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A new perspective on the asymmetric Phillips curve: Fresh evidence from ECOWAS member countries

Olufemi Gbenga Onatunji [*] [+]
Oluwabunmi Opeyemi Adejumo [**]
Oluwayinka Samuel Olabode [***]

Abstract: *A growing body of scholarly research has explored the non-linearity of the Phillips curve, but empirical evidence from an African perspective, particularly within the ECOWAS sub-regional context, remains underexplored. This study aims to address this gap by offering a fresh perspective on the asymmetric Phillips curve for West African countries through a comparative country-specific analysis and a panel framework utilizing the nonlinear autoregressive distributed lag (NARDL) model for the period 1986–2020. The empirical outcomes demonstrate that the asymmetric response of inflation to both positive and negative unemployment differs across the countries of Benin, Burkina Faso, Ghana, Guinea, Cote d'Ivoire, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Specifically, the study finds that inflation declines when unemployment rises and surges when unemployment declines in both short- and long-term dynamics. These findings highlight that low unemployment during economic expansion leads to wage-price spirals, while high unemployment results in low inflationary pressure during economic downturns in the analyzed countries. The empirical outcomes are robust and consistent for both country-specific and panel analyses, but the extent of the inflation response to unemployment is more pronounced in the WAMZ subregion. This study provides valuable insights for policymakers regarding the formulation of sound regional monetary policy.*

Keywords: Phillip curve; unemployment; inflation; NARDL Cointegration; ECOWAS

JEL Classification: C20, C32, C51, E30, E31

[*] Department of Economics, Redeemer's University, Ede, Nigeria
[+] Olufemi Gbenga Onatunji is corresponding author. E-mail: onatunjio@run.edu.ng.
[**] Institute for Entrepreneurship and Development Studies, Obafemi Awolowo University, Ile-Ife, Nigeria.
[***] Department of Economics, Redeemer's University, Ede, Nigeria.

Introduction

Achieving price stability remains a major concern for global monetary policymakers. The emergence of the COVID-19 pandemic, coupled with the ongoing global economic crisis, has positioned economic policymakers to grapple with the dual challenges of maintaining price stability and achieving sustainable employment. Over the past few decades, understanding the two policy variables—inflation and unemployment—has become a critical policy consideration for central bankers pursuing inflation-targeting policies, particularly since the resurgence of the Phillips curve in 1958. The Phillips curve remains a useful tool for medium-term inflation forecasting and significantly influences monetary policy. For instance, Barnichon and Mesters (2020) emphasize the importance of the inflation-unemployment trade-off in monetary policy, as central banks utilize this trade-off to convert unemployment into inflation (or vice versa) through an interest rate policy. They further argue that a central bank's ability to control inflation is contingent upon the magnitude of this trade-off, or more colloquially, the "unemployment cost" of lowering inflation.

Recently, concerns about combating rising inflation and unemployment have led to a debate on whether inflation responds differently to changes in unemployment. This argument was sparked by the observed failure of inflation to change when there was ostensibly high or low unemployment during the Great Depression and the global financial crisis of 2008. Consequently, scholars have speculated that the Phillips curve could be non-linear and convex and that inflation may respond asymmetrically to unemployment declines above and below natural levels. For example, Forbes et al. (2021) argue that upward pressure on prices is greater when there is a decline in unemployment than when there is downward pressure, and that changes in slack (unemployment) have little effect on inflation when there is spare capacity in the economy. This finding suggests the possibility of an asymmetric nexus between unemployment and inflation. However, empirical consideration of this central question has remained equivocal among economic policymakers and scholars since the pathbreaking study of Phillip (1958). Hence, this present study aims to reinvestigate the asymmetric trade-off nexus between unemployment and inflation, with a focus on the Economic Community of West African States (ECOWAS). The choice of the ECOWAS sub-region is based on three crucial factors. First, investigating the existence of the Phillips curve in the West African region is essential because of the impact of various socioeconomic backgrounds, macroeconomic policy implementations, and labour market reforms on the relationship between unemployment and inflation in each country. Second, unemployment is a pressing economic issue in this region, coupled with the outbreak of the COVID-19 pandemic, which exacerbates this menace. According to the International Labour Organization's (2020) report, the unemployment rate in Africa is the highest at 6.8%, followed by Europe and Central Asia (6.6%), the Americas (6.6%), and the Asia-Pacific region, with the lowest unemployment rate of 4.4%. The

report also indicated that southern African countries have the highest youth unemployment rate in Africa, which was 53% in 2019, followed by North African countries (30%), West Africa (10%), Central Africa (9%), and East African countries (6%). Finally, understanding the dynamics of the unemployment and inflation nexus in the subregion is critical for policymakers and scholars, as the apparent disparity between the two series in the selected region could undermine the success of the proposed long-standing single monetary zone. Inflation is a key variable of interest because it is an essential convergence indicator for the successful implementation of monetary integration in the region. Therefore, this study would provide valuable insights necessary for the successful implementation of convergence criteria.

This study makes an important contribution to the extant literature on the Phillip curve in three folds. First, our study is the first to offer empirical evidence on the asymmetric Phillips curve for West African countries through a comparative country-specific analysis and panel framework. The results of this investigation offer fundamental insights into predicting inflation rates and addressing the persistent unemployment issue in the region. Second, this study not only examines long-run dynamics but also delves into the short-run relationship between the variables. We employ the recent nonlinear autoregressive distributed lag (NARDL) and panel non-linear autoregressive distributed lag (PNARDL) techniques developed by Shin et al. (2014) for country-specific and panel studies, respectively. Third, most existing panel-based studies failed to consider subregional heterogeneity by grouping entire economies as a single entity. We extend the extant literature by dividing the sub-region into two blocs[1], WAEMU and WAMZ, as highlighted by Folawewo and Adeboje (2017), as the different economic and political systems in these blocs warrant such disaggregation.

The rest of the paper is organized as follows. The next section provides a brief literature review. This third section presents the data sources and methodology. The fourth section is devoted to the empirical results and discussion, and section five provides the concluding remarks.

Brief Literature Review

The observed failure of inflation to change when unemployment rose and declined during the Great Depression witnessed in 1929 has generated intense debate among scholars and policymakers. The significant explanation for the "missing deflation puzzle" when there is ostensibly high unemployment globally is the downward nominal rigidity. This phenomenon underscores that the Phillips curve could perform poorly when the asymmetric nexus between inflation and unemployment is less understood (Ball and Mazumder, 2011). Over the past few years, a new strand of research has explored the asymmetry of the Phillips curve, but the empirical outcomes remain divergent across different economies. For instance, Debelle and Laxton (1997) in-

vestigated the non-linearity of the Phillips curve in a cross-country setting using the Kalmer filter and maximum likelihood estimation (MLE) approaches spanning 1971Q1–1995Q2 and uncovered the existence of an asymmetric trade-off between unemployment and inflation. Similarly, Stiglitz (1997) conducted the same investigation and found that the cyclical trade-off between the two variables becomes moderate on the margin in the United States. Filardo (1998) explored the non-linearity of the Phillip curve in the U.S.A. and discovered that the Phillip curve is asymmetric when the output is rising and becomes linear as the output gap is declining. Similarly, Laxton et al. (1999) assessed the asymmetric linkages between unemployment and inflation in the U.S.A. spanning 1972Q1–1997Q1 by deploying a regime-switching procedure. The authors discovered that rising unemployment leads to low prices, whereas declining unemployment contributes to rising prices.

Eliasson (2001) investigated the asymmetry of the Phillips curve in Australia, Sweden, and the USA using a smooth transition regression approach and found evidence of asymmetry in Australia and Sweden, but no evidence of asymmetry was reported in the USA. Furthermore, Barnes and Olivei (2003) explored the same investigation in the case of the USA using a threshold regression method spanning 1961–2002 and documented that inflation responds differently to unemployment depending on unemployment gaps. Using the New Keynesian Phillips Curve (NKPC) model, Huh and Jang (2007) examined the asymmetric Phillips curve in the UK and the USA, respectively. The authors discovered that the existence of a nonlinear nexus between unemployment and inflation hinges on the peculiarity of the economy, the magnitude of the intended inflation change, and whether central bankers aim to disinflate or prevent inflation from increasing. Similarly, Musso et al. (2007) analyzed the asymmetric Phillips curve for the case of euro-area economies and found no nonlinear Phillips curve. Onder (2009) investigated the same inquiry using the Markov-switching regime approach and documented evidence of an asymmetric trade-off between unemployment and inflation. The same conclusion was established by Ormerod et al. (2009), who deployed the fuzzy clustering technique and found that unemployment and inflation regimes are subject to persistent fluctuations over time.

Additionally, Hassonov et al. (2010) examined the asymmetric Phillip curve in Turkey over the period 1980–2008 and found that labour market tightening leads to a significant rise in inflation, while labour market slack causes a weak increase in inflation. The same conclusion was established by Peach et al. (2011). In a related study, Chortareas et al. (2011) discovered that prices respond asymmetrically to both decreasing and increasing unemployment in different quantiles in Euro area economies. Arabaci and Eryigit (2012) furthered the same inquiry using data from Turkey and documented that an asymmetric Phillips curve exists between unemployment and inflation. Using a USA state-level dataset, Kumar and Orrenius (2015) analyzed the asymmetry of the Phillips curve and documented that a fall in unemployment is more responsive to higher wages compared to a rise in unemployment above the his-

torical average. Xu et al. (2015) also explored the same investigation in the USA using the asymmetric quantile regression technique and found that rising unemployment exerts a low increase in prices while declining unemployment causes a significant increase in inflation. Similarly, Bildirici and Ozaksoy (2015), deploying the asymmetric ARDL and Granger causality techniques in Canada, documented the existence of an asymmetric trade-off between the variables.

Furthermore, Gatt (2016) examined the asymmetric nexus between unemployment and inflation in the Maltese economy and found that inflation varies little with unemployment during recessions but responds to it during expansions. The same investigation was conducted by Nalewaik (2016) using the Markov-switching regime technique, which found that inflation increases as labour markets tighten beyond a certain point. Furthermore, Doser et al. (2017) also adopted threshold regression to investigate their study and discovered that, when the labour market tightens, there is a strong negative relationship between the variables but weak negative nexuses as the labour market loosens. The same conclusion was established by Kobb and Gabsi (2017), who utilized the logistic smooth-transition regression method in Tunisia. Detmeister and Babb (2017) reported similar findings using national- and state-level data, but they found relatively little asymmetry. Murphy (2017) and Albuquerque and Baumann (2017) arrived at similar conclusions in their investigations.

Furthermore, N'Guessan (2018) explored the non-linear Phillips curve in Cote d'Ivoire by employing threshold cointegration methods and found that positive shocks to unemployment respond more rapidly than negative shocks. Bildirici and Ozaksoy (2018) revisited the same inquiry in the cases of Turkey, the USA, France, and Japan, and the authors discovered a weak trade-off between the variables during increasing unemployment, but it became stronger when the labour market was tightened. Conversely, Bryne and Zekaite (2019) discovered that wage inflation is unresponsive to unemployment when the labour market is tight in Euro-area economies. Using the frequency domain approach, Mallick (2019) investigated the Phillips curve in Australia and discovered that the asymmetric Phillips curve is induced by numerous monetary policy regimes and changes in labour markets. Fu (2019), also using numerous measures of inflation and unemployment, uncovered that the Phillips curve changes over time. In a related study, Mutascu (2019) analyzed the asymmetric Phillips curve in the USA spanning 1945Q1–2017Q4 based on wavelet analysis techniques and found that the nexus between the variables is not stable during an economic downturn but becomes stable during economic expansion. In the same direction, Hooper et al. (2019) examined the same inquiry and discovered that the existence of an asymmetric Phillips curve in the USA is hinged on the nature of monetary policy implementation.

More recently, Abreu and Lopes (2020) estimated a nonlinear version of the New Keynesian Wage Phillips Curve (NKWPC) for the United States using the three-regime threshold regression technique. The results reveal that wage rates increase significantly when unemployment is low, and the rate of change in wages becomes con-

Table 1: Summary of literature on asymmetric Phillips curve

S/N	Author(s)	Data Period	Region/ Country	Methodology	Sustainability
1	Debelle & Laxton (1997)	1971Q1-1995Q2	USA, UK and Canada	Kalmer filter and Maximum likelihood estimation (MLE)	Trade-off
2	Laxton et al (1999)	1972Q1-1997Q1	USA	Regime switching	Trade-off
3	Eliasson (2001)	1977Q1-1997Q4	Australia, Sweden and USA	Smooth transition regression (STR)	Trade-off holds only for Australia and Sweden
4	Enders & Hurn (2002)	1965Q3-1997Q4	Australia	Threshold Autoregressive (TAR)	Trade-off
5	Barnes & Olivei (2003)	1961-2002	USA	TAR	Trade-off
6	De Veirman (2007)	1971Q2-2004Q4	Japan	OLS/MLE	Trade-off
7	Huh & Jang (2007)	1960Q1-2003Q2	USA and UK	Linear Threshold Autoregressive (LTAR)	Trade-off
8	Musso et al (2007)	1970Q1-2005Q4	Euro area countries	Smooth transition regression	Trade-off
9	Huh et al (2009)	1954Q1-2001Q4	USA	Linear smooth transition autoregressive (LSTAR)	Trade-off
10	Onder (2009)	1987Q1-2004Q4	Turkey	Markov switching	Trade-off
11	Ormerod et al (2009)	1971-2009	USA, Germany and UK	Fuzzy clustering technique	Trade-off
12	Correa & Minella (2010)	1995Q1-2005Q4	Brazil	TAR	Trade-off
13	Hassanov et al (2010)	1980-2008	Turkey	Smooth transition regression (STR)	Trade-off
14	Arabaci & Eryigit (2012)	1991Q1-2010Q4	Turkey	TAR	Trade-off
15	Kumar & Orrenius (2015)	1982-2013	USA	Spline regression	Trade-off
16	Xu et al (2015)	1952Q1-2011Q4	USA	Quantile regression	Trade-off
17	Bildirici & Ozaksoy (2015)	1957-2015	Canada	Non-linear autoregressive distributed lag (NARDL) and Granger causality	Trade-off
18	Gatt (2016)	1966Q4-2014Q4	Malta	Time-varying parameter	Trade-off
19	Nalewaik (2016)	1961Q1-2016Q1	USA	Regime Markov switching	Trade-off
20	Doser et al (2017)	1968Q4-2016Q3	USA	TAR	Trade-off
21	Kobbi & Gabsi (2017)	1993Q1-2012Q3	Tunisia	LSTAR	Trade-off

S/N	Author(s)	Data Period	Region/ Country	Methodology	Sustainability
22	Detmeister & Babb (2017)	1985-2016	USA	Spline regression	Weak trade-off
23	Albuquerque & Baumann (2017)	1992Q1-2015Q1	USA	TAR	Trade-off
24	Ho & Njindan Iyke (2018)	1991M-2017	Euro zone countries	Panel threshold	Trade-off
25	Murphy (2018)	1991Q1-2017Q2	USA	Spline regression	Trade-off
26	N'Guessan (2018)	1960-2014	Cote d'Ivoire	Engle and Granger threshold	Trade-off
27	Bildirici & Ozaksoy (2018)	1960-2016	Turkey, USA, France and Japan	NARDL and Granger causality	Trade-off
28	Bryne & Zekaite (2019)	1999Q1-2018	Euro area countries	Spline regression	Trade-off
29	Fu (2019)	1955Q1-2013Q1	USA	Bayesian estimation	Trade-off
30	Mallick (2019)	1959Q3-2013Q1	Australia	Frequency and time domain (spectral)	Trade-off
31	Mutascu (2019)	1945Q1-2017Q4	USA	Wavelet technique	Trade-off
32	Hooper et al (2019)	1961Q1-2018Q3	USA	Spline regression	Trade-off
33	Abreu & Lopes (2020)	1965-2018	USA	Three regime threshold	Trade-off
34	Cristini & Ferri (2021)	1961Q1-2019Q4	USA	Pairwise regression and TAR	Trade-off
35	Bishop & Greenland (2021)	1993Q2-2019Q4	Australia	Spline regression	Trade-off

stant at high unemployment levels. Bishop and Greenland (2021) found similar results when examining the Australian economy. Furthermore, Cristini and Ferri (2021) studied the various forms and levels of nonlinearity in the price Phillips curve in the United States over the period 1961Q1–2019Q4 by employing both pairwise and threshold techniques. The empirical outcomes indicated that, at a specific threshold, the relationship between the variables weakens during periods of rising unemployment but becomes stronger as the labour market strengthens. Similarly, Onatunji et al. (2023) investigated the asymmetric Phillips curve in Nigeria spanning 1980–2020 using the non-linear ARDL procedure. The authors discovered that declining unemployment spurs rising inflation, while increasing unemployment leads to low inflation in the country.

The extensive review of prior studies (Table 1) has identified crucial research areas that require attention in order to fill existing gaps in the literature. Notably, the review has revealed an expanding body of scholarly documents on the non-linearity Phillips curve, but the empirical evidence on this discourse from an African perspective, particularly within the ECOWAS sub-regional context, has been underexplored. This necessitates the current study to examine the non-linearity Phillips curve in the ECOWAS member countries from the perspective of comparative country-specific and panel framework employing the most recent econometric strategy, the nonlinear autoregressive distributed lag (NARDL) technique.

Data and methodology

Data

To analyze the asymmetric relationship between unemployment and inflation, we employ an annual dataset for all fifteen ECOWAS countries spanning over the period 1986–2020. The countries included were Benin, Burkina Faso, Cape Verde, Guinea, Guinea-Bissau, the Ivory Coast, Ghana, Liberia, Nigeria, Senegal, Niger, Mali, Sierra Leone, Togo, and Gambia. The choice of the sample period was primarily informed by the availability of data and marked the period in which different economic stabilization reforms, macroeconomic frameworks, and ongoing convergence programmes were witnessed in these economies. The inflation rate is measured using the consumer price index and the unemployment rate as proxies for the total unemployment rate (as a percentage of the total labour force, a national estimate). Data on both the inflation rate (INF) and the unemployment rate (UNE) were drawn from the World Development Indicators database. The variables are transformed into natural logarithms to obviate the problem of non-normality and heteroskedasticity. Table 2 presents the summary statistics of the variables used in this empirical investigation for both the country and sub-regional studies. The statistics indicate significant variability between the series in all countries considered, which confirms the heterogeneity

across countries. Specifically, Cape Verde and Niger had the highest and lowest levels of unemployment, with values of 11.179 and 1.203, respectively. Similarly, Nigeria and Benin have been reported to have the highest and lowest inflation rates, respectively, during the analyzed period. Interestingly, standard deviation statistics show evidence of homogeneity across countries with respect to the inflation rate. The inflation rate is the most and least volatile in Ghana (79.4896) and Liberia (8.154), respectively. Similarly, Nigeria (4.649) and Guinea (0.097) reported the highest and lowest variations, respectively, in unemployment. Jarque-Bera statistics indicate that neither series, particularly inflation, follows a normal distribution in all countries. At the group level, the average unemployment rate is higher in WAEMU countries than in WAMZ countries. Conversely, the inflation rate is higher in WAMZ countries than in WAEMU countries, with an average and standard deviation values of 48.928 and 56.835, respectively.

Table 2: Descriptive statistics

Country	Variables	Mean	Median	Maximum	Minimum	Std. Dev	Jarque-Bera
Burkina Faso	UNE	4.133	3.635	3.6.479	2.440	1.535	3.719
	INF	77.377	81.685	11.979	3.230	3.386	8.872
Benin	UNE	1.565	1.316	2.677	0.690	0.765	4.044
	INF	5.299	2.519	4.342	0.710	10.171	5.150
Cape Verde	UNE	11.179	10.679	14.000	10.239	0.923	4.192
	INF	79.002	82.704	10.801	0.610	30.972	2.061
Guinea Bissau	UNE	2.648	2.658	3.210	2.406	0.176	3.943
	INF	58.189	76.041	10.579	0.250	40.773	3.519
Gambia	UNE	9.318	9.378	9.642	8.959	0.164	2.115
	INF	57.646	29.181	18.579	0.250	40.773	3.519
Ghana	UNE	6.077	5.570	10.360	4.157	1.705	5.978
	INF	73.492	43.400	28.360	2.550	79.496	6.924
Guinea	UNE	4.422	4.460	4.554	4.193	0.097	3.530
	INF	12.039	8.234	10.626	0.432	17.856	4.611
Cote d'Ivore	UNE	4.740	4.515	7.223	2.599	1.305	2.034
	INF	77.119	83.592	12.856	0.810	32.567	5.776
Liberia	UNE	2.391	2.266	3.300	2.073	0.337	9.154
	INF	7.704	7.588	26.970	3.734	8.154	1.566
Mali	UNE	6.662	7.167	11.710	3.210	2.401	0.742
	INF	79.078	83.847	11.559	2.890	31.396	2.219
Niger	UNE	1.203	1.307	3.100	0.317	0.719	3.082
	INF	78.142	82.689	12.115	2.520	31.216	6.982
Nigeria	UNE	6.636	3.805	25.890	3.539	4.649	8.334
	INF	82.538	28.822	27.511	6.405	71.644	5.825
Senegal	UNE	7.189	6.645	10.360	5.440	1.755	4.083
	INF	80.259	85.433	19.251	1.029	30.160	7.495
Sierra Leone	UNE	3.876	3.526	4.678	3.268	0.538	4.493
	INF	20.913	13.442	12.761	3.916	26.680	6.308
Togo	UNE	3.559	4.229	4.927	1.982	1.083	4.409
	INF	79.257	79.783	13.296	1.803	30.260	6.096
WAMZ	UNE	3.978	3.295	11.710	0.317	2.468	4.047
	INF	66.941	79.041	13.296	3.230	38.847	2.970
WAEMU	UNE	6.372	4.562	25.890	2.073	3.496	4.476
	INF	48.928	23.559	28.360	3.916	56.835	6.412

Econometric Methodology

Our study applies the nonlinear autoregressive distributed lag (NARDL) model developed by Shin et al. (2014), which is an asymmetric extension to the linear autoregressive distributed lag (ARDL) model developed by Pesaran et al. (2001). NARDL is unique among existing cointegration techniques due to the following features: First, this technique allows the quantification of the respective responses of the regressor to positive and negative shocks originating from the asymmetric dynamic multipliers (Arize et al., 2017; Onatunji, 2019). Second, NARDL is a one-step estimation of asymmetry between variables for both short- and long-run dynamics. Third, the technique can also be applied to varying integration orders of variables, such as I(0), I(1), or a mix of both, and it is more efficient in small sample sizes. The NARDL method also enables one to distinguish between three different possible cases of cointegration: linear, non-linear, and no cointegration. Thus, the unrestricted error correction form of the linear ARDL is first specified as follows:

$$\Delta\pi_t = \alpha_t + \beta_1\pi_{t-1} + \beta_2 UNE_{t-1} + \sum_{i=1}^{m_1}\theta_i\Delta\pi_{t-i} + \sum_{i=1}^{m_2}\varphi_i\Delta UNE_{t-i} + \varepsilon_t \quad (1)$$

In this case, Δ represents the first difference operator, π_t is the inflation rate as a proxy for the consumer price index and UNE_t signifies the unemployment rate. m_i is the optimal lag length chosen using the Schwartz information criterion (SIC) and Akaike information criterion (AIC) and ε_t denotes the error term. The long run coefficient is denoted by β_i and the short run coefficients are represented by θ_i and φ_i respectively. The determination of a long-run relationship between the variables is confirmed by examining the null hypothesis that there is no cointegration ($\beta_1 = \beta_2 = 0$), using a non-standard F-test developed by Pesaran et al. (2001).

Equ (1) is a linear estimate of the ARDL approach. Using the NARDL method, unemployment is broken down into two partial sum processes with positive (UNE_t^+) and negative (UNE_t^-) components to examine the asymmetric relationship between inflation and unemployment, as depicted below:

$$UNE_t^+ = \sum_{j=1}^{t}\Delta UNE_j^+ = \sum_{j=1}^{t}\max\left(\Delta UNE_j, 0\right); UNE_t^- = \sum_{j=1}^{t}\Delta UNE_j^- = \sum_{j=1}^{t}\min\left(\Delta UNE_j, 0\right) \quad (2)$$

By integrating the two partial sum processes of positive and negative components in Equ. (2) the linear ARDL model in Eq. (1), the error-correction model of the NARDL approach is formulated as follows:

$$\Delta\pi_t = \alpha_t + \beta_1\pi_{t-1} + \beta_2^+ UNE_{t-1}^+ + \beta_2^- UNE_{t-1}^- + \sum_{i=1}^{m_1}\theta_i\Delta\pi_{t-i} + \sum_{i=0}^{m_2}\left(\varphi_i^+\Delta UNE_{t-i}^+ + \varphi_i^-\Delta UNE_{t-i}^-\right) + \varepsilon_t \quad (3)$$

The NARDL technique is empirically analyzed in the same process as the linear ARDL model. An asymmetric long-run relationship between the variables is also es-

tablished by testing the null hypothesis of no cointegration using the Bound test (F_{PSS}) (proposed by Pesaran et al. (2001) or the t-statistic (t_{BDM}) developed by Banerjee et al. (1998). To ascertain the presence of long run and short run asymmetries between the variables, Wald tests are employed to accomplish this purpose. The long run asymmetry impact of unemployment on inflation is verified under the null hypothesis of $H_0: -\frac{\beta_2^+}{\beta_1} \neq -\frac{\beta_2^-}{\beta_1}$ and the short run asymmetry effect is checked under the null hypothesis of $H_0: \sum_{i=0}^{m_2} \varphi_{k,i}^+ \neq \sum_{i=0}^{m_2} \varphi_{k,i}^-$. Additionally, the asymmetric cumulative dynamic multiplier effect of a unit change in unemployment is computed to observe how inflation is responsive to unemployment. As such, the asymmetric cumulative dynamic multiplier detects the adjustment path of inflation from the initial equilibrium to a new equilibrium, following positive and negative shocks to unemployment, as follows:

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial \pi_{t+j}}{\partial UNE_t^+}, \quad m_h^- = \sum_{j=0}^{h} \frac{\partial \pi_{t+j}}{\partial UNE_t^-} \qquad h = 0,1,2,.....$$

Note that as $h \rightarrow \infty$, then $m_h^+ \rightarrow \theta^+$ and $m_h^- \rightarrow \theta^-$. Where θ^+ and θ^- are estimated, as $\theta^+ = \frac{-\beta^+}{\beta}$ and $\theta^- = \frac{-\beta^-}{\beta}$, respectively.

Empirical results

The preliminary estimation of the analysis begins with an examination of the time series properties of the series using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests[2] . The results of the unit root test show a mixed order of integration between the series in the countries considered; in particular, inflation contains a unit root at level in most countries. However, both series were found to be stationary at the first difference in all countries, with no presence of the I(2) process. Perron (1989) pointed out that the conventional unit root test may exhibit low power and size distortions when there is existence of structural breaks in the series. To circumvent this problem, we employed Zivot and Andrew (1992) unit root test which permit one endogenous structural break. The results reveal that only inflation is stationary at level in some countries, but both series become stationary at the first difference in all countries.

Having established that the series are of different orders of integration, we proceed further to determine whether a long-run cointegration nexus exists between the series in the countries considered, employing linear and nonlinear ARDL bound tests. The results of the linear ARDL bound tests () in Table 3 indicate that the null hypothesis of no linear cointegration is rejected in eight out of the fifteen countries,

namely Benin (6.895), Burkina Faso (4.923), Ghana (6.548), Guinea (9.813), Liberia (6.406), Mali (5.766), Niger (5.940), and Sierra Leone (8.357), respectively. This finding suggests a linear co-integration relationship between the variables in these countries. Conversely, the non-existence of a linear cointegration relationship between the variables is reported in Cape Verde (2.145), Cote d'Ivoire (1.887), Gambia (1.147), Guinea-Bissau (2.191), Nigeria (2.895), Senegal (1.792), and Togo (2.094). This can be attributed to the presence of asymmetric characteristics between the variables in these countries. However, the results of the nonlinear ARDL bound test in Table 4 demonstrate evidence of asymmetric cointegration relationships between the variables in all countries under investigation. Because some countries exhibit a linear long-run relationship between the series, an empirical investigation of the long- and short-run relationships was conducted using the ARDL technique. Table 3 presents the results of the long- and short-run estimations of the linear Phillips curve for country-level analysis. This finding shows that unemployment has a negative effect on inflation, but the relationship is statistically insignificant in ten countries: Benin, Cape Verde, Gambia, Ghana, Guinea-Bissau, Guinea, Liberia, Mali, Nigeria, and Sierra Leone. The findings from the linear ARDL technique indicate that the Phillips curve is invalid in these countries because the coefficients are insignificant. Additionally, the effect of unemployment on inflation was positive and statistically insignificant in Burkina Faso, Cote d'Ivoire, Niger, Senegal, and Togo. Overall, the results of the linear ARDL techniques show an insignificant relationship between unemployment and inflation, despite the expected signs of the coefficients aligned with theoretical arguments that an increase in unemployment leads to a decline in inflation. The outcomes, however, lack economic significance or implications, suggesting that modelling the nexus between the series in a linear framework might lead to incorrect inferences and implications when there is potential asymmetry between the series.

Table 3: Linear ARDL Results

Variable	Benin	B. Faso	Cape Verde	Cote d'Ivore	Gambia	Ghana	G. Bissau	Guinea
Constant	1.158(0.002)[a]	4.189(0.000)[a]	2.841(0.589)	-0.272(0.944)	0.216(0.211)	-2.287(0.177)	0.887(0.424)	0.122(0.275)
INF_{t-1}	-0.503(0.127)	-0.934(0.278)	-0.192(0.046)[b]	-0.283(0.147)	-0.189(0.004)[a]	-0.556(0.294)	-1.054(0.328)	1.048(0.149)
UNE_t	-0.518(0.978)	0.328(0.116)	-1.216(0.498)	2.696(0.279)	-1.138(0.239)	-0.459(0.442)	-2.883(0.446)	-1.322(0.339)
ΔUNE_t	-0.0146(0.948)	0.036(0.215)	-4.487(0.067)[c]	0.704(0.208)	-0.350(0.000)[a]	-0.445(0.349)	3.952(0.002)[a]	-3.457(0.013)[a]
ΔUNE_{t-1}	-0.454(0.098)	-0.030(0.180)		0.540(0.059)	-0.210(0.020)		-0.249(0.353)	
ECM_{t-1}	-0.760(0.091)[c]	-0.111(0.05I)[b]	-0.495(0.074)[c]	-0.261(0.086)[c]	-0.214(0.159)	-0.128(0.122)	-0.038(0.337)	-0.768(0.106)[c]
Diagnostic								
R^2	0.554	0.842	0.657	0.488	0.705	0.802	0.791	0.896
X^2_{SC}	0.732(0.042)[b]	0.304(0.073)[c]	1.511(0.028)[b]	0.932(0.070)[c]	3.069(0.064)[c]	1.546(0.230)	0.217(0.806)	0.251(0.779)
X^2_H	1.823(0.187)	0.278(0.046)[b]	1.831(0.147)	1.373(0.268)	1.526(0000)[a]	0.940(0.061)[c]	3.321(0.036)[b]	1.028(0.395)
X^2_{FF}	1.553(0.824)	0.749(0.146)	1.064(0.029)[b]	0.971(0.035)[b]	2.610(0.014)[a]	1.769(0.000)[a]	2.141(0043)	0.876(0.105)[c]
X^2_N	1.330(0.013)[a]	24.283(0.000)[a]	4.679(0.000)[a]	5.862(0.000)[a]	4.275(0.001)[a]	1.402(0.107)[c]	1.944(0.057)[b]	0.331(0.847)
F_{PSS}	6.895[a]	4.923[a]	2.145	1.887	1.147	6.548[a]	2.191	9.813[a]
Variable	**Liberia**	**Mali**	**Niger**	**Nigeria**	**Senegal**	**Sierra Leone**	**Togo**	
Constant	-1.950(0.032)[b]	1.164(0.000)[a]	1.927(0.171)	1.370(0.000)[a]	1.256(0.853)	0.703(0.000)[a]	0.503(0.051)[b]	
INF_{t-1}	-0.210(0.280)	-0.783(0.153)	-1.103(0.254)	-0.189(0.320)	-0.635(0.140)	-0.316(0.482)	-0.175(0.592)	
UNE_t	-0.510(0.156)	-0.248(0.514)	1.306(0.876)	-0.509(0.125)	1.258(0.714)	-0.311(0.177)	1.271(0.625)	
ΔUNE_t	-0.692(0.778)	-0.227(0.590)	-0.136(0.492)	-0.442(0.120)	0.247(0.492)	-1.386(0.126)	0.493(0.350)	
ΔUNE_{t-1}	-0.108(0.472)		-0.026(0.911)	-1.125(0.184)		-0.813(0.296)	-0.213(0.104)[c]	
ECM_{t-1}	-0.868(0.004)[a]	-0.913(0.105)[c]	-0.317(0.024)[b]	-0.126(0.087)[c]	-0.573(0.042)[b]	-0.813(0.014)[a]	-0.652(0.039)[b]	
Diagnostic								
R^2	0.893	0.792	0.504	0.942	0.825	0.495	0.914	
X^2_{SC}	1.158(0.346)	1.511(0.046)[b]	0.664(0.052)[b]	1.503(0.187)	0.982(0.387)	1.644(0.439)	1.845(0.011)	
X^2_H	0.555(0.062)	2.628(0.026)[b]	0.581(0.565)	0.928(0.028)[b]	1.139(0.870)	2.016(0.154)	0.630(0.540)	
X^2_{FF}	1.428(0.024)[b]	1.286(0.073)[c]	0.682(0.102)[c]	1.038(0.000)[a]	0.428(0.041)[b]	0.969(0.032)[b]	0.684(0.051)[b]	
X^2_N	1.560(0.014)[a]	0.374(0.054)[b]	1.146(0.062)[c]	0.530(0.598)	0.968(0.101)[c]	0.871(0.391)	1.608(0.109)[c]	
F_{PSS}	6.406[a]	5.766[a]	5.940[a]	2.895	1.792	8.357[a]	2.094	

Note: a, b and c indicate significance levels for 1%,5% and 10% respectively. The values in parenthesis are p-values respectively. X^2_{SC}, X^2_H, X^2_{FF} and X^2_N represent LM test for serial correlation, heteroskedacticity, RAMSEY RESET test, and normality test, respectively. F_{PSS} denotes the results of the linear ARDL Bound test.

Accordingly, we extend the empirical analysis by investigating the asymmetric nexus between unemployment and inflation using the NARDLL technique, following the confirmation of a nonlinear cointegration relationship between the variables. Table 4 shows the outcomes of the long- and short-run NARDL approaches. The long-run results reveal that the positive (rising) and negative (declining) shocks to unemployment have a negative and statistically significant effect on inflation in Benin, Burkina Faso, Ghana, Guinea, Cote d'Ivoire, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Specifically, a 1% rise (decline) in unemployment reduces (surges) inflation by 0.1844 (0.015), 0.2888 (0.328), 1.613 (0.409), 2.322 (1.229), 0.378 (0.569), 0.797 (0.713), 1.489 (0.121), 1.821 (0.408), 1.209 (0.016), 0.909 (0.761), 1.249 (0.702), and 2.272 (0.648), respectively. This finding suggests that during low unemployment rates, ECOWAS countries face rising inflationary pressure and witness low prices when there is an ostensibly high unemployment rate in these economies. This outcome points out that pursuing accommodative monetary-fiscal policies to create a conducive labour market atmosphere could result in a wage-price spiral in the ECOWAS sub-region if monetary policymakers do not adequately implement inflationary targeting policies. Additionally, the results suggest that restrictive unemployment policies that keep unemployment below the natural level lead to astronomical increases in inflation, whereas surges in unemployment above the natural level cause a decline in inflation in these West African economies. This outcome therefore validates the existence of asymmetry in the Phillips curve in the sub-region, as the estimated coefficients of positive (rising) and negative (declining) unemployment have a differential impact on inflation, but the effect is more pronounced for the positive impact. This finding further highlights that during an economic downturn, rising unemployment causes low inflationary pressure, while low unemployment results in a wage-price spiral in the analyzed countries during economic expansion. The policy implication of this outcome is that policymakers must weigh the real costs of these policy variables before formulating macroeconomic policies in these economies to avoid undesirable consequences. This finding validates Phillip's (1958) theoretical argument that inflation increases steeply when unemployment is low, and the change in inflation becomes flat at a high unemployment rate. This outcome is congruent with the findings of Kumar and Orrenius (2015), Nalewaik (2016), Albuquerque and Baumann (2017), Bryne and Zekaite (2017), Bishop and Greenland (2021), and Onatunji et al. (2023), who discovered similar findings in their investigations. Additionally, the results show that positive (rising) unemployment has a significant negative effect on inflation, while negative (declining) unemployment has an insignificant negative impact on inflation in Cape Verde, Gambia, and Guinea-Bissau.

This study expands the empirical analysis by dividing the entire ECOWAS sub-region into two sub-regions, WAEMU and WAMZ, to account for sub-regional heterogeneity. The results of the subregional analysis reveal that inflation responds asymmetrically to both positive and negative unemployment shocks in both subre-

gions. Specifically, the inflation response to changes in unemployment is greater in the WAMZ subregion than in the WAEMU subregion. The estimated coefficients indicate that a 1% increase (decrease) in unemployment leads to a 1.197% (0.172%) decrease (increase) in inflation, respectively, in the WAEMU sub-region, while in the WAMZ sub-region, a 1% increase (decrease) in unemployment leads to a 1.805% (1.618%) increase (decrease) in inflation, respectively. This finding further supports the notion that the observed effect of unemployment on inflation is more pronounced in WAMZ countries, which have a higher unemployment rate than the WAEMU sub-region, which has a track record of relatively low unemployment due to its currency stability and fiscal relaxation. The policy implication of this finding is that ECOWAS policymakers should focus on achieving sustainable low unemployment, as an increase in unemployment has a negligible effect on inflation compared to the effect of low unemployment on inflation. Therefore, monetary policymakers should exercise caution when implementing policies to achieve low inflation in a sub-region to prevent a significant rise in unemployment.

The short-run outcomes show that the negative and positive changes in unemployment exert a negative and significant effect on inflation in nine countries but are insignificant in Liberia, Cape Verde, and Togo. While the negative shock to unemployment is positively significant in Nigeria, insignificant findings have been reported in Mali and Burkina Faso. The evidence of the positive findings suggests the existence of Phillips curve instability in the short run, which could be attributed to the inefficient implementation of macroeconomic policies. Additionally, the estimated coefficients of the error correction term (ECT) are negative and statistically significant in all the countries under consideration, suggesting that short-run disequilibrium converges to long-run equilibrium in each country at different magnitudes. The reliability of the estimated NARDL techniques was validated using different diagnostic tests, including the Durbin-Watson test, Breusch-Godfrey LM (BG-LM) test, Ramsey RESET test, and Breusch-Pagan-Godfrey (BPG) test. The lower panel of Table 4 shows evidence of no serial correlation, heteroscedasticity, autocorrelation, and model misspecification in the considered model. Furthermore, the validity of the existence of long-and short-run asymmetries was corroborated by the Wald test. The Wald test results shows that the null hypothesis of both short-run and long-run symmetry is rejected in Benin, Cote d'Iviore, Ghana, Guinea, Niger, Senegal and Sierra Leone. The long-run asymmetry is confirmed in only 12 countries, while short-run asymmetry is established in only nine countries. The Wald test results validate the existence of an asymmetric nexus between unemployment and inflation in the analyzed countries. Finally, the cumulative dynamic multiplier is derived to depict the path of adjustment of inflation to its long- and short-run equilibrium following a positive or negative shock in unemployment. The figures show an asymmetric relationship between unemployment and inflation in the analyzed countries, as the upper and lower bands are located within the zero line.

Table 4: Non-linear ARDL Results

Variable	Benin	B. Faso	Cape Verde	Cote d'Ivore	Gambia	Ghana	G. Bissau	Guinea	
Constant	1.784(0.000)[a]	4.084(0.000)[a]	1.046(0.000)[a]	0.259(0.000)[a]	-1.586(0.135)	0.919(0.429)	-0.209(0.571)	1.640(0.029)[b]	
UNE_t^+	-0.184(0.019)[a]	-0.288(0.057)[b]	-1.216(0.089)[c]	-0.378(0.019)[a]	-1.138(0.021)[b]	-1.613(0.069)[c]	-0.456(0.016)[a]	-2.322(0.042)[b]	
UNE_t^-	-0.015(0.037)[b]	-0.328(0.014)[a]	-0.841(0.044)[b]	-0.569(0.050)[b]	-0.369(0.114)	-0.409(0.021)[b]	-0.187(0.058)[b]	-1.229(0.026)[b]	
ΔUNE_t^+	-0.477(0.029)[b]	-0.365(0.058)[b]	-0.487(0.186)	-0.111(0.093)[c]	-1.350(0.002)[a]	-0.297(0.070)[c]	-0.646(0.031)[b]	-0.457(0.081)[c]	
ΔUNE_t^-	-0.880(0.017)[a]	0.163(0.143)	-0.856(0.126)	-0.460(0.078)[c]	-0.858(0.069)[b]	-0.412(0.015)[a]	-0.502(0.069)[c]	-0.405(0.056)[b]	
ECM_{t-1}	-0.760(0.001)[a]	-0.531(0.000)[a]	-0.674(0.012)[a]	-0.923(0.000)[a]	-0.466(0.012)[a]	-0.858(0.006)[a]	-0.623(0.000)[a]	-0.769(0.004)[a]	
L_{UNE}^+	-4.270(0.051)[a]	-18.431(0.000)[a]	-2.675(0.001)[a]	-13.412(0.000)[a]	-7.340(0.000)[a]	-2.478(0.037)[b]	-5.023(0.013)[a]	-3.129(0.019)[a]	
L_{UNE}^-	-6.832(0.014)[a]	-4.872(0.013)[a]	-1.042(0.120)	-24.698(0.000)[a]	-1.288(0.213)	-5.540(0.021)[b]	-1.041(0.148)	-1.028(0.072)[c]	
W_{LR}	8.450(0.000)[a]	2.397(0.010)[a]	1.150(0.170)	3.158(0.011)[a]	0.768(0.124)	7.142(0.001)[a]	1.897(0.214)	6.158(0.001)[a]	
W_{SR}	10.280(0.000)[a]	1.984(0.126)	1.743(0.149)	1.377(0.000)[a]	3.896(0.047)[b]	4.251(0.028)[b]	3.977(0.000)[a]	4.878(0.016)[a]	
F_{PSS}	8.288	9.074	5.347	6.901	7.862	10.622	5.506	12.668	
Diagnostic results									
R^2	0.987	0.920	0.645	0.892	0.664	0.797	0.918	0.860	
X_{SC}^2	0.473(0.688)	0.241(0.376)	0.051(0.243)	0.117(0.528)	0.178(0.460)	0.499(0.172)	0.179(0.457)	1.349(0.502)	
X_H^2	0.157(0.334)	0.785(0.477)	0.192(0.630)	0.747(0.138)	0.235(0.473)	1.126(0.492)	0.851(0.239)	0.158(0.928)	
X_{FF}^2	1.021(0.147)	1.193(0.154)	0.383(0.897)	0.516(0.721)	0.164(0.185)	0.407(0.360)	0.962(0.714)	0.471(0.340)	
X_N^2	0.487(0.342)	1.536(0.741)	1.468(0.263)	0.253(0.127)	1.473(0.291)	0.152(0.431)	0.141(0.158)	0.516(0.762)	
Variable	**Liberia**	**Mali**	**Niger**	**Nigeria**	**Senegal**	**Sierra Leone**	**Togo**	**WAEMU**	**WAMZ**
Constant	-1.958(0.114)	-0.037(0.000)[a]	0.295(0.493)	0.661(0.000)[a]	0.388(0.000)[a]	0.993(0.000)[a]	4.636(0.000)[a]	3.015(0.000)[a]	2.733(0.000)[a]
UNE_t^+	-0.797(0.085)[c]	-1.489(0.000)[a]	-1.821(0.048)[b]	-1.209(0.012)[a]	-0.909(0.084)[c]	-1.249(0.066)[c]	-2.272(0.015)[a]	-1.197(0.000)[a]	-1.805(0.008)[a]
UNE_t^-	-0.713(0.051)[b]	-0.121(0.059)[b]	-0.408(0.069)[c]	-0.016(0.078)[c]	-0.761(0.012)[a]	-0.702(0.051)[b]	-0.648(0.000)[a]	-0.172(0.000)[a]	-1.618(0.049)[b]
ΔUNE_t^+	-0.692(0.781)	-0.278(0.000)[a]	-0.074(0.084)[c]	-0.459(0.169)	-0.273(0.068)[c]	-0.558(0.074)[c]	-2.367(0.122)	-0.283(0.005)[a]	-1.767(0.000)[a]
ΔUNE_t^-	-0.056(0.146)	0.115(0.348)	-0.039(0.042)[b]	0.209(0.054)[b]	-0.185(0.032)[b]	-0.359(0.102)[c]	-0.849(0.163)	-0.197(0.000)[a]	-0.511(0.000)[a]
ECM_{t-1}	-0.868(0.005)[a]	-0.551(0.000)[a]	-0.432(0.046)[b]	-0.575(0.005)[a]	-0.735(0.095)[c]	-0.394(0.058)[b]	-0.475(0.050)[b]	-0.905(0.000)[a]	-0.951(0.000)[a]
L_{UNE}^+	-10.222(0.000)[a]	-4.344(0.000)[a]	-5.495(0.000)[a]	-9.486(0.019)[a]	-5.761(0.001)[a]	-10.057(0.000)[a]	-21.608(0.000)[a]	-7.227(0.000)[a]	-9.810(0.000)[a]
L_{UNE}^-	-7.413(0.021)[b]	-2.700(0.067)[c]	-8.796(0.012)[a]	-6.109(0.066)[c]	-4.388(0.021)[b]	-6.702(0.015)[a]	-16.842(0.000)[a]	-6.938(0.000)[a]	-7.371(0.024)[b]
W_{LR}	4.134(0.000)[a]	3.533(0.017)[a]	3.074(0.014)[a]	4.241(0.058)[b]	1.575(0.024)[b]	3.249(0.019)[a]	7.212(0.016)[a]	24.411(0.000)[a]	35.640(0.000)[a]
W_{SR}	2.880(0.151)	1.994(0.150)	1.743(0.048)[b]	2.699(0.127)	3.657(0.017)[a]	2.936(0.011)[a]	2.438(0.120)	8.940(0.000)[a]	10.809(0.000)[a]
F_{PSS}	9.490	15.868	8.910	9.824	10.835	10.122	7.109	6.557	9.201
Diagnostic results									
R^2	0.890	0.994	0.701	0.943	0.657	0.713	0.995	0.750	0.879
X_{SC}^2	1.050(0.223)	0.895(0.140)	1.184(0.432)	0.871(0.169)	0.508(0.118)	1.722(0.165)	1.322(0.212)	1.467(0.232)	1.805(0.166)
X_H^2	0.553(0.197)	0.227(0.663)	0.678(0.566)	2.560(0.125)	0.828(0.253)	0.187(0.219)	2.611(0.536)	0.324(0.121)	0.747(0.560)
X_{FF}^2	0.856(0.184)	0.614(0.277)	0.274(0.524)	0.685(0.413)	1.360(0.416)	0.868(0.297)	0.489(0.718)	0.701(0.483)	1.758(0.180)
X_N^2	1.326(0.446)	0.419(0.680)	0.460(0.351)	1.315(0.155)	1.053(0.349)	0.251(0.487)	0.562(0.841)	0.126(0.330)	1.593(0.258)

Note: a, b and c indicate significance levels for 1%,5% and 10% respectively. The subscripts "+" and "-" indicate positive and negative cumulative sums respectively. L_{UNE}^+ and L_{UNE}^- are the estimated long run coefficients associated with positive and negative changes in unemployment rate. W_{LR} and W_{SR} represent Wald test for long run and short run symmetry, respectively. The values in parenthesis are p-values respectively. X_{SC}^2, X_H^2, X_{FF}^2 and X_N^2 represent LM test for serial correlation, heteroskedacticity, RAMSEY RESET test, and normality test, respectively.

Concluding Remarks

A growing body of scholarly research has explored the non-linearity of the Phillips curve, but empirical evidence from an African perspective, particularly within the ECOWAS sub-regional context, remains underexplored. This study aims to address this gap by offering a fresh perspective on the asymmetric Phillips curve for West African countries through a comparative country-specific analysis and a panel framework utilizing the nonlinear autoregressive distributed lag (NARDL) model for 1986–2020. The empirical outcomes demonstrate that the asymmetric response of inflation to both positive and negative unemployment differs across the countries of Benin, Burkina Faso, Ghana, Guinea, Cote d'Ivoire, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo. Specifically, the study finds that inflation declines when unemployment rises and surges when unemployment declines in both short- and long-term dynamics. These findings highlight that low unemployment during economic expansion leads to wage-price spirals, while high unemployment results in low inflationary pressure during economic downturns in the analyzed countries. The empirical outcomes are robust and consistent for both country-specific and panel analyses, but the extent of the inflation response to unemployment is more pronounced in the WAMZ subregion.

Our empirical findings offer important implications for effective management of persistent chronic unemployment and rising inflation across West African economies. First, the results point out the existence of an asymmetric Phillips curve in most West African countries, which suggests that ignoring the significance of nonlinearity might result in incorrect policy recommendations and forecasting for these economies. The present study stresses that understanding the nonlinearity of the Phillip curve framework is central to policymakers' effective formulation of viable and significant macroeconomic policies. Policymakers need to pursue the dual objectives of achieving stable prices and sustainable employment for the sub-region given the ongoing rising inflation and unemployment rates experienced in the region. Additionally, based on the outcome of the findings, it is critical to consider the unemployment cost of pursuing low inflation, particularly in countries experiencing a growing labour force. This is because pursuing a policy that prioritizes only low inflation is likely to lead to chronic unemployment across West African economies when there are no adequate monetary and fiscal stimulus measures and employability programs. Thus, monetary policy must be efficiently combined with other macroeconomic policies to stimulate employment in periods in which contractionary monetary policy is pursued.

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Availability of data and material

The data that support the findings of this study are openly available in the website of World Bank (www.worldbank.org)

Code Availability

The computer program results are shared through the tables in the manuscript.

Authors' Contributions

O.G. Onatunji: Conceptualization, Investigation, Writing – original draft, Formal analysis. **O.O. Adejumo:** Writing – review and editing, Project administration. **O.S. Olabode:** Data curation, Methodology

NOTES

[1] The WAEMU countries comprises of Benin, Burkina Faso, Cote d'Ivoire, Mali, Senegal, Togo, Niger, and Guinea Bissau while WAMZ countries consists of Nigeria, Ghana, Gambia, Guinea, Sierra Leone, and Liberia.

[2] For the sub-regional level, panel unit root tests such as Levin, Lin, and Chu (2002) and Im, Pesaran, and Shin (2003) are employed. The findings of the unit root tests are not reported but available from the authors upon request.

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