employees that they have invested in, which may offset the wage bill in terms of productivity.

The second concern of the study is based on a limitation of the theory. If inflation outstrips a nominal increase, the real wage drops and the incentive effect diminishes or even goes the other way: workers can work harder in order to maintain an income that still counts; or withdraw effort, arrive late, move to a competitor or quit. The



theory does not predict a dominance of one response over the other, and it is an empirical question. In Nigeria it means that at least wages should rise in line with inflation, and that far apart wage reviews will be ineffective before the next review.

The competitive point of view gives a contrast. An above-market wage (legislated or bargained) decreases the demand for labour and the productivity of workers who still have jobs would reflect the existing capital stock and not the wage increase (Card & Krueger, 1994, did not find that an increase in the minimum wage in New Jersey lead to a loss in employment). The cost-push framing here is based on the view that wage rises above productivity growth will show up as a reduction in the demand for labor or as an increase in the price of the good, but not necessarily in the quantity produced per worker.

Empirical Review

Data from the worker level is the strongest evidence in favour of the efficiency wage prediction. Coviello et al. (2021) reported increases in individual productivity at a large US retailer without an increase in resignations, and Ku (2020) reported that gains to piece-rate workers were restricted to the workers who faced the larger increase in the minimum wage, indicating that the incentive effect is strongest where the wage bite is strongest. Both studies assess productivity at the individual level, and both are from contexts where inflation does not rapidly reduce the real value of a wage increment, as in Nigeria.

Other evidence is less robust. However, Bossler et al. (2018) reported that the introduction of the minimum wage in Germany had no impact on firms' productivity, investment, or business expectations; they argue that this is due to the fact that minimum wages already existed and that employment protection was robust. Mayneris et al. (2018) reported that Chinese companies responded either by increasing the productivity of their labor, or by exiting the market, depending on their ability to adjust, not on the magnitude of the adjustment. These studies jointly indicate that the productivity impact is not solely determined by factors within the framework of the efficiency wage model but also by other factors, such as labour market institutions, capital availability and the rate of the real-wage erosion due to the rate of inflation, which plays a crucial role in this paper.

More specifically, Nhegele et al. (2019) identified minimum wages, domestic investment, inflation and government spending as jointly influencing the employment in developing economies, among which inflation is one of the effects of minimum wages. Rizov et al., (2016) identified industry and firm size differences in firm's responses to the National Minimum Wage for the United Kingdom and Britain et al., (2016) showed that wages and productivity co-move only if collective bargaining, wage enforcement and skills systems reinforce the links, which is arguably weak in Nigeria.

However, Ajibola and Oraka (2020) in Nigeria estimated the regression of youth unemployment for the period 1991-2019 and observed that there was a significant minimum-wage effect and no inflation effect, meaning that the minimum wage should be based on the market rather than political negotiation. According to Babasanya et al. (2020), labour force growth and national savings were the determinants of productivity in manufacturing while wages were not and Afolabi and Laseinde (2019) discovered that the factors that affected the productivity of manufacturing were capital, infrastructure and unstable operating environment but not wages. Alaloul et al. (2021) presented the case of Malaysia, where despite frequent nominal wage increases, real wages declined as a result of inflation. Their direction of causation is from prices to wages – the opposite of the second question of this study – but both are aspects of one cost push mechanism that sees a wage-driven price increase eroding the price increase that brought it about, and no study has modelled this for Nigeria.

Overall, the evidence is consistent with the possibility that wage-setting in Nigeria has been ahead of the level of capital and productivity to support it, which this study examines.

The interpretation of the institutions is of importance. Nigeria's minimum wage is politically negotiated between the government and organised labour without taking firms' productivity into account, and the negative youth-unemployment effect as observed by Ajibola and Oraka (2020) corroborates this politically negotiated wage-setting. From an efficiency wage perspective, an increase negotiated primarily to keep up with the rate of inflation would be expected to have at most an initial productivity response, followed by a decline when prices catch up, as examined in Section 4. Similarly, Mike et al. (2024) also indicate that the issue of political instability has an impact on the productivity of the Nigerian economy because the issue extends beyond the stability of the wage policy.

Recent studies draw a finer line. Kışlacık and Ecevit (2026) find that productivity in Türkiye increases with an increase in real wages with ARDL and Toda–Yamamoto methods, but a longer work time reduces the positive impact. The results presented here replicate those of Onwuka et al. (2025) for Nigeria over 1991-2023, which show that the minimum wage does not impact informal employment, rather population growth and inflation do, and suggest that this should be combined with demographic and price stability policies. The authors of Ezeanyagu et al. (2025) obtain a negative association between labour force participation, which serves as a proxy for productivity in the current study, and Nigerian growth in 1990-2023, and a positive association between capital formation and growth. The results by Agu et al. (2026) also support the positive relationship between GDP growth and Nigeria productivity with no long run effect of public health expenditure, while the negative long run coefficient of GDP reported in the results below indicates that the nature of growth has more impact than growth per se. However, Okpala et al. (2026) conclude that no transmission to transformational productivity gains in Nigeria, Kenya or Ethiopia over 2000-2022, and Okechukwu and Adesanya (2025) conclude that Nigeria's inflationary environment limits the mediating effect of productivity on the inflation-savings-growth nexus.

Methodologically, the best evidence (Coviello et al., 2021; Ku, 2020) is on the worker level, in lower inflation and higher income countries, while the worst (Bossler et al., 2018; Mayneris et al., 2018) is on the firm level, in countries with easy absorption of the wage floor or in countries where firms could not move wages. Nigeria does not align with either of these: inflation in the country peaked at over 70 per cent, and the minimum wage is not determined based on productivity benchmarks but through a political negotiation. The ARDL bounds approach employed here is developed for that purpose.

METHODOLOGY

Model Specification

Two separate models are estimated in the study. Model 1 is a model of the relationship between labour productivity and the statutory minimum wage, with inflation, real GDP and population growth as controls. The labour force participation rate is used as a proxy for productivity (LPR) as consistent time series of output per hour or per worker is not available for Nigeria for the 1981–2024 period. Wage (LWGR) is a nominal series which is the base-10 logarithm of the statutory national minimum wage in naira per month and is different from the average earnings and real wage (Table 2). Inflation (INFR) is the annual CPI inflation rate, real GDP (LGDP) is in base-10 logarithms and population growth (POPGR) is an annual percentage rate (Table 1). General form and estimating form: 1 and 2, respectively, where $t = 1981, \dots, 2024$:

$$LPR_t = f(LWGR_t, INFR_t, LGDP_t, POPGR_t) \quad (1)$$



$$\text{LPR}_t = \alpha_0 + \beta_1 \text{LWGR}_t + \beta_2 \text{INFR}_t + \beta_3 \text{LGDP}_t + \beta_4 \text{POPGR}_t + \varepsilon_t \quad (2)$$

where α_0 is the intercept, β_1 to β_4 are coefficients and ε_t is the error term. An ARDL model (Equation 3) is estimated for Equation 2, with the maximum number of lags set to four (2,500 models) and the optimal combination of lags (1,2,3,3,3) of LPR, LWGR, INFR, LGDP and POPGR selected by the Akaike criterion, providing 41 observations (1984–2024). The sum of the ARDL coefficient of each regressor, divided by 1 minus the autoregressive coefficient (Equation 4), represents each long-run effect.

$$\text{LPR}_t = c_0 + \phi_1 \text{LPR}_{t-1} + \sum_{j=0}^2 \theta_{1j} \text{LWGR}_{t-j} + \sum_{j=0}^3 \theta_{2j} \text{INFR}_{t-j} + \sum_{j=0}^3 \theta_{3j} \text{LGDP}_{t-j} + \sum_{j=0}^3 \theta_{4j} \text{POPGR}_{t-j} + u_t \quad (3)$$

$$\theta_k = (\sum_j \theta_{kj}) / (1 - \phi_1), \quad k = 1, \dots, 4 \quad (4)$$

Since LWGR is in base-10 logarithms and LPR is in per cent, θ is the change in participation, in percentage points, for a tenfold change in the wage. A $g\%$ wage change therefore has an effect of about $\theta \times \log_{10}(1 + g/100)$, that is $\theta \times 0.0043$ for 1% and $\theta \times 0.0414$ for 10% (Equation 5).

$$\text{Effect on LPR (percentage points) of a } g\% \text{ change in the wage} \approx \theta \times \log_{10}(1 + g/100) \quad (5)$$

Model 2 relates to the second goal. Because inflation is stationary in levels while the wage, participation and GDP are $I(1)$ (Table 5), the first differences (growth rates for the logged series) of these variables are included in the equations, and inflation enters as a natural logarithm to reduce the skewness and spikes of the 1980s and 1990s. The Akaike criterion was used to select the lags (2,3,3,3,0) and the long-run effect of wage growth is specified in Equation 7.

$$\ln \text{INFR}_t = \gamma_0 + \sum_{i=1}^2 \rho_i \ln \text{INFR}_{t-i} + \sum_{j=0}^3 \delta_{1j} \Delta \text{LWGR}_{t-j} + \sum_{j=0}^3 \delta_{2j} \Delta \text{LPR}_{t-j} + \sum_{j=0}^3 \delta_{3j} \Delta \text{LGDP}_{t-j} + \delta_4 \text{POPGR}_t + v_t \quad (6)$$

$$\Phi W = (\sum_{j=0}^3 \delta_{1j}) / (1 - \rho_1 - \rho_2) \quad (7)$$

A cost push channel implies that $\Phi W > 0$. ΦW is based on the revision episodes, since $\Delta \text{LWGR} = 0$ in non-revision years. Model 2 is a reduced-form model without any producer-cost data, and is not thought of as a true structural cost-push model. An error-correction model (ARDL bounds) in levels of inflation was also attempted, but it produced an error-correction term less than minus one, and did not pass the specification and serial-correlation tests (available on request).

Estimation Technique

There are two stages of estimation. The order of integration is first determined using the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests (Dickey & Fuller, 1979; Phillips & Perron, 1988), so as to avoid the problem of spurious regression and to rule out $I(2)$ series for which the bounds test is not applicable. Lags in the ADF tests are selected by the Schwarz criterion (with a maximum of nine lags); the Bartlett kernel is adopted in the PP test; and p-values are MacKinnon's (1996) asymptotic values. The ADF equation is:

$$\Delta Y_t = \alpha_0 + \gamma Y_{t-1} + \sum_{i=1}^p \gamma_i \Delta Y_{t-i} + \varepsilon_t \quad (8)$$

with $H_0: \gamma = 0$ (unit root) against $H_1: \gamma < 0$ (stationarity); the 5% critical value is about -2.93 . Second, the conditional error-correction form in Equation 9 is bounded by the series mix $I(0)$ and $I(1)$, the ARDL bounds

test of Pesaran et al. (2001) is adopted, and this is suitable for small samples.

$$\Delta LPR_t = \alpha_0 + \beta_1 LPR_{t-1} + \beta_2 LWGR_{t-1} + \beta_3 INFR_{t-1} + \beta_4 LGDP_{t-1} + \beta_5 POPGR_{t-1} + \sum \alpha_{1i} \Delta LPR_{t-i} + \sum \alpha_{2i} \Delta LWGR_{t-i} + \sum \alpha_{3i} \Delta INFR_{t-i} + \sum \alpha_{4i} \Delta LGDP_{t-i} + \sum \alpha_{5i} \Delta POPGR_{t-i} + \varepsilon_t \quad (9)$$

The F-test on the lagged levels ($k = 4$) is performed to accept or reject the null of no level relationship: it is rejected if its value is above the upper critical value, accepted if it is below the lower critical value, and inconclusive if it is in between. The statistic is compared to the asymptotic.

Case III values of Pesaran et al. (2001) and small-sample values simulated for this sample and lag structure (20,000 replications). As in Pesaran et al. (2001), McNown et al. (2018) and Sam et al. (2019), the t-test on the lagged dependent variable and the F-tests on the lagged regressors are also reported; cointegration is conclusive only when all three tests reject, and supportive when only the F-tests reject. The speed of adjustment is provided by the error-correction form (Equation 10):

$$\Delta LPR_t = \alpha_0 + \sum \alpha_{1i} \Delta LPR_{t-i} + \sum \alpha_{2i} \Delta LWGR_{t-i} + \sum \alpha_{3i} \Delta INFR_{t-i} + \sum \alpha_{4i} \Delta LGDP_{t-i} + \sum \alpha_{5i} \Delta POPGR_{t-i} + \emptyset ECT_{t-1} + \varepsilon_t \quad (10)$$

where if a long-run relationship exists then $\emptyset$ should be negative and significant. In this form, the ARDL coefficient of a contemporaneous change is unchanged, the ARDL coefficient of the j -th lagged change is $-\sum_{j=1}^k \text{ARDL}(j)$, and $\emptyset = \sum \text{ARDL} - 1$; the long-run standard errors are calculated using the delta method. At 5% significance level unless specified, both models are tested for Ramsey RESET (squared fitted values), Breusch–Godfrey (two lags), Breusch–Pagan–Godfrey tests, ARCH(1) and Jarque–Bera tests as well as CUSUM and CUSUM of squares stability tests.

Measurement of variables and data sources

Data for the period 1981 to 2024 were retrieved from the National Bureau of Statistics for participation rate and the population growth, while minimum wage, inflation and GDP data were retrieved from the Central Bank of Nigeria Statistical Bulletin (Central Bank of Nigeria, 2024; National Bureau of Statistics, 2024). These sources give consistent annual series for all variables over a period that spans the 2011, 2019 and 2024 reviews. Definitions, units, transformations and sources are summarised in Table 1.

Table 1: Variable Definitions, Units, Transformations and Data Sources

Variable	Definition and unit	Transformation in the models	Source
LPR (labour productivity proxy)	Labour force participation rate, per cent of the working-age population [18-60]. A proxy: it is not output per worker or output per hour	None (level, percentage points)	National Bureau of Statistics (2024)
LWGR (wage)	Statutory national minimum wage, nominal, naira per month. Changes only when the minimum wage is revised	Logarithm to base 10 of the naira amount	Central Bank of Nigeria (2024)
INFR (inflation)	Annual percentage change in the headline all-items consumer price index (CPI), per cent	Level (Model 1); natural logarithm, ln INFR (Model 2)	Central Bank of Nigeria (2024)
LGDP (output)	Real gross domestic product, naira billion at	Logarithm to	Central Bank

	constant 2010 basic prices	base 10	of Nigeria (2024)
POPGR(population)	Annual population growth rate, per cent	None (level, percentage points)	National Bureau of Statistics (2024)
Real minimum wage (robustness only)	Nominal statutory minimum wage divided by a CPI index (1981 = 100) built by chain-linking INFR	Logarithm to base 10 (LRMW)	Derived by the authors from the series above
Average wage (robustness only)	Wage series WGR	Logarithm to base 10(LAW); deflated version LRAW	National Bureau of Statistics (2024)

Source: Compiled by the authors, 2026.

Table 2 provides a breakdown of four wage concepts. The primary one is the legal minimum wage, which is a nominal bottom limit. It is neither the average wage (which also fluctuates annually with pay settlements) nor a real wage (which deflates pay by CPI), and there is no consistent economy-wide series of earnings for informal and self-employed workers for the period 1981-2024. The minimum wage rose from ₦125 in 1981, where it stayed until 1988, to ₦70,000 in 2024, with revisions in only 17 of 43 years (1989, 1992–2001, 2007, 2011–2013, 2019 and 2024; Figure 1). There is no universal indication, rather, that its coefficients represent associations with statutory revisions, rather than with general wage movements. The minimum wage in 2024, deflated by a price index chain-linked from the inflation rates (1981 = 100), is approximately valued at ₦52 in 1981 prices, which is about 58% lower than the minimum wage in 1981. Model 1 is re-estimated with this real minimum wage as well as with another nominal wage series and its deflated version (Table 13) as sensitivity checks, as they are constructed using the inflation series.

Table 2: Wage Concepts and Their Use in This Study

Concept	What it measures	How it moves	Use in this paper
Statutory minimum wage	Legal floor on monthly pay, fixed by national legislation; nominal naira	Step series: revised in 17 of 43 years, unchanged otherwise	Main wage variable (LWGR) in Models 1 and 2
Nominal wage rate (average)	Average earnings of employees in current naira; not a legal floor	Changes continuously with pay settlements and inflation	Robustness only (series WGR)
Real wage	Nominal wage deflated by the CPI; purchasing power of pay	Falls when inflation outpaces revisions	Robustness: real minimum wage (LRMW) and real average wage (LRAW)
Economy-wide wage	Average earnings of all workers, including informal and self-employed	Not observed as a consistent annual series for Nigeria	Not available; treated as a limitation (Section 5.3)

Source: Compiled by the authors, 2026.

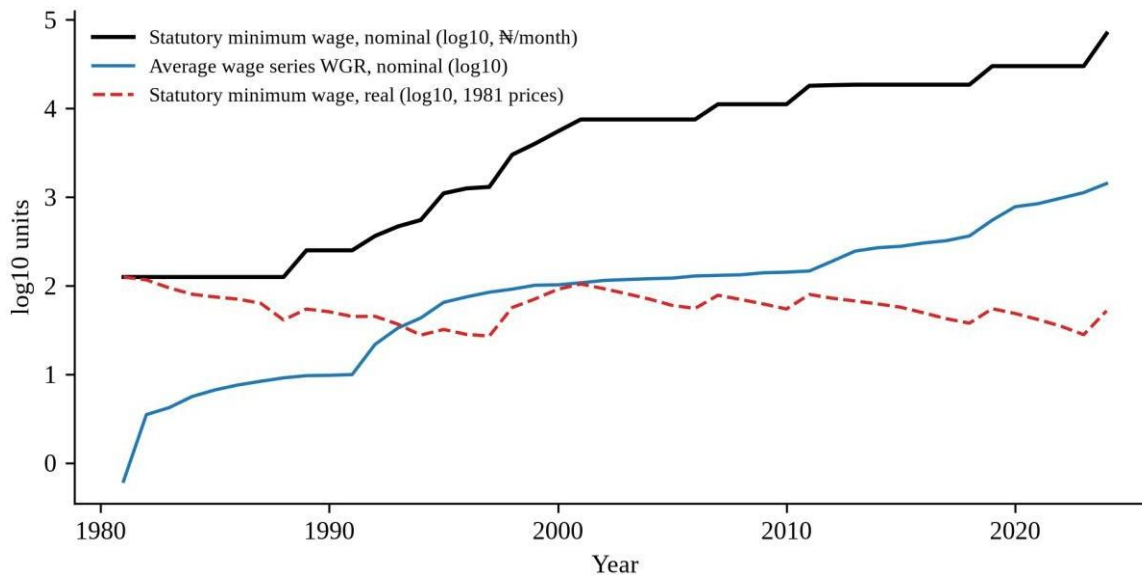


Figure 1: Alternative Wage Measures, 1981–2024

Source: Authors' computation, 2026, from the statutory minimum-wage series, the CBN inflation series and the average-wage series WGR. The real minimum wage uses a CPI index built from INFR (1981 = 100).

A-Priori Expectations

In line with the efficiency wage theory, the minimum wage is predicted to increase productivity ($\beta_1 > 0$). The short run effect of inflation is unclear, workers can try to work longer to compensate for loss of purchasing power but can also choose to work less, the long run effect should be negative as loss of purchasing power ($\beta_2 < 0$). Real GDP is likely to increase productivity through

increasing capital and infrastructure ($\beta_3 > 0$) and population growth can increase the supply of labor, although it might also increase the demand for labor faster than the supply of labor or infrastructure, meaning that population growth would lead to Malthusian congestion (β_4 ambiguous, may be negative in the long run). Positive signs are anticipated on the variables representing cost-push (minimum-wage growth), demand pressure (real GDP growth) and population growth; and negative sign on change in productivity for Model 2 (Table 3).

Table 3: A Priori Expectations for Models 1 and 2

Model and variable	Transformation	Expected sign	Rationale
Model 1: LWGR	log10 of minimum wage	Positive	Efficiency wage theory: higher pay raises effort and retention
Model 1: INFR	Level (per cent)	Negative (long run); ambiguous (short run)	Inflation erodes real earnings; short-run coping behaviour is ambiguous
Model 1: LGDP	log10 of real GDP	Positive	More capital and infrastructure per worker
Model 1: POPGR	Level (per cent)	Ambiguous; negative if congestion dominates	Larger labour force versus pressure on jobs and infrastructure
Model 2: Δ LWGR	Change in log10 of minimum wage	Positive	Cost-push: higher labour costs are passed into prices
Model 2: Δ LPR	Change in participation rate (points)	Negative	Productivity gains offset unit-cost pressure



Model 2: Δ LGDP	Change in log10 of real GDP	Positive	Demand-pull pressure in growth years
Model 2: POPGR	Level (per cent)	Positive	Faster population growth raises demand for goods and housing

Source: Compiled by the authors, 2026.

RESULTS AND DISCUSSION

Pre-Estimation Results

Descriptive statistics are provided in Table 4. The participation rate was normally distributed (Jarque–Bera $p = 0.141$) with a narrow distribution (62.62 to 73.67 per cent; mean 68.01; standard deviation 3.71). The log minimum wage (mean 3.47, standard deviation 0.91) ran from 2.10 (₦125) to 4.85 (₦70,000), and its negative skew (−0.43) reflects the long period at ₦125. The most dispersed series was inflation (5.39 – 72.84, mean ~19.2, standard deviation 16.12), which was right-skewed (1.85) and non-normal ($p < 0.0001$) due to the high inflation periods in the late 1980s and 1990s. The least variable were real GDP and population growth (standard deviations 0.24 and 0.23, respectively), though population growth was not normal at 5% ($p = 0.0297$).

Table 4: Descriptive Statistics, 1981–2024

Statistic	LPR	LWGR	INFR	LGDP	POPGR
Mean	68.013	3.473	19.225	4.541	2.612
Median	67.635	3.875	13.13	4.503	2.655
Standard deviation	3.714	0.907	16.119	0.243	0.228
Minimum	62.62	2.097	5.39	4.205	2.09
Maximum	73.67	4.845	72.84	4.899	3.07
Skewness	0.198	−0.428	1.854	0.151	−0.944
Kurtosis	1.593	1.633	5.495	1.415	3.525
Jarque–Bera	3.918	4.774	36.603	4.771	7.033
Jarque–Bera probability	0.141	0.0919	<0.0001	0.0921	0.0297
Observations	44	44	44	44	44

Source: Authors' computation, 2026. LPR, INFR and POPGR are in per cent; LWGR and LGDP are base-10 logarithms.

In Table 5, participation, the wage and GDP have unit roots in levels (ADF $p = 0.7423$, 0.9109 and 0.7636; PP $p = 0.5848$, 0.9053 and 0.9763) and are stationary in first differences (ADF $p = 0.0175$, <0.0001 and 0.0008), so they are I(1). Inflation is I(0) under both tests (ADF $p = 0.0257$; PP $p = 0.0359$). Population growth is stationary under the ADF test ($p < 0.0001$) and not under the PP test ($p = 0.3406$) and is therefore considered to be borderline. The series I(2) is absent in this case, and the combination of I(0) and I(1) variables is appropriate for the bounds test, which is different from the Engle–Granger and Johansen tests because it does not require the variables to have a common order of integration (Pesaran et al., 2001).

Table 5: Unit Root Tests, 1981–2024

Variable	ADF level	ADF first difference	PP level	PP first difference	Order
LPR	−1.030	−3.246 (0.0175)	−1.395	−3.446 (0.0095)	I(1)



	(0.7423)		(0.5848)		
LWGR	-0.395 (0.9109)	-5.731 (<0.0001)	-0.428 (0.9053)	-5.888 (<0.0001)	I(1)
INFR	-3.112 (0.0257)	-6.779 (<0.0001)	-2.989 (0.0359)	-7.020 (<0.0001)	I(0)
LGDP	-0.971 (0.7636)	-4.139 (0.0008)	0.279 (0.9763)	-4.055 (0.0011)	I(1)
POPGR	-5.303 (<0.0001)	-5.315 (<0.0001)	-1.882 (0.3406)	-5.183 (<0.0001)	I(0) by ADF; PP inconclusive

Source: Authors' computation, 2026. Entries are test statistics with asymptotic MacKinnon *p*-values in parentheses. Specification: intercept, no trend; ADF lag length chosen by the Schwarz criterion (maximum 9); PP with Bartlett kernel and truncation lag 10. The 5% critical value is about -2.93 for every test. The null hypothesis is a unit root.

Table 6 shows that the F-statistic of 13.942 exceeds the upper bound at every level, both asymptotically (5%: 4.01; 1%: 5.06) and with small-sample values (5%: 4.78; 1%: 6.61), and the F-test on the lagged regressors (17.301) also rejects at 1% (upper bound 7.21). However, the t-statistic on the lagged dependent variable (-2.162) does not reject even at the 10% level (bound -2.46). Evidence in favour of the long-run relationship is thus suggestive but not conclusive and the estimates of the long-run relationship should not be interpreted literally.

Table 6: ARDL Bounds Tests for Cointegration (Unrestricted Intercept, No Trend; $k = 4$)

Test	Statistic	Level	I(0) bound	I(1) bound	Decision
F-test, Pesaran et al. (2001) asymptotic	13.942	10%	2.45	3.52	Reject H0
		5%	2.86	4.01	Reject H0
		2.50%	3.25	4.49	Reject H0
		1%	3.74	5.06	Reject H0
F-test, small-sample ($n = 41$, ARDL(1,2,3,3,3))	13.942	10%	2.57	4	Reject H0
		5%	3.15	4.78	Reject H0
		2.50%	3.79	5.52	Reject H0
		1%	4.61	6.61	Reject H0
t-test on LPR(-1), small-sample	-2.162	10%	-2.46	-3.69	Do not reject H0
		5%	-2.85	-4.13	Do not reject H0
		1%	-3.61	-4.93	Do not reject H0
F-test on the four regressor levels, small- sample	17.301	10%	2.48	4.07	Reject H0
		5%	3.1	5	Reject H0
		1%	4.79	7.21	Reject H0

Source: Authors' computation, 2026. H0: no level relationship. Small-sample critical values are from 20,000 Monte Carlo replications of the bounds statistics for the same sample size and lag structure; the t-test rejects only if the statistic is more negative than the bound. The asymptotic F values are those of Pesaran et al. (2001), Case III.

Estimation Results

Model 1: Minimum Wage and Labour Productivity

Model 1 was estimated on 41 observations (1984–2024; adjusted $R^2 = 0.995$). Table 7 gives the short-run error-correction coefficients, Table 8 the long-run multipliers and Table A1 in the Appendix the full ARDL output. Coefficients on base-10 logged wage and GDP are semi- elasticities which are transformed into percentage-point effects in Table 9; coefficients on INFR and POPGR are in percentage points of LPR per percentage point of regressor.

Table 7: Short-Run (Error-Correction) Estimates, Model 1, Dependent Variable ΔLPR

Variable	Coefficient	Std. error	t-statistic	Probability
$\Delta LWGR_t$	1.039	0.535	1.942	0.0639
$\Delta LWGR_{t-1}$	1.99	0.575	3.461	0.002
$\Delta INFR_t$	0.002	0.005	0.439	0.6643
$\Delta INFR_{t-1}$	-0.005	0.005	-0.987	0.3337
$\Delta INFR_{t-2}$	0.014	0.005	3.008	0.0061
$\Delta LGDP_t$	-21.152	4.082	-5.182	<0.0001
$\Delta LGDP_{t-1}$	3.957	3.692	1.072	0.2945
$\Delta LGDP_{t-2}$	10.336	3.947	2.619	0.0151
$\Delta POPGR_t$	-0.419	1.005	-0.417	0.6805
$\Delta POPGR_{t-1}$	-0.265	0.695	-0.381	0.7065
$\Delta POPGR_{t-2}$	-2.228	0.765	-2.913	0.0076
Constant	25.35	12.438	2.038	0.0527
ECT_{t-1}	-0.136	0.063	-2.162	0.0408

Source: Authors' computation, 2026. $ARDL(1,2,3,3,3)$, sample 1984–2024 (41 observations). The coefficient on a lagged difference is minus the sum of the ARDL coefficients at longer lags, so it differs from any single ARDL lag coefficient. ECT_{t-1} equals the sum of the autoregressive coefficients minus one.

Table 8: Long-Run Estimates, Model 1, Dependent Variable LPR

Variable	Coefficient	Std. error	t-statistic	Probability	95% confidence interval
LWGR	-1.846	3.486	-0.529	0.6014	[-9.041, 5.350]
INFR	0.001	0.058	0.022	0.9823	[-0.117, 0.120]
LGDP	-18.335	7.617	-2.407	0.0241	[-34.057, -2.614]
POPGR	-11.203	4.444	-2.521	0.0188	[-20.375, -2.031]
Constant	186.157	25.433	7.32	<0.0001	[133.667, 238.648]

Source: Authors' computation, 2026. Long-run multipliers are the sum of the ARDL coefficients on each regressor divided by one minus the sum of the autoregressive coefficients; standard errors use the delta method; the confidence interval uses the t distribution with 24 degrees of freedom.

Table 9: Converting Coefficients into Percentage-Point Effects (Model 1)

Coefficient	Estimate	p-value	Units of the regressor	Effect on LPR of a 1% rise (points)	Effect on LPR of a 10% rise (points)
Wage, same year ($\Delta LWGR_t$)	1.039	0.0639	log10 units	0.0045	0.043

Wage, one-year lag ($\Delta LWGR_t - 1$)	1.99	0.002	log10 units	0.0086	0.082
Wage, long run	-1.846	0.6014	log10 units	-0.0080	-0.076
GDP, same year ($\Delta LGDP_t$)	-21.152	<0.0001	log10 units	-0.0914	-0.876
GDP, long run	-18.335	0.0241	log10 units	-0.0792	-0.759
Inflation, same year ($\Delta INFRT$)	0.002	0.6643	percentage points	+1 point of inflation: 0.002 points	—
Inflation, long run	0.001	0.9823	percentage points	+1 point of inflation: 0.001 points	—
Population growth, long run	-11.203	0.0188	percentage points	+1 point of growth: -11.203 points	—

Source: Authors' computation, 2026. For a variable in base-10 logarithms the effect of a $g\%$ change is the coefficient times $\log_{10}(1 + g/100)$: 0.0043 for $g = 1$ and 0.0414 for $g = 10$. LPR is a rate in per cent, so effects are in percentage points of the participation rate.

The error-correction coefficient is -0.136 ($p = 0.0408$) which suggests that 13.6% of deviation from equilibrium is corrected every year, and the half-life is approximately 4.7 years, although the p -value is only indicative due to bounds tests of t -test. Model 1 passes all diagnostics at 5% (Table 12): RESET $p = 0.1924$, Breusch–Godfrey $p = 0.9864$, Breusch–Pagan–Godfrey $p = 0.2619$, ARCH(1) $p = 0.5636$ and Jarque–Bera $p = 0.2718$, with a Durbin–Watson statistic of 1.926. However, the CUSUM falls inside of its 5% limits (maximum = 48% of the limit) and the CUSUM of squares (Figure 2) is also within 5% limits, albeit with 41 observations and 17 parameters, the power of these tests is limited.

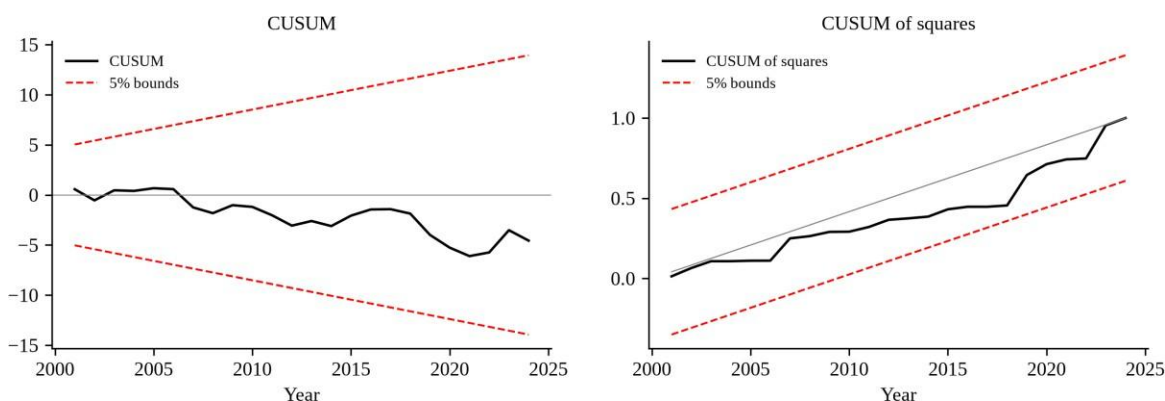


Figure 2: CUSUM and CUSUM-of-Squares Tests, Model 1

Source: Authors' computation, 2026. Dashed lines are 5% bounds.

Model 2: Minimum-Wage Growth and Inflation

Model 2 (ADL(2,3,3,3,0), 1985–2024; Table 10) explains 57% of the variation in log inflation after adjusting for degrees of freedom and passes all diagnostics (Table 12; Figure 3): RESET $p = 0.9935$, Breusch–Godfrey $p = 0.2207$, Breusch–Pagan–Godfrey $p = 0.5091$, ARCH(1) $p = 0.6873$ and Jarque–Bera $p = 0.3384$. The four wage-growth terms are jointly insignificant ($F(4, 24) = 1.905$, $p = 0.1423$), and the long-run multiplier of wage growth is 1.242 (standard error 2.454, $p = 0.6175$; Table 11). The 5.3% cost-push effect of a 10% increase in the minimum wage on the inflation rate in the LR (e.g. from 19.2% to 20.2%) is not detectable by the confidence interval, as it includes zero. This is not evidence that no revision exists, but revisions are few,

power is low and revisions may be a reaction to past inflation as well as be inflationary. The real GDP growth terms are jointly significant ($p = 0.0362$) and the long-run multiplier on the change in participation is 0.788 ($p = 0.0358$).

Table 10: Model 2 (Inflation) Estimates, Dependent Variable $\ln \text{INFR}_t$

Variable	Coefficient	Std. error	t-statistic	Probability
Constant	1.531	1.018	1.504	0.1457
$\ln \text{INFR}_{t-1}$	0.778	0.152	5.107	<0.0001
$\ln \text{INFR}_{t-2}$	-0.408	0.157	-2.600	0.0157
ΔLWGR_t	0.145	0.761	0.19	0.851
ΔLWGR_{t-1}	-1.295	0.781	-1.657	0.1105
ΔLWGR_{t-2}	0.127	0.901	0.141	0.8891
ΔLWGR_{t-3}	1.807	0.949	1.905	0.0689
ΔLPR_t	0.042	0.203	0.207	0.8377
ΔLPR_{t-1}	0.061	0.219	0.28	0.7818
ΔLPR_{t-2}	0.055	0.191	0.285	0.7778
ΔLPR_{t-3}	0.339	0.169	2.004	0.0565
ΔLGDP_t	-11.963	6.833	-1.751	0.0927
ΔLGDP_{t-1}	0.059	7.01	0.008	0.9933
ΔLGDP_{t-2}	3.3	5.434	0.607	0.5494
ΔLGDP_{t-3}	12.994	5.504	2.361	0.0267
POPGR_t	0.044	0.399	0.109	0.9139

Source: Authors' computation, 2026. Autoregressive distributed lag model $\text{ADL}(2,3,3,3,0)$ in $\ln \text{INFR}$, with minimum-wage growth (ΔLWGR), change in participation (ΔLPR), real GDP growth (ΔLGDP) and the level of population growth; sample 1985–2024 (40 observations); lags chosen by the Akaike criterion (maximum 3). $R^2 = 0.738$; adjusted $R^2 = 0.574$; $F(15, 24) = 4.503$ ($p = 0.0005$).

Table 11: Model 2, Long-Run Multipliers and Joint Tests

Item	Estimate or F-statistic	Std. error or d.f.	t-statistic	Probability
Long-run multiplier: ΔLWGR	1.242	2.454	0.506	0.6175
Long-run multiplier: ΔLPR	0.788	0.354	2.224	0.0358
Long-run multiplier: ΔLGDP	6.961	17.128	0.406	0.688
Long-run multiplier: POPGR	0.069	0.633	0.109	0.9139
Joint test: all four ΔLWGR terms = 0	1.905	(4, 24)	—	0.1423
Joint test: all four ΔLPR terms = 0	2.01	(4, 24)	—	0.1251
Joint test: all four ΔLGDP terms = 0	3.055	(4, 24)	—	0.0362

Source: Authors' computation, 2026. The multiplier is the sum of the coefficients on a regressor divided by one minus the sum of the two autoregressive coefficients (0.631); standard errors use the delta method.

Table 12: Diagnostic and Stability Tests, Models 1 and 2

Test (null hypothesis)	Model 1: statistic (p-value)	Model 2: statistic (p-value)
Ramsey RESET, squared fitted values (correct specification), F	1.804 (0.1924)	0.000 (0.9935)
Breusch–Godfrey, 2 lags (no serial correlation), F	0.014 (0.9864)	1.619 (0.2207)
Breusch–Pagan–Godfrey (homoskedasticity), F	1.321 (0.2619)	0.973 (0.5091)
ARCH(1) (no ARCH effects), F	0.339 (0.5636)	0.165 (0.6873)
Jarque–Bera (normal residuals)	2.605 (0.2718)	2.167 (0.3384)
Durbin–Watson	1.926	1.929
CUSUM (stable parameters)	Inside 5% bounds	Inside 5% bounds
CUSUM of squares (stable parameters)	Inside 5% bounds	Inside 5% bounds

Source: Authors' computation, 2026. Probabilities above 0.05 mean the null hypothesis is not rejected at 5%. See Figures 2 and 3 for the stability plots.

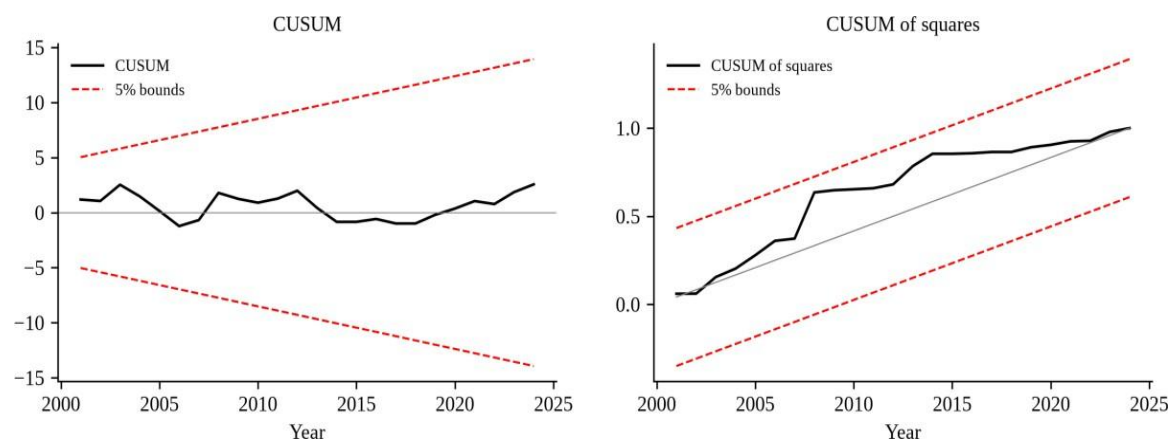


Figure 3: CUSUM and CUSUM-of-Squares Tests, Model 2

Source: Authors' computation, 2026. Dashed lines are 5% bounds.

DISCUSSION OF FINDINGS

First is whether any increase in the minimum wage leads to permanent increases in productivity. The same-year coefficient 1.039 (significant only at 10%) corresponds to an increase in log10 wage by 0.041, or about 0.043 percentage point higher participation rates, while the coefficient of the wage in the previous year, 1.990 ($p = 0.0020$), corresponds to an increase by 0.082 percentage point a year later (Table 9). The sign is consistent with the efficiency wage theory and Coviello et al. (2021) and the higher lagged effect is consistent with Ku (2020), who finds gains lag. But the magnitudes are small: even a doubling of the minimum wage is only 0.313 and 0.599 points on a sample standard deviation of 3.71 points, and the estimates are based on a few revision episodes (Table 2, Figure 1).

The association is not continued. The long-run coefficient of -1.846 (Table 8) is the sum of the ARDL wage coefficients ($1.039 + 0.700 - 1.990 = -0.251$; standard error 0.370, $p = 0.5036$) divided by the small adjustment term (0.136), which inflates both the coefficient and its standard error (3.486); its 95% confidence interval runs from -9.041 to 5.350 ($p = 0.6014$). A 10% wage rise thus implies a long-run change of -0.076 points (interval -0.374 to 0.221). This does not indicate a negative effect, it is only an absence of evidence of a

lasting positive effect—reading it as a 1.85% reduction in productivity for each 1% increase in wages would miss the point of both the logarithmic wage and the percentage-point participation. This is in line with the non-persistence of effects in Germany (Bossler et al., 2018) and the result of Mayneris et al. (2018) that effects are contingent on firms' ability to absorb the wage. The adjustment is slow and the bounds t-test failed to reject, thus the long-run relationship is supported but not confirmed.

This outcome is not influenced by the wage measure used (Table 13). The long run coefficient is negative for all four measures and is never significantly positive (−21.316 for the real minimum wage ($p = 0.0512$; approximately −0.0921 points per 1% increase) and −14.778 ($p = 0.5652$) and −10.467 ($p = 0.1432$) for the nominal and real average wage, respectively). The results for the average wage are less good as the real version does not pass the RESET test, and the nominal version does not have a significant error-correction term. All these results refer to minimum wage changes and not wage trends, since the statutory minimum wage is mainly for workers in the formal sector.

Table 13: Sensitivity of Model 1 to the Wage Measure

Wage measure (log10)	ARDL order	Bounds F (5% upper bound)	Long-run wage coefficient (p)	ECT (p)	Same-year wage coefficient (p)	Diagnostics p-values
Minimum wage, nominal (main)	(1,2,3,3,3)	13.94 (4.78)	−1.846 (0.6014)	−0.136-0.0408	1.039 (0.0639)	RESET 0.1924; BG0.9864; BPG0.2619
Minimum wage, real	(1,2,4,3,3)	18.69 (4.88)	−21.316-0.0512	−0.143-0.0002	−0.304-0.6649	RESET 0.0644; BG0.7170; BPG0.2813
Average wage WGR, nominal	(2,3,3,3,3)	9.32 (4.91)	−14.778-0.5652	−0.062-0.3546	−2.146-0.1088	RESET 0.0567; BG0.9680; BPG0.0851
Average wage WGR, real	(3,3,3,3,3)	6.48 (4.95)	−10.467-0.1432	−0.197-0.008	−2.642-0.0801	RESET 0.0070*; BG 0.8531; BPG0.4552

Source: Authors' computation, 2026. Lag orders are chosen by the Akaike criterion with at most four lags, as in the main model; the order lists LPR, wage, INFR, LGDP, POPGR. The 5% upper bound is the small-sample Monte Carlo value. * marks a rejection at 5% (a diagnostic failure). Real wages deflate by a CPI index built from INFR (1981 = 100). BG = Breusch–Godfrey; BPG = Breusch–Pagan–Godfrey.

The next is does the increase in the minimum wage lead to inflation? The cost push channel posited by Alaloul et al. (2021) is not identified in the annual national data as model 2 shows no significant effect (joint $p = 0.1423$; long run multiplier = 1.242, standard error = 2.454). The effect of a change in participation (0.788, $p = 0.0358$) is positive, which is the opposite of what was expected, and is more likely to be due to a common cyclical effect on participation and prices than to a causal effect. In Model 1, the long-run inflation coefficient is close to zero (0.001, $p = 0.9823$), suggesting that the data do not support the hypothesis that inflation undermines productivity gains driven by changes in wages in this sample.

Real GDP has a negative long-run coefficient of −18.335 ($p = 0.024$, about −0.079 points per 1% increase) and a negative same-year effect of −21.152 ($p < 0.0001$) among the controls, which, surprisingly, indicates that Nigerian growth has not been broad-based or labour absorptive. This aligns with Babasanya et al. (2020) who have attributed manufacturing productivity to savings and capital formation commensurate with the growth rate of the labour force, and Ezeanyagu et al. (2025), who reported a negative association between participation and growth. Similarly, population growth is also negative and significant (−11.203, $p = 0.019$),



which means that one additional point of population growth is correlated with a 11.2-point decrease in the participation rate or 2.6 points for a one-standard-deviation (0.23-point) change in population growth, consistent with the congestion effect that was theoretically anticipated in Section 3.4 and with Nhegele et al. (2019). So overall, it appears that the structural conditions play a greater role on participation than the wage floor, consistent with Ajibola and Oraka (2020) who found that the minimum wage in Nigeria has not yielded the desired labour market outcomes.

Policy Implications

Three implications follow. First, the relationship between minimum-wage changes and productivity is weak in the short run and is not significantly different from zero in the long run, that is, changes in the minimum wage by themselves cannot be expected to have an impact on productivity. Longer time intervals between reviews also allow the real minimum wage to drop below its level in 1981 (Figure 1), so reviews should be more frequent or should be linked to a published formula of inflation and productivity, a suggestion that also seeks to correct the disconnect between the wage-setting and welfare goals highlighted by Ajibola and Oraka (2020).

Second, wage increases increase productivity only if workers have capital, and if other factors such as skills or technology are not other limiting factors. Investment is not measured here but the negative long run GDP association (Table 8) is consistent with growth failure in the sense that it has not absorbed labour, while Afolabi and Laseinde (2019) reveal that manufacturing in Nigeria is as much limited by investment and infrastructure as by labour cost. In the absence of complements, a wage increase can lead to an increase in production costs and wage policy must therefore be combined with training and capital investment. Thirdly, the negative GDP and population coefficients suggest conditions that require consideration, and that are structural in nature, and beyond the reach of wage policy to address; as Mike et al. (2024) have noted, a bad policy environment can undo a wage increase even when it is needed. In contrast, the lack of any apparent inflation impact (Table 11) indicates that the inflation implications of the revisions are not visible in annual data, although the low power of the test calls for caution.

CONCLUSION AND RECOMMENDATIONS

Conclusion

The relationship between the statutory minimum wage, inflation and labour productivity was investigated in Nigeria between 1981 and 2024 using ARDL bounds testing and modelling the inflation separately. The minimum wage is associated with a relatively small increase (+0.043 percentage points) in the participation rate (proxy for productivity) in the same year and (+0.082 points) a year later, in keeping with efficiency wage theory. The association is not sustained, as the long run coefficient (in log units, -1.846 points per 10% increase) is statistically indistinguishable from zero ($p = 0.6014$), and the long run relationship is supported but not confirmed by bounds F-tests but not by t-tests. There is no significant long-run association between minimum-wage growth and inflation ($p = 0.1423$), but both the growth of real GDP and population have significant negative long-run associations with participation. Hence, there is no evidence that minimum-wage increases have a lasting impact on productivity, and that they negatively affect productivity or inflation; this is because of the limit of the data, the productivity proxy, and the step-like wage series.

Recommendations

First, minimum wages should be reviewed with a published formula that reflects both the realised productivity growth and inflation, not one-off political negotiation, to maintain the real value of minimum wages, which is

seen to erode rapidly between minimum wage reviews in Figure 1. Second, an increase in wages should be accompanied by an investment in worker training, technology and capital; it is not clear there is any sustained link between revisions and the proxy for productivity. Third, monetary and fiscal authorities should consider a policy of making price stability be a condition for preserving the real value of minimum-wage increases, as the real minimum wage decreased significantly, although no significant effect of inflation on participation was detected. Fourth, the sources of growth in real GDP must be broadened to activities where the contribution of labour is more important, since there is a negative long run relationship between real GDP and participation (and participation is only a proxy for productivity). Fifth, the National Bureau of Statistics ought to provide year-to-year series of output per worker and average earnings so that the wage-productivity relationship can be directly evaluated.

Limitations

Several limitations apply. First, participation is not a measure of output by people, and therefore, the findings cannot be interpreted as a direct measure of productivity; to the extent a consistent series is available, output per employed person should be used. Second, the wage is a policy-determined step series, and the magnitude of the estimates is determined by wage revisions, which do not necessarily reflect average or typical earnings, but may be a consequence of past inflation. Third, Nigeria's labour market is largely informal with the Labour Force Survey for the second quarter of 2024 estimating the informal sector to account for approximately 93% of employment and self-employment accounting for approximately 85.6% of working Nigerians (National Bureau of Statistics, 2024). The minimum wage is only relevant to covered formal-sector workers, participation and inflation cover the entire economy, which likely weakens effects measured and does not allow for generalisation to the informal sector, where no consistent annual series exists to record earnings. Fourth, the reported p-values based on 41 usable observations, 17 coefficients and data-selected lags do not take model selection into consideration, and the long-run relationship is supported but not confirmed. Fifth, the estimates are associations in the aggregate annual data and should not be viewed as causal effects.

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