The Asymmetric Effects of Business Cycle Fluctuations on Real Wage Determination in Nigeria

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ABSTRACT

This study examines the asymmetric effects of business cycle fluctuations on real wage determination in Nigeria, with particular emphasis on the roles of inflation and labor market conditions. The motivation for the study arises from the persistent disconnect between theoretical predictions of wage flexibility and empirical evidence of wage rigidity in developing economies. Using annual time-series data spanning 1990–2024, the study employs an Ordinary Least Squares (OLS) estimation technique to analyze the relationship between real wages, output, inflation, and unemployment. The findings reveal the existence of a significant long-run relationship between real wages and key macroeconomic variables. Economic expansion is found to exert a positive and statistically significant effect on real wages, while economic contraction negatively affects wages, albeit with a smaller magnitude, indicating incomplete downward adjustment. This provides evidence of asymmetric wage behavior in Nigeria. Furthermore, inflation is shown to have a strong negative impact on real wages, highlighting its role in eroding workers' purchasing power. Unemployment also exerts a negative influence, reflecting weak labor demand and reduced bargaining power. The study concludes that real wage determination in Nigeria is characterized by asymmetry, wage rigidity, and vulnerability to macroeconomic instability. These findings challenge the conventional assumption of symmetric wage adjustment and underscore the importance of adopting flexible and responsive policy frameworks. The study recommends policies aimed at controlling inflation, strengthening labor market institutions, promoting employment generation, and ensuring sustainable economic growth. Overall, the study contributes to the empirical literature by providing evidence on wage dynamics in a developing economy and offering policy insights for improving workers' welfare.

Keywords: Real wages; Business cycle; Inflation; Unemployment; Wage rigidity; Asymmetry; Nigeria; Economic growth; Labor market dynamics

1. INTRODUCTION

The determination of real wages remains a fundamental concern in macroeconomic theory and labor economics, particularly within the context of business cycle dynamics. Real wages—defined as nominal wages adjusted for changes in the general price level—constitute a crucial indicator of workers' purchasing power and overall economic welfare (Blanchard, 2017). Across both advanced and developing economies, the interaction between real wages and macroeconomic fluctuations has attracted considerable scholarly attention due to its far-reaching implications for income distribution, employment outcomes, and macroeconomic stability.

Business cycles, characterized by recurrent phases of economic expansion and contraction, exert significant influence on labor market performance. During periods of economic expansion, increased aggregate demand stimulates labor demand, thereby exerting upward pressure on wages. Conversely, economic downturns are typically associated with declining labor demand, rising unemployment, and downward pressure on wages (Mankiw, 2021). Notwithstanding these theoretical expectations, empirical evidence indicates that real wages often fail to adjust symmetrically across business cycle phases. Instead, they exhibit varying degrees of rigidity—

particularly downward rigidity—where wages are resistant to reduction during recessions but adjust more readily during economic upturns (Eze & Okeke, 2021).

The phenomenon of wage rigidity is deeply rooted in Keynesian and New Keynesian frameworks, which emphasize the role of market imperfections, institutional constraints, and behavioral considerations in wage-setting processes (Keynes, 1936; Akerlof, Dickens, & Perry, 1996). Downward wage rigidity, in particular, has

been widely recognized as a critical factor underpinning labor market frictions, unemployment persistence, and broader macroeconomic instability. Recent empirical contributions further corroborate the asymmetric nature of wage adjustments, demonstrating stronger responsiveness during periods of economic expansion relative to contractions (Elsby, Shin, & Solon, 2016).

In developing economies such as Nigeria, the process of real wage determination is further complicated by distinct structural characteristics of the labor market. These include the predominance of informal employment, weak institutional frameworks, low levels of unionization, and heightened exposure to inflationary pressures (International Labour Organization [ILO], 2023). Inflation plays a pivotal role in shaping real wage outcomes, as increases in the general price level erode purchasing power even in the absence of changes in nominal wages. Consequently, a comprehensive understanding of real wage dynamics necessitates a joint consideration of nominal wage movements and inflationary trends.

Moreover, the Nigerian economy is particularly vulnerable to macroeconomic volatility, driven by its heavy reliance on oil revenues, exchange rate instability, and exposure to external shocks. Such volatility significantly affects aggregate output and sectoral performance, with direct implications for labor demand and wage determination (Akinlo & Lawal, 2023). In this context, real wage adjustments may exhibit complex and unpredictable patterns across different phases of the business cycle, underscoring the need for rigorous empirical investigation.

An additional layer of complexity arises from the coexistence of formal and informal labor market segments. In many developing economies, the informal sector accounts for a substantial proportion of total employment. While wages in the informal sector tend to be more flexible, they are also more susceptible to economic shocks. In contrast, formal sector wages are often characterized by greater rigidity due to contractual arrangements and institutional protections (Fields, 2019). This dual labor market structure complicates the analysis of aggregate wage behavior over the business cycle.

Recent empirical studies have also highlighted the heterogeneity of wage responses across different categories of workers. For example, newly hired workers often exhibit greater wage sensitivity to macroeconomic conditions compared to incumbent workers, reflecting differences in bargaining power, job security, and labor mobility (Ibrahim & Lawal, 2022). These micro-level variations further underscore the importance of disaggregated analysis in understanding aggregate wage dynamics.

Despite the expanding body of literature on wage determination, a significant proportion of existing studies continues to assume a symmetric relationship between economic activity and wage adjustments. Such an assumption may lead to biased or incomplete conclusions, particularly in the presence of nonlinearities and asymmetric responses (Mankiw, 2021). This limitation is especially pronounced in developing economies, where labor market conditions differ markedly from those of advanced economies.

Against this backdrop, the present study seeks to address this gap by examining the asymmetric effects of business cycle fluctuations on real wage determination in Nigeria. By employing advanced econometric techniques capable of capturing nonlinear relationships, the study aims to provide a more nuanced and empirically robust understanding of how real wages respond to economic expansions and contractions. In doing so, it contributes to both the theoretical and empirical literature on wage dynamics in developing economies.

1.2 Statement of the Problem

The relationship between business cycle fluctuations and real wage determination remains one of the most debated issues in macroeconomic and labor market research, particularly within the context of developing

economies. Conventional macroeconomic theory predicts that wages should adjust in response to changes in economic conditions, reflecting shifts in labor demand and supply. However, a growing body of empirical literature demonstrates that such adjustments are often incomplete, uneven, and asymmetric across different phases of the business cycle (Elsby, Shin, & Solon, 2016). This divergence between theoretical expectations and empirical realities raises important questions regarding the mechanisms underlying wage determination, especially in economies characterized by structural rigidities and institutional weaknesses.

One of the central problems lies in the persistence of wage rigidity, particularly downward rigidity, which constrains the ability of wages to adjust during economic downturns. In theory, declining economic activity should lead to reductions in real wages as firms attempt to minimize costs in the face of reduced demand. In practice, however, wages tend to be "sticky" downward due to factors such as labor contracts, efficiency wage considerations, institutional regulations, and worker resistance to nominal wage cuts. This rigidity can exacerbate unemployment during recessions, as firms may opt to reduce labor demand rather than adjust wages, thereby undermining labor market efficiency and prolonging economic recovery.

In the Nigerian context, the problem is further compounded by structural and institutional peculiarities of the labor market. Nigeria is characterized by a high level of informality, with a significant proportion of the workforce engaged in informal employment where wage-setting mechanisms are largely unregulated. While wages in the informal sector may exhibit greater flexibility, they are also more vulnerable to macroeconomic shocks and often fail to provide adequate income security. Conversely, the formal sector is typically associated with greater wage rigidity due to contractual agreements, labor laws, and union activities. This duality creates a complex wage structure in which aggregate wage dynamics may mask significant sectoral disparities.

Another critical issue is the role of inflation in shaping real wage outcomes. Persistent inflationary pressures in Nigeria have the potential to erode the purchasing power of workers, particularly when nominal wages fail to adjust proportionately. In such circumstances, even stable nominal wages may translate into declining real wages, thereby reducing living standards and increasing income inequality. Despite this, many empirical studies on wage determination tend to focus primarily on nominal wage adjustments, often neglecting the interaction between inflation and wage dynamics. This represents a significant gap in the literature, particularly for economies experiencing high and volatile inflation rates.

Furthermore, the Nigerian economy is highly susceptible to external and internal shocks, including fluctuations in global oil prices, exchange rate volatility, and policy uncertainties. These shocks contribute to pronounced business cycle fluctuations, which in turn affect output, employment, and wage levels. However, the extent to which real wages respond to these fluctuations—and whether such responses differ between periods of economic expansion and contraction—remains insufficiently explored. Most existing studies adopt linear modeling approaches that implicitly assume symmetric wage responses, thereby overlooking potential nonlinearities and asymmetries in the wage adjustment process.

Additionally, there is limited empirical evidence on how different categories of workers are affected by business cycle fluctuations in Nigeria. Wage responses may vary significantly across worker groups based on factors such as skill level, employment status, and bargaining power. For instance, newly hired workers and those in precarious employment may experience greater wage volatility compared to established workers in more secure positions. Ignoring such heterogeneity may lead to incomplete or misleading conclusions regarding overall wage behavior.

Given these challenges, there is a compelling need for a comprehensive and methodologically robust analysis of real wage determination that explicitly accounts for asymmetries in wage responses, sectoral differences, and the influence of key macroeconomic variables such as inflation and output fluctuations. In particular, the application of nonlinear econometric techniques capable of capturing asymmetric relationships offers a promising avenue for advancing understanding in this area.

Therefore, this study seeks to address these gaps by investigating the asymmetric effects of business cycle fluctuations on real wage determination in Nigeria. By doing so, it aims to provide empirical evidence that can inform policy formulation, particularly in designing labor market and macroeconomic policies that promote wage flexibility, protect workers' purchasing power, and enhance overall economic stability.

1.3 Objective of the study

The general objective of this study is to examine the asymmetric effects of business cycle fluctuations on real wage determination in Nigeria, with a view to providing empirical evidence on how real wages respond differently to periods of economic expansion and contraction. In order to achieve the broad objective, the study is guided by the following specific objectives:

1. To analyze the impact of economic expansions on real wage dynamics in Nigeria.
2. To examine the effect of economic contractions on real wages, particularly in terms of wage adjustments during periods of declining economic activity.
3. To investigate the existence of asymmetric relationships between business cycle fluctuations and real wage determination.
4. To assess the extent and implications of downward wage rigidity during recessionary periods in Nigeria.

1.4 Research Questions

In line with the stated objectives of the study, the following research questions are formulated to guide the empirical investigation:

1. How do real wages respond to periods of economic expansion and contraction in Nigeria?
2. Is there empirical evidence of asymmetric adjustment in real wages across different phases of the business cycle?
3. To what extent does downward wage rigidity persist during periods of economic downturn in Nigeria?
4. What is the role of inflation in influencing real wage determination in Nigeria?

1.5 Research Hypotheses

H_{01}: Business cycle fluctuations have no significant effect on real wage determination in Nigeria.

H_{02}: There is no asymmetric relationship between economic expansions and contractions in real wage determination.

H_{03}: Downward wage rigidity does not exist during economic contraction.

H_{04}: Inflation has no significant effect on real wage adjustments.

2. LITERATURE REVIEW

2.1 Conceptual Review: Concept of Real Wages

Real wages refer to the purchasing power of wages after adjusting for inflation. Unlike nominal wages, which represent the actual monetary compensation received by workers, real wages reflect the quantity of goods and services that wages can buy (Blanchard, 2017). In Nigeria, rising inflation has significantly reduced the purchasing power of workers, making real wage analysis particularly important (Aberu, 2023; World Bank, 2024 cited in). Recent evidence shows that persistent inflationary pressures in Nigeria continue to erode real incomes, thereby worsening living standards and increasing poverty levels (Adeniyi et al., 2024). This highlights the importance of studying real wage dynamics rather than nominal wages.

2.2 Business Cycle Fluctuations and Wage Rigidity

Business cycles refer to periodic fluctuations in economic activity, typically measured by changes in Gross Domestic Product (GDP). These fluctuations consist of four main phases: expansion, peak, contraction (recession), and trough (Mankiw, 2021). In Nigeria, business cycles are often influenced by external shocks such as oil price volatility, exchange rate instability, and inflation dynamics. These factors significantly affect employment levels and wage determination (Akinlo & Lawal, 2023). Wage rigidity refers to the resistance of wages to adjust to changes in economic conditions. It can be categorized into: Nominal wage rigidity and Real wage rigidity Downward. wage rigidity occurs when wages do not fall during economic downturns. This phenomenon is common in many economies and is often attributed to labor contracts, minimum wage laws, and worker morale considerations (Akerlof et al., 1996). Empirical evidence shows that wage rigidity leads to asymmetric wage adjustments across business cycle phases (Elsby et al., 2016).

2.3. Inflation and Real Wage Dynamics

Inflation plays a critical role in determining real wages. High inflation reduces the purchasing power of wages, even when nominal wages increase. In Nigeria, inflation has been identified as a major factor affecting wage dynamics and workers' welfare (Adeniyi et al., 2024). Recent studies indicate that inflationary shocks significantly influence wage adjustments and can lead to wage-price spirals, thereby complicating macroeconomic stability (Amoo, 2025). The Nigerian labor market is characterized by a dual structure consisting of formal and informal sectors. The informal sector accounts for a large proportion of employment and is associated with flexible but unstable wages (Fields, 2019). Studies show that wages in the informal sector are more responsive to economic shocks, while formal sector wages tend to be more rigid due to institutional arrangements (ILO, 2023).

2.4 Theoretical Review

The theoretical foundations of real wage determination and its interaction with business cycle fluctuations are deeply rooted in both classical and modern macroeconomic frameworks. These theories provide competing and complementary explanations for wage behavior, particularly with respect to wage flexibility, rigidity, and asymmetric adjustment across different phases of the business cycle.

The Keynesian theory of wage determination offers one of the earliest and most influential explanations for wage rigidity. According to Keynes (1936), wages—especially nominal wages—are downwardly rigid due to a combination of institutional arrangements and behavioral considerations. Workers tend to resist wage reductions because they perceive them as unfair, which may adversely affect morale and productivity. Additionally, labor unions and contractual agreements often reinforce this rigidity by preventing firms from adjusting wages downward during economic downturns. As a result, instead of reducing wages, firms may respond to declining demand by cutting employment, thereby leading to higher unemployment. This framework provides a strong theoretical basis for understanding why real wages may not adjust proportionately during recessions, contributing to asymmetric wage responses over the business cycle.

Building on this foundation, the New Keynesian framework introduces microeconomic underpinnings to explain wage and price stickiness. It emphasizes the role of efficiency wages, menu costs, and implicit or explicit labor contracts in shaping wage dynamics (Akerlof, Dickens, & Perry, 1996). Efficiency wage theory suggests that firms deliberately pay wages above the market-clearing level to enhance worker productivity, reduce shirking, and minimize turnover costs. Consequently, firms may be reluctant to reduce wages during downturns for fear of diminishing worker effort and increasing labor turnover. Menu costs, though more commonly associated with price adjustments, also capture the broader costs associated with changing wage structures, including administrative, contractual, and reputational costs. Furthermore, labor contracts—both formal and informal—often fix wages for a specified period, limiting their responsiveness to short-term economic fluctuations. Together, these factors reinforce wage rigidity and provide a more comprehensive explanation for the persistence of asymmetric wage adjustments.

In contrast, the neoclassical theory of wage determination assumes a perfectly competitive labor market in which wages are determined by the interaction of labor demand and supply. Under this framework, wages are fully

flexible and adjust instantaneously to clear the labor market. During economic expansions, increased demand for labor leads to higher wages, while contractions result in wage reductions that restore equilibrium. However, this theoretical assumption of wage flexibility implies symmetric wage adjustments across business cycle phases—an assumption that is often inconsistent with empirical observations, particularly in developing economies. In countries like Nigeria, where labor markets are characterized by structural rigidities, information asymmetries, and institutional constraints, the neoclassical model provides limited explanatory power for observed wage behavior.

Another important theoretical perspective is the insider–outsider theory, which highlights the role of labor market segmentation in wage determination. This theory distinguishes between "insiders," who are currently employed, and "outsiders," who are unemployed or seeking employment. Insiders typically possess greater bargaining power due to their established positions within firms and their ability to influence wage-setting processes. As a result, they are often able to resist wage reductions, even during periods of economic downturn. Outsiders, on the other hand, have limited influence on wage determination despite being willing to work at lower wages. This dynamic contributes to wage rigidity and the persistence of unemployment, as firms are constrained in their ability to adjust wages downward.

Closely related to these frameworks is the concept of asymmetric adjustment theory, which provides a direct explanation for the nonlinear behavior of economic variables in response to shocks. This theory posits that economic relationships may differ depending on whether changes are positive or negative. In the context of wage determination, this implies that wages may increase relatively quickly during periods of economic expansion but decline slowly, or not at all, during recessions. Such asymmetry may arise from a combination of institutional constraints, behavioral responses, and adjustment costs. The recognition of asymmetric dynamics has important methodological implications, as it necessitates the use of nonlinear econometric techniques—such as the Nonlinear Autoregressive Distributed Lag (NARDL) model—to accurately capture the differential effects of positive and negative shocks (Shin, Yu, & Greenwood-Nimmo, 2014).

Taken together, these theoretical perspectives provide a comprehensive framework for understanding real wage determination in the presence of business cycle fluctuations. While the neoclassical model emphasizes wage flexibility and market clearing, Keynesian and New Keynesian theories highlight the prevalence of wage rigidity arising from institutional and behavioral factors. The insider–outsider framework further underscores the role of labor market segmentation, while asymmetric adjustment theory explains the nonlinear nature of wage responses. In the context of developing economies such as Nigeria—where structural constraints, inflationary pressures, and labor market imperfections are prevalent—these theories collectively suggest that real wage adjustments are likely to be asymmetric, thereby justifying the need for empirical investigation using nonlinear modeling approaches.

2.5 Empirical Review

Empirical literature on real wage determination in Nigeria has expanded considerably in recent years, with increasing attention devoted to the interaction between inflation, macroeconomic instability, labor market conditions, and wage outcomes. While a substantial body of research has examined the determinants of wages and employment separately, relatively few studies explicitly analyze the asymmetric effects of business cycle fluctuations on real wages. Nonetheless, recent empirical contributions (2020–2026) provide important insights into the dynamics of real wages, particularly within the context of persistent inflation, structural rigidities, and macroeconomic volatility.

A dominant strand of the empirical literature emphasizes the critical role of inflation in shaping real wage dynamics in Nigeria. Several studies consistently identify inflation as the primary factor eroding workers' purchasing power. For instance, Aberu (2023), using an Autoregressive Distributed Lag (ARDL) framework, finds that persistent inflation exerts a significant negative effect on household welfare by reducing real income and weakening consumption capacity. Similarly, Adeniyi, Olanrewaju, and Musa (2024) demonstrate that inflation offsets nominal wage increases, resulting in declining real wages and worsening living standards. Their findings further reveal that inflation and unemployment jointly account for a substantial proportion of poverty variations in Nigeria. Complementing these results, Amoo (2025) examines the interaction between exchange

rate depreciation, inflation, and wage adjustments, showing that macroeconomic instability significantly undermines real wage growth. Other recent studies, including Ibrahim and Lawal (2022), Eze and Okeke (2021), and Salisu and Adediran (2020), also confirm that inflationary pressures remain a persistent constraint on real wage improvement in Nigeria.

Recent macroeconomic evidence further supports these findings. National accounts data indicate that although nominal wages have increased in recent years, real wages have declined due to sustained inflationary pressures. For example, recent estimates show that real compensation of employees declined significantly des-

pite substantial nominal wage growth, underscoring the severe erosion of purchasing power. Studies by the Central Bank of Nigeria (2024) and National Bureau of Statistics (2025) corroborate this trend, highlighting the disconnect between nominal wage growth and real income improvements. Similarly, international evidence from the World Bank (2025) and International Labour Organization (2023) suggests that inflation remains a key determinant of wage stagnation in developing economies, including Nigeria.

Another important strand of empirical literature focuses on the relationship between price volatility, employment dynamics, and wage outcomes. Olujobi and Abu (2024) examine the effects of price instability on employment and find that fluctuations in price levels significantly influence labor demand, thereby affecting wage determination. Their study concludes that macroeconomic uncertainty reduces firms' ability to adjust wages efficiently, leading to suboptimal labor market outcomes. In a related study, Onwuemeka, Okafor, and Nwokocha (2024) investigate the inflation–unemployment nexus using time-series data and confirm the presence of a weak Phillips curve relationship in Nigeria. Their findings suggest that inflation and unemployment jointly influence wage outcomes, particularly during economic downturns when rising unemployment and high inflation simultaneously depress real wages. Additional studies by Oyinlola and Adedeji (2022) and Bakare and Fawehinmi (2021) further demonstrate that macroeconomic volatility—captured through fluctuations in output and prices—has significant implications for wage determination and employment conditions.

Empirical evidence also highlights the role of institutional and policy factors in shaping wage dynamics. Recent studies on minimum wage policy reforms reveal that wage adjustments in Nigeria often lag behind inflationary trends, thereby failing to protect workers' purchasing power. Okoro (2025) notes that periodic wage reviews are insufficient in the face of persistent inflation, leading to a decline in real wages over time. Similarly, the Anker Research Institute (2025) reports that living income benchmarks in Nigeria have increased dramatically due to cumulative inflation, indicating a widening gap between wages and the cost of living. Studies by Adegboye (2022) and Nwosa (2021) further emphasize that weak institutional frameworks and limited enforcement of labor regulations contribute to wage rigidity and inequality. These findings suggest that while policy interventions such as minimum wage adjustments are important, they are often inadequate in addressing the underlying drivers of real wage decline.

The structure of the Nigerian labor market, particularly the dominance of the informal sector, also plays a crucial role in wage determination. Empirical studies indicate that wages in the informal sector are relatively more flexible but also more volatile and vulnerable to economic shocks. Omoju, Abraham, and Adesanya (2023) find that informal sector workers experience greater income instability, especially during periods of economic downturn. Similarly, National Bureau of Statistics (2025) reports reveal high levels of underemployment and disguised unemployment, with many workers engaged in low-paying and unstable jobs. Studies by Olorunfemi and Fasanya (2022) and Adeola (2020) further show that the prevalence of informal employment weakens overall wage stability and reduces the effectiveness of macroeconomic policies aimed at improving labor market outcomes. While wage flexibility in the informal sector may facilitate adjustment to economic shocks, it also exacerbates income vulnerability and inequality.

Despite these extensive empirical contributions, significant gaps remain in the literature. First, there is limited empirical evidence explicitly examining the asymmetric effects of business cycle fluctuations on real wages in Nigeria. Most existing studies focus on linear relationships between macroeconomic variables and wage outcomes, thereby assuming symmetric adjustments across economic expansions and contractions. Second, there is an overreliance on conventional econometric techniques that fail to capture nonlinear dynamics and asymmetric responses. Third, insufficient attention has been given to sectoral differences in wage determination,

particularly the distinction between formal and informal labor markets. Finally, there is a lack of integrated analyses that simultaneously consider the interaction between inflation, business cycles, and wage dynamics within a unified framework.

Given these limitations, there is a clear need for a more comprehensive and methodologically robust approach to analyzing real wage determination in Nigeria. In particular, the application of nonlinear econometric models—such as the Nonlinear Autoregressive Distributed Lag (NARDL) framework—provides an opportunity to capture asymmetric responses of real wages to positive and negative economic shocks.

In conclusion, the empirical literature on Nigeria demonstrates that real wage determination is strongly influenced by inflation, macroeconomic instability, institutional factors, and labor market structure. However, existing studies have not adequately addressed the asymmetric nature of wage adjustments across business cycle phases. This study seeks to fill this gap by adopting a nonlinear analytical framework to examine how real wages respond differently to economic expansions and contractions, thereby contributing to a deeper understanding of wage dynamics in developing economies.

3.0 RESEARCH METHODOLOGY

3.1 Research Design

The study employs the Nonlinear Autoregressive Distributed Lag (NARDL) model developed by Shin, Yu, and Greenwood-Nimmo (2014). The NARDL framework is appropriate because it distinguishes between the positive and negative changes in explanatory variables, thereby allowing the study to capture both short-run and long-run asymmetries in real wage determination.

3.2 Nature and Sources of Data

The study relies exclusively on secondary time-series data for Nigeria covering the period 1990–2025, subject to the availability and consistency of the required observations. The variables include real wages, economic growth, inflation, and unemployment. Data are obtained from authoritative sources, including the Central Bank of Nigeria (CBN), the National Bureau of Statistics (NBS), the World Bank's World Development Indicators, and other relevant official statistical publications. The variables are measured using consistent definitions across the study period.

3.3 Model Specification

The functional relationship between real wages and the explanatory variables is expressed as:

$RW_t = f(GDP_t, INF_t, UNEMP_t)$

Where RW_t = real wages at time t; GDP_t = economic growth or real GDP measure; INF_t = inflation rate; $UNEMP_t$ = unemployment rate; and t = time period.

The corresponding linear long-run relationship is specified as:

$$RW_t = \beta_0 + \beta_1 GDP_t + \beta_2 INF_t + \beta_3 UNEMP_t + \varepsilon_t$$

Here, β_0 is the intercept, β_1, β_2, and β_3 are the long-run coefficients, and ε_t is the error term. However, the conventional linear model assumes that positive and negative changes in economic growth have identical effects on real wages. To relax this assumption, the study adopts the NARDL framework.

3.4 Nonlinear ARDL (NARDL) Model Specification

Following Shin et al. (2014), the NARDL model decomposes economic growth into partial sums of positive and negative changes. This enables the researcher to estimate the separate effects of economic expansion and contraction on real wages.

$GDP_t^+ = \Sigma_{j=1}^{t} \max(\Delta GDP_j, 0)$

$GDP_t^- = \Sigma_{j=1}^{t} \min(\Delta GDP_j, 0)$

GDP_t^+ represents cumulative positive changes in economic growth, while GDP_t^- represents cumulative negative changes. The symbol Δ denotes the first-difference operator.

The long-run NARDL relationship is specified as:

$$RW_t = \beta_0 + \beta_1^+ GDP_t^+ + \beta_1^- GDP_t^- + \beta_2 INF_t + \beta_3 UNEMP_t + \varepsilon_t$$

This specification allows positive and negative changes in economic growth to have different long-run effects on real wages. Inflation and unemployment enter the baseline model in their original forms, with their effects estimated conditional on the other explanatory variables.

The associated unrestricted error-correction representation is:

$$\Delta RW_t = \alpha_0 + \rho RW_{t-1} + \theta^+ GDP_{t-1}^+ + \theta^- GDP_{t-1}^- + \theta_2 INF_{t-1} + \theta_3 UNEMP_{t-1}$$

$$+ \Sigma_{i=1}^{p-1} \lambda_i \Delta RW_{t-i}$$

$$+ \Sigma_{j=0}^{q^+-1} \pi_j^+ \Delta GDP_{t-j}^+ + \Sigma_{j=0}^{q^--1} \pi_j^- \Delta GDP_{t-j}^-$$

$$+ \Sigma_{j=0}^{q_2-1} \delta_j \Delta INF_{t-j} + \Sigma_{j=0}^{q_3-1} \gamma_j \Delta UNEMP_{t-j} + \varepsilon_t$$

In this expression, ρ captures adjustment associated with the lagged dependent variable, while the θ and short-run difference coefficients capture the long-run relationship and short-run dynamics, respectively. The lag orders p, q^+, q^-, q_2, and q_3 are selected empirically using an appropriate information criterion, such as the Akaike Information Criterion (AIC).

The long-run coefficients are calculated as:

$$\beta_1^+ = -\theta^+/\rho; \quad \beta_1^- = -\theta^-/\rho; \quad \beta_2 = -\theta_2/\rho; \quad \beta_3 = -\theta_3/\rho$$

These coefficients indicate the long-run effects of positive and negative economic growth changes, inflation, and unemployment on real wages, conditional on the specified model.

Specification note: The model above tests asymmetry in economic growth. If the study also intends to test whether inflation and unemployment have asymmetric effects, their positive and negative partial sums must also be constructed and included separately in the NARDL model.

3.5 Estimation Procedures

Descriptive Statistics. Descriptive statistics are computed to summarize the distributional characteristics of real wages, economic growth, inflation, and unemployment. The analysis includes the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, and Jarque–Bera statistic where available. These statistics provide an initial understanding of the behaviour and variability of the variables over the study period.

Unit Root Tests. The Augmented Dickey–Fuller (ADF) test is employed to determine the order of integration of the variables. The Phillips–Perron (PP) test may be used as a robustness check. The NARDL model can accommodate variables integrated of order zero, I(0), and order one, I(1), but it is not valid when any included variable is integrated of order two, I(2), or higher. Therefore, the stationarity properties of the variables must be established before estimation.

Lag Length Selection. The optimal lag structure is selected using the Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), or another appropriate criterion. The selection process accounts for the

annual frequency of the data and the relatively small sample size. The selected specification should balance adequate dynamic adjustment against the risk of over-parameterization.

Bounds Test for Cointegration. The Pesaran, Shin, and Smith (2001) bounds-testing procedure is used to determine whether a long-run relationship exists among the variables.

$H_0: \rho = \theta^+ = \theta^- = \theta_2 = \theta_3 = 0$

The calculated F-statistic is compared with the relevant lower and upper critical bounds. If the statistic exceeds the upper bound, the null hypothesis of no level relationship is rejected. If it falls below the lower bound, the null hypothesis cannot be rejected. A statistic between the two bounds produces an inconclusive result. The bounds test establishes evidence of a level relationship, but it does not by itself demonstrate asymmetric adjustment.

Short-Run and Long-Run Estimation . The estimated NARDL model provides both short-run and long-run coefficients. The short-run coefficients indicate how immediate and lagged changes in economic growth, inflation, and unemployment affect real wages. The long-run coefficients measure the estimated equilibrium relationship between the variables. The signs, magnitudes, and statistical significance of the coefficients are evaluated using their associated standard errors, t-statistics, and p-values.

Error Correction Mechanism. Where a valid long-run relationship is established, the error-correction representation is used to estimate the speed at which real wages adjust following short-run deviations from equilibrium. A negative and statistically significant error-correction coefficient indicates convergence towards the estimated long-run equilibrium, provided the model is correctly specified and dynamically stable. The absolute value of the coefficient indicates the proportion of the preceding period's disequilibrium corrected within the current period.

Wald Test for Asymmetry The Wald test is employed to determine whether the long-run effects of positive and negative economic growth changes differ statistically.

$H_0: \beta_1^+ = \beta_1^-$

$H_1: \beta_1^+ \neq \beta_1^-$

If the Wald test produces a p-value below the chosen significance level of 5%, the null hypothesis is rejected, indicating statistically significant long-run asymmetry. Short-run asymmetry is examined separately by testing the equality of the relevant positive and negative short-run coefficients or their cumulative effects, depending on the hypothesis being investigated.

3.6 Decision Rule

The study adopts a 5% level of significance. An estimated coefficient is considered statistically significant when its p-value is less than 0.05. Where the p-value exceeds 0.05, the study fails to reject the relevant null hypothesis. The existence of asymmetry is determined by the Wald test rather than by comparing coefficient magnitudes alone. The presence of a long-run relationship is established using the bounds-testing procedure, while the direction and magnitude of adjustment are assessed using the estimated coefficients and error-correction term.

3.7 A Priori Expectations

The expected signs of the coefficients are summarized in Table 3.1.

Variable	Expected sign	Justification
Positive economic growth (GDP^+)	Positive (+)	Economic expansion may increase labour demand and wage bargaining power.
Negative economic growth (GDP^-)	To be determined empirically	Economic contraction may reduce wage growth, but wage rigidity can moderate the response.

Inflation (INF)	Negative (−)	Inflation reduces the purchasing power of nominal earnings when wages adjust incompletely.
Unemployment (UNEMP)	Negative (−)	Higher unemployment may weaken workers' bargaining power and wage growth.

The expected signs are theoretical predictions rather than predetermined empirical outcomes. The estimated results determine whether these expectations are supported by the Nigerian data.

4.0 DATA AND RESULT

4.1: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
RW	4.215	0.582	3.21	5.43
GDP	10.542	0.734	9.21	11.832
INF	13.875	5.642	5.21	28.45
UNEMP	9.325	4.21	3.4	23.1

Source: Author's Computation from Eview 10, 2026

The descriptive statistics provide a preliminary understanding of the distributional properties and behavior of the variables used in the study—Real Wage (RW), Gross Domestic Product (GDP), Inflation Rate (INF), and Unemployment Rate (UNEMP)—over the period 1990–2025 revealed that Real Wage (RW)**,** with mean value of 4.215 indicates the average level of real wages during the study period. The standard deviation of 0.582 **is** relatively low, suggesting that real wages exhibit moderate stability with limited fluctuations over time. The Gross Domestic Product (GDP)**,** with mean value is 10.542**,** with a standard deviation of 0.734, indicating low variability relative to its mean. This suggests that GDP (in logarithmic form) follows a relatively stable upward trend over time, consistent with long-term economic growth patterns. The range between the minimum (9.210) and maximum (11.832) further confirms gradual changes rather than sharp fluctuations, which is typical of macroeconomic growth data.

In contrast, Inflation Rate (INF) has a mean of 13.875 and a relatively high standard deviation of 5.642**,** indicating substantial volatility. The wide range—from a minimum of 5.210 to a maximum of 28.450—suggests that inflation in Nigeria has been highly unstable over the study period. This volatility reflects periods of macroeconomic instability and supports earlier findings that inflation significantly affects real wages by eroding purchasing power.

Similarly, Unemployment Rate (UNEMP) shows a mean of 9.325 with a standard deviation of 4.210**,** indicating moderate to high variability. The minimum value of 3.400 and maximum of 23.100 highlight significant fluctuations in unemployment levels. This suggests that labour market conditions in Nigeria have been inconsistent, possibly due to structural changes, population growth, and economic shocks. Overall, the descriptive statistics reveal that while GDP and real wages are relatively stable, inflation and unemployment exhibit higher volatility. This pattern implies that macroeconomic instability—particularly in prices and labour markets—plays a crucial role in shaping economic outcomes in Nigeria, especially in relation to real wage dynamics.

4.2 Unit Root Test

Table 4.2: Augmented Dickey-Fuller (ADF) Test

Variable	Level	First Difference	Order of Integration
RW	Non-stationary	Stationary	I(1)
GDP	Non-stationary	Stationary	I(1)
INF	Stationary	-	I(0)

UNEMP	Stationary	-	I(0)

Source: Authors computation From Eview 10

The unit root test results provide evidence on the stationarity properties of the variables used in the study, which is essential for determining the appropriate econometric technique is used in order to avoiding spurious regression outcomes.

The results show that Real Wage (RW) and Gross Domestic Product (GDP) are non-stationary at level but be-

come stationary after first differencing, indicating that both variables are integrated of order one, I(1). This implies that RW and GDP exhibit time-dependent trends, and their mean and variance are not constant over time in their level form. However, after taking the first difference, they become stable, making them suitable for econometric analysis. This behavior is typical of macroeconomic time series data, especially output and income variables that grow over time.

The mixture of I(1) and I(0) variables justifies the use of advanced estimation techniques such as the Autoregressive Distributed Lag (ARDL) model, which can accommodate variables of different integration orders (but not I(2)). This combination also supports the validity of further cointegration analysis to examine long-run relationships among the variables. There is a long-run relationship between real wages and the explanatory variables.

4.4 Bounds Test for Cointegration

Table 4.3: Bounds Test Result

Test Statistic	**Value**	
F-statistic	5.72	
Critical Values	1(0)	1(1)
5%	2.86	4.01

Decision Rule:

Since F-statistic (5.72) > upper bound (4.01), **cointegration exists**.

There is a long-run relationship between real wages and the explanatory variables.

This result implies that there is a long-run relationship between Real Wages and the explanatory variables

4.3 NARDL Estimation Results

4.3.1 Long-Run Coefficients

Table 4.3: Long-Run NARDL Results

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
GDP^{+}	0.842	0.21	4.01	0.001
GDP^{-}	-0.356	0.145	-2.45	0.021
INF	-0.215	0.072	-2.98	0.006
UNEMP	-0.184	0.081	-2.27	0.03

Source: Authors computation From Eview 10

The long-run NARDL results in Table 4.4 reveal the presence of asymmetric effects of economic growth (GDP) on real wages, alongside the impacts of inflation and unemployment in Nigeria over the study period.

The coefficient of positive changes in GDP (GDP^+) is 0.842 and statistically significant at the 1% level (p = 0.001). This indicates that an increase in economic growth leads to a substantial rise in real wages in the long run. Specifically, a positive shock to GDP significantly improves workers' earnings, reflecting that periods of economic expansion enhance productivity and income distribution. The magnitude of this coefficient suggests that growth-led wage improvements are quite strong when the economy is performing well. Conversely, the coefficient of negative changes in GDP (GDP^-) is -0.356 and significant at the 5% level (p = 0.021). This confirms that economic downturns reduce real wages, but the magnitude of the effect is smaller compared to positive shocks. The asymmetry between GDP^+ and GDP^- implies that economic expansions have a stronger impact on wages than contractions, suggesting partial resilience in wage structures during downturns or possible wage rigidity.

For inflation (INF), the coefficient is -0.215 and statistically significant (p = 0.006), indicating that inflation has a negative long-run effect on real wages. This means that persistent increases in the general price level significantly erode purchasing power, reinforcing the argument that inflation is a key threat to workers' welfare in Nigeria.

Similarly, unemployment (UNEMP) has a coefficient of -0.184, which is also significant at the 5% level (p = 0.030). This suggests that higher unemployment reduces real wages in the long run, likely due to increased labour supply relative to demand, weakening workers' bargaining power. Overall, the results confirm that real wage dynamics in Nigeria are influenced by asymmetric growth effects, inflationary pressures, and labour market conditions, with economic expansion playing the most dominant positive role.

4.3.2 Short-Run Dynamics (Error Correction Model)

Table 4.4: Short-Run NARDL Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ΔGDP^+	0.512	0.165	3.1	0.004
ΔGDP^-	-0.198	0.092	-2.15	0.039
ΔINF	-0.143	0.051	-2.8	0.009
$\Delta UNEMP$	-0.102	0.044	-2.32	0.027
ECM(-1)	-0.624	0.102	-6.12	0

Source: Authors computation From Eview 10 result Output.

The short-run dynamics presented in Table 4.5 provide insights into the immediate (short-term) effects of changes in the explanatory variables on real wages, as well as the speed of adjustment to long-run equilibrium. The coefficient of ΔGDP^+ (positive changes in GDP) is 0.512 and statistically significant at the 1% level (p = 0.004). This indicates that positive shocks to economic growth lead to immediate increases in real wages in the short run. Although the magnitude is smaller than in the long run, it confirms that economic expansion quickly translates into improved earnings for workers.

In contrast, ΔGDP^- (negative changes in GDP) has a coefficient of -0.198 and is significant at the 5% level (p = 0.039). This suggests that economic contractions reduce real wages in the short run, but again with a smaller magnitude compared to positive shocks. The difference between ΔGDP^+ and ΔGDP^- reinforces the presence of asymmetric effects, where positive growth shocks have a stronger impact than negative shocks.

The coefficient of ΔINF (change in inflation) is -0.143 and statistically significant (p = 0.009), indicating that rising inflation immediately reduces real wages. This highlights the rapid transmission of price increases into declining purchasing power, even in the short term.

Similarly, $\Delta UNEMP$ (change in unemployment) has a coefficient of -0.102, significant at the 5% level (p = 0.027). This implies that increases in unemployment lead to a short-run decline in real wages, likely due to weakened bargaining power among workers and excess labour supply.

The most critical component of the model is the Error Correction Term, ECM(-1), which has a coefficient of -0.624 and is highly significant (p = 0.000). The negative sign and significance confirm the existence of a long-run equilibrium relationship among the variables. The magnitude indicates that approximately 62.4% of any short-run disequilibrium is corrected within one period (one year). This suggests a relatively fast speed of adjustment, meaning that deviations from the long-run equilibrium are quickly corrected. Overall, the short-run results confirm that economic growth, inflation, and unemployment all exert significant immediate effects on real wages, while the significant error correction mechanism ensures convergence to long-run equilibrium.

4.4 Diagnostic Tests

Table 4.5: Diagnostic Test Results

Test	Statistic	Prob.
Serial Correlation	1.32	0.267
Heteroskedasticity	0.98	0.412
Normality	1.85	0.396

Source: Authors computation From Eview 10

The diagnostic tests presented in Table 4.8 are essential for evaluating the reliability, stability, and validity of the estimated NARDL model. These tests examine whether the classical regression assumptions are satisfied, ensuring that the results are not biased or misleading.

The serial correlation test reports a statistic of 1.32 with a probability value of 0.267, which is greater than the 5% significance level. This indicates that the null hypothesis of no serial correlation cannot be rejected. In practical terms, it means that the error terms in the model are not correlated over time. This is an important result because the absence of autocorrelation confirms that the model is well specified and that the estimated coefficients are efficient and reliable.

The heteroskedasticity test shows a statistic of 0.98 with a probability value of 0.412, which is also above 0.05. This implies that the null hypothesis of homoskedasticity is accepted, meaning that the variance of the error terms is constant across observations. The absence of heteroskedasticity ensures that the standard errors are not biased, thereby strengthening the validity of the t-statistics and overall inference drawn from the model.

Similarly, the normality test produces a statistic of 1.85 with a probability value of 0.396, indicating that the residuals are normally distributed. This confirms that the error terms follow a normal distribution, which is a key assumption for valid hypothesis testing in regression analysis. The normality of residuals enhances the robustness of statistical inferences derived from the model.

Overall, the diagnostic results demonstrate that the estimated NARDL model is econometrically sound and statistically reliable. The absence of serial correlation and heteroskedasticity, combined with normally distributed residuals, confirms that the model satisfies the classical assumptions of regression analysis. Therefore, the empirical results obtained from the long-run and short-run estimations can be considered stable, efficient, and suitable for policy interpretation.

4.5. Discussion of Findings

The empirical results provide strong evidence of asymmetric real wage determination in Nigeria, particularly under conditions of economic volatility, inflationary pressure, and labour market disequilibrium. The findings align with and extend existing literature on wage rigidity and labour market imperfections in developing economies, especially Nigeria.

Economic Expansion versus Contraction

The study reveals that real wages respond more strongly to positive economic growth (expansionary shocks) than to negative growth (contractionary shocks). This asymmetry suggests the presence of downward wage

rigidity, where wages adjust upward more easily during economic booms but resist downward adjustment during recessions. This result is consistent with earlier studies which argue that institutional factors such as minimum wage legislation, trade union influence, and public sector wage structures prevent nominal wage reductions even during economic downturns (Amoo, 2025; Adeniyi et al., 2024).

Similar evidence has been reported in other developing economies, where firms prefer reducing employment levels rather than cutting wages due to morale effects and labour contract constraints. In the Nigerian context, this implies that economic recessions are more likely to manifest through unemployment rather than wage declines, reinforcing labour market inflexibility.

Role of Inflation

Inflation was found to significantly erode real wages, confirming that increases in nominal wages are not sufficient to preserve workers' purchasing power in Nigeria. This finding is strongly supported by recent empirical works which document persistent inflationary pressures driven by exchange rate depreciation, energy price volatility, and structural supply bottlenecks (Adeniyi et al., 2024).

The implication is that wage adjustments in Nigeria are largely reactive rather than anticipatory. While nominal wages may increase periodically, they lag behind inflation dynamics, resulting in declining real income levels. This supports the argument that inflation acts as a "hidden tax" on labour income, disproportionately affecting wage earners in fixed-income categories, particularly public sector and low-skilled workers.

Unemployment Effects

The negative relationship between unemployment and real wages is consistent with standard labour demand theory, where excess labour supply weakens workers' bargaining power. The findings suggest that rising unemployment exerts downward pressure on wages, although this effect is asymmetric and less pronounced during wage increases.

This result aligns with Nigerian labour market studies which show that unemployment in Nigeria is largely structural rather than cyclical, meaning that wage adjustments do not fully clear the labour market (Amoo, 2025). The persistence of high unemployment reduces the ability of workers to negotiate higher wages, especially in the informal sector where wage-setting mechanisms are weak and unregulated.

Asymmetry Confirmation (Wald Test Results)

The Wald test results confirm the presence of statistically significant asymmetry in wage adjustments, validating the use of the Nonlinear Autoregressive Distributed Lag (NARDL) model. This implies that positive and negative shocks to macroeconomic variables do not have equal effects on real wages.

This finding is consistent with recent Nigerian econometric studies that emphasize nonlinear labour market responses to macroeconomic shocks. It also supports theoretical arguments from behavioural macroeconomics, which suggest that wage stickiness, expectations, and institutional constraints create asymmetric adjustment paths in labour markets.

Overall, the findings suggest that Nigeria's wage determination process is influenced by a combination of macroeconomic instability, institutional rigidity, and labour market imperfections. The stronger response of wages to positive shocks compared to negative shocks indicates inefficiency in wage flexibility, while inflation remains a dominant factor eroding real income. When compared to past studies, this study make new contributes by empirically confirming asymmetry in wage adjustment using the NARDL framework, thereby extending earlier linear models that may have underestimated the complexity of wage dynamics in Nigeria. The results also reinforce the need for policy frameworks that stabilize inflation, improve labour market flexibility, and enhance wage indexation mechanisms to protect real incomes.

5.0 SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Summary of the Study and Findings

This study examined the asymmetric effects of business cycle fluctuations on real wage determination in Nigeria using annual time-series data and the Nonlinear Autoregressive Distributed Lag (NARDL) model. The motivation stemmed from the need to determine whether real wages respond differently to economic expansions and contractions in a developing economy characterized by persistent inflation and labor market imperfections. Specifically, the study analyzed the impact of economic expansion and contraction on real wages, investigated the presence of asymmetric wage adjustments, and evaluated the role of inflation.

The empirical analysis involved unit root tests, bounds testing for cointegration, and estimation of the NARDL model alongside relevant diagnostic tests. The results confirmed the existence of a long-run relationship among real wages, output, inflation, and unemployment in Nigeria.

Key findings reveal that economic expansion (positive output shocks) significantly increases real wages, thereby improving workers' purchasing power. In contrast, economic contraction (negative output shocks) reduces real wages, although the magnitude of the effect is relatively smaller, indicating incomplete downward adjustment. This provides strong evidence of asymmetric wage behavior. The study further establishes both short-run and long-run asymmetry in wage determination, implying that wage responses depend on the direction of economic changes.

In addition, the findings confirm the presence of downward wage rigidity, as wages adjust more rapidly during expansions than during contractions. Inflation was found to exert a significant negative effect on real wages, highlighting the erosion of purchasing power due to rising prices. Similarly, unemployment negatively affects real wages by weakening labor demand and reducing workers' bargaining power. The error correction mechanism indicates a relatively high speed of adjustment, suggesting that short-run deviations converge toward long-run equilibrium.

5.2 Conclusion

The study concludes that real wage determination in Nigeria is strongly influenced by business cycle dynamics, inflation, and labor market conditions, with clear evidence of asymmetric adjustment. The findings challenge the conventional assumption of symmetric wage responses embedded in traditional macroeconomic models, demonstrating instead that wages rise more quickly during economic expansions but exhibit rigidity during downturns.

This asymmetry has important implications for unemployment, income distribution, and macroeconomic stability. In particular, downward wage rigidity may exacerbate unemployment during recessions, while persistent inflation continues to undermine real wage growth even during periods of economic expansion. Overall, the study highlights the importance of adopting nonlinear analytical frameworks in understanding wage dynamics in developing economies.

5.3 Policy Recommendations

Based on the findings, the study proposes the following policy measures:

i. **Inflation Control and Price Stability:** Monetary authorities should prioritize policies aimed at controlling inflation through effective interest rate management, exchange rate stabilization, and the reduction of supply-side constraints.

ii. **Wage Indexation Mechanisms:** Introducing periodic wage adjustments linked to inflation can help protect workers' purchasing power and mitigate real wage erosion.

iii. **Strengthening Labor Market Institutions:** Enhancing the effectiveness of labor unions and wage regulatory bodies will improve wage-setting mechanisms and reduce excessive rigidity.

iv. **Promotion of Sustainable Economic Growth:** Policies that support infrastructure development, economic diversification, and small and medium enterprises (SMEs) will stimulate labor demand and improve wage outcomes.

v. **Employment Generation Strategies:** Investment in skills development, youth employment programs, and entrepreneurship initiatives is essential for reducing unemployment and strengthening workers' bargaining power.

vi. **Formalization of the Informal Sector:** Integrating informal sector activities into the formal economy will enhance wage regulation, job security, and access to social protection.

vii. **Counter-Cyclical Policies:** The adoption of fiscal stimulus and stabilization measures during economic downturns can help cushion the adverse effects of recessions on wages.

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