

# Is there a Trade-Off between Inflation and Unemployment: The Case of Nigeria

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## ABSTRACT

This study examined whether a trade-off exist between inflation and unemployment in Nigeria by investigating the validity of the Phillips Curve Preposition in the Nigerian economy using data from 1981-2022. The Autoregressive Distributed Lag Bounds of cointegration was employed for the analysis of short-run and long-run effects of inflation, population growth rate and foreign direct investment on unemployment. The short-run result endorsed the validity of the Phillips Curve preposition in Nigeria. Thus, a moderate inflation is tolerated in order to enjoy low unemployment in the short-run and vice versa. However, the results of the long-run revealed that there is no trade-off between inflation and unemployment in Nigeria and that the Phillips Curve is a vertical line at the natural rate of unemployment. Furthermore, the causality results showed the presence of unidirectional causality from inflation to unemployment in Nigeria. On the basis of this study it can be concluded that an attempt to decrease unemployment at the cost of higher inflation in the short run led to higher inflation and no change in unemployment in the long run in Nigeria. Consequently, we recommend among others, adoption of discretionary policy that would reduce unemployment by boosting government spending and at same time maintain stability in money supply. In addition, creation of a more business friendly economy by the government is needed to attract foreign direct investment into the economy for job creation.

**Keywords:** Inflation, Unemployment, Phillips Curve phenomenon, Nigeria.

## INTRODUCTION

Inflation and unemployment are two most important economic indicators that reveal the health status of an economy. Their relationship has been a topic of much debate among intellectuals, policymakers, economists and researchers since the mid 20<sup>th</sup> century. To date, the duo has maintained a rising trend in the Nigerian economy and this however, poses a serious problem in the growth and development of the country. Moghalu and ude (2023) stated that “persistent rise in prices of commodities erodes the value of real wages, leading to a slump in the purchasing power of Nigerians, resulting to decreases in demand for goods and services”. In addition, the high inflation trend in the country has led to increased demand for higher minimum wage by Nigerian Labour Congress (NLC). Furthermore, the desire to save and invest has been on the decline, adversely affecting economic growth and as well causing unemployment to increase (Udoh & Isaiah, 2018).

An examination of the inflationary trend in Nigeria shows the alarming rates of inflation in the country. It was 11.40% in 1999, showing a 0.7% decrease from 2018. It rose to 15.75% in 2020 and dropped to 15.63% in 2021. In 2022 and 2023, it rose again to 21.34% and 28.92% respectively and soared to 31.7% in the first quarter of 2024 (NBS, 2024; Macrotrends, 2024). It should be noted that Nigeria’s inflation is driven by soaring food and energy costs, which despite the Central Bank interest rate hikes aimed at halting its ascent, left millions of people struggling to meet basic needs. Meanwhile, the price pressures have been spurred by President Bola Tinubu’s reforms on ending a costly petrol subsidy and twice devaluing the naira currency.

Similarly, Nigeria's unemployment has continued to surge upwards as the proportion of the able-bodied youths who are qualified and willing to work but cannot find any has risen to an alarming rate. Currently, this is a serious threat to the Nigerian economy because labour, which is an active ingredient for Nigeria's industrialization process, is in abundance but underutilized. Emmanuel (2019) maintained that year in year out, millions of able-bodied youths graduating from the tertiary institution are thrown into the labour market that has no capacity to absorb them. Be that as it may, idle manpower constitutes economic wastes, social disorder, and a source of human suffering to the Nigerian economy. Consequently, this has led to an increasing number of youths in certain categories leaving Nigeria for other countries perceived to hold greater promise through irregular means. Available statistics from National Bureau of Statistics (NBS) report October 2021 further revealed that between 2016 and 2018, Nigeria's unemployment rate has been rising consistently. In 2016, 2017 and 2018, it rose to 14.4%, 20.42% and 23.1% respectively. However, in 2019, it dropped to 17.6% and further rose to 33.2% in 2020 as a result of the COVID-19 pandemic, leading to the closure of many companies that left so many people unemployed. It further rose to 37.7% in 2023.

It is imperative to note that for Nigeria to achieve any meaningful progress in her quest for sustainable growth and development, the government must formulate and implement sound macroeconomic policies aimed at maintaining price stability and attaining full employment. Hence, knowledge of the link between inflation and unemployment is pertinent for policy makers in Nigeria as it will guide them on the steps to be taken in solving or reducing the problems. As was propounded by J.W Phillips in 1958, inflation and unemployment rate are inversely related, that is, a trade-off exist between the two macroeconomic variables such that an increase in one variable, automatically reduces the other variable. Hence, from the point of view of Phillips Curve theory, countries need to choose the level of inflation and unemployment rate they could tolerate as they cannot have a very low rate of inflation at the same time with a very low rate of unemployment. The Phillip's preposition was subsequently supported by Lipsey (1960); Samuelson and Solow (1960). Therefore, the Nigerian government in her consideration of employing either fiscal or monetary policies geared towards curtailing the country's rising inflation and swelling unemployment, ought to decide what rate of inflation should be sacrificed for an acceptable rate of unemployment.

Some influential studies have employed various econometric methods to discuss the link between inflation and unemployment in the context of Nigeria (Umoru & Anyiwe, 2013; Orji, Orji & Okafor, 2015; Iyeli & Ekpung, 2017; Darma & Onimisi, 2017; Salisu, Sulaiman, Yakubu & Usman, 2018; Isa & Joel, 2018; Edema, 2018; Eje, 2018; Nzidee & Chukwunweike, 2019; Nurudeen, 2019; Efayena & Olele, 2020; Babatunde, Oni, Adenomon, Abiola & Folorunso 2020; Abubakar, 2020; Anoke, Ogbonna, Atuma & Uzoechinna, 2021; Aliyu & Jelilov, 2022; Lawal, 2023). However, the evidence remains diverse and inconclusive. Thus, as a result of the lingering inflation and unemployment problems in Nigeria, a further probe into the connection between the duo is pertinent. Hence, the main objective of this study is to investigate the validity of the Phillips Curve Phenomenon in Nigeria. Following the introduction in Section 1 is the theoretical background and empirical literature in Section 2. The methodology for the study would be explained in Section 3, whereas the results and discussion of findings would be the focus of Section 4. The conclusion and recommendations would be presented in Section 5.

## **THEORITICAL BACKGROUND**

Over the years, one of the basic questions in macroeconomic theory of the cause of inflation has occupied the minds of scholars. Economists initially operated under the assumption that there was a trade-off between unemployment and inflation. The first widely acknowledged research on inflation-unemployment trade-off was done by A. W. Phillips in 1958. Phillip (1958) employed data from 1861 to 1957 to find out if statistical evidence supports the hypothesis that the rate of change of money wage rates in the United Kingdom can be explained by the level of unemployment and the rate of change of unemployment. However, he concluded that an inverse relationship existed between the rate of increase in money wages (which signifies inflation) and the rate of unemployment, presented in the form of a curve called the "Phillips Curve". The conclusion drawn from this finding is that a rise in money wage rate reduces the rate of unemployment, while a fall in money wages increases the rate of unemployment. Meanwhile, the theoretical foundation of this study would be anchored on the Phillips curve hypothesis because it can be relied upon as a tool for inflation forecasts.

Further support for Phillip's finding was provided by Lipsey (1960); Samuelson and Solow (1960). They empirically demonstrated in their study that there exists an inverse relationship between unemployment and inflation. The argument here is that pursuing monetary or fiscal expansion, which might result in inflation, will effectively trade for a lower rate of unemployment (Okoebor, Eje & Chude, 2022). This simply means that it is practically impossible to simultaneously maintain low inflation rate and low rate of unemployment. From a policy point of view, Blanchard and Illing (2009) inferred that if a country wishes to enjoy low unemployment, it should be willing to tolerate moderate inflation, but if it desired low inflation, it would have to face higher unemployment. However, due to the occurrence of stagflation in the 1970s, the Phillips hypothesis was refuted. The gap in the explanation of the phenomenon of high inflation and high unemployment which lasted from 1971-1984 in the United States economy resulted in the emergence of natural rate of unemployment which was subsequently termed as the non-accelerating inflation rate of unemployment (NAIRU) theory in the 1970s pioneered by Friedman (1977) and Phelps (1967). The natural rate of unemployment is simply the unemployment rate at which the actual inflation rate is equal to the expected inflation rate. Friedman and Phelps asserted that, it was workers and consumers adaptive expectations to future inflation rates that was the main driving force for a direct relationship between inflation and unemployment in the long-run. The logic is that an unexpected increase in inflation initially reduces unemployment but once higher inflation is fully anticipated by employers and workers, they will revise their plans and unemployment will return to its natural level consistent with equilibrium real wages and the overall structure of the labour market. This analysis gave a clear difference between the short-run and long-run Phillips curve of which becomes a vertical line in the long-run. The practical implication is that, expansionary policies may simply speed up the pace of inflation and cause an upward shift in the Phillips curve showing a higher degree of unemployment and inflation rates (Pratinidhi & Verma, 2020). Therefore, there is no trade-off between inflation and unemployment in the long-run.

However, Lucas criticized Friedman and Phelps and incorporated a new concept termed rational expectation as the reason for stagflation. Lucas (1976) argued that the trade-off relationship between unemployment and inflation may only exist if workers do not expect that the policy makers could create an artificial situation of high inflation combined with low unemployment. Otherwise, if the workers can predict an impending high inflation, they would demand a wage increase, leading to high unemployment and high inflation. This entails that attempts to reduce unemployment will only result in higher inflation.

## **Empirical Literature**

The sensitivity of the dynamic relationship existing between inflation and unemployment rates has sparked research interest for developing and developed economies with mixed results and submission. However, the practical evidence on the Phillips curve phenomenon remains unsettled. Some of these empirical studies are:

In China, Chang-Shuai and Zi-Juan (2012) examined the long-run and short-run relationship between unemployment rate, economic growth and inflation using annual time series data from 1970 to 2010. Applying a number of econometric techniques: unit root test, cointegration test, VAR, VEC and Granger Causality test, they discovered that a long-term stable equilibrium exist among the variables. In addition, the results showed that economic growth is positively correlated with unemployment rate in the short-run, while inflation and unemployment are inversely correlated. This result violates the submission of Qin and Wang (2013), who argued that the Phillips curve is ineffective in determining the causal relationship between unemployment and inflation in China. They cited the complexity of the Chinese economy as the reason for the non-applicability of the Phillips curve. This was revealed in their study which examined the correlation coefficient and causal link between unemployment and inflation rates in China from 1978 to 2011.

Umoru and Anyiwe (2013) carried out a study to explore the dynamics of inflation and unemployment in Nigeria over a period of twenty seven years. By applying the Eagle-Granger test, Johansen Maximum Likelihood test and VECM in the estimation, the findings revealed that a positive relationship exists between inflation and unemployment. This result invalidates the Phillip's curve phenomenon, hence shows evidence of stagflation in the Nigerian economy within the study period. Contrarily, the study by Furuoka and Munir (2014) confirmed the validity of the Phillips curve hypothesis in Malaysia. Using data from 1975 to 2004 and the error correction model (ECM) technique to empirically analyze the relationship between inflation and

unemployment in Malaysia, the findings revealed that inflation is negatively related with unemployment at both short and long-run.

In another study for Nigeria, Orji et al. (2015) contended that the Phillips curve is invalid when applied to the Nigerian economy. The study employed the error correction mechanism (ECM), ordinary least square (OLS) techniques and annual data from 1970 to 2011 to empirically examine the inflation and unemployment nexus in Nigeria with the aim of finding out if the original Phillips curve proposition holds for Nigeria. The findings revealed that unemployment is major determinant of inflation and that a positive relationship exists between inflation and unemployment, thus, refuting the existence of the Phillips curve proposition in Nigeria. Similarly, Boateng (2015) utilized the new Keynesian Phillips curve model on annual data from 1970 to 2013 to explore the relationship between inflation and unemployment in Ghana with the intention of determining the existence of the Phillips curve in Ghana. The OLS result debunks the existence of the Phillips curve hypothesis in Ghana by revealing that no relationship exists between unemployment and inflation in Ghana.

In the same vein, Iyeli and Ekpung (2017) used the Johansen Maximum Likelihood test, error correction mechanism (ECM) and data from 1970 to 2011 to determine if there exist asymmetry between price expectation and unemployment as captured by Phillips curve in the Nigeria economy. The results revealed that a positive relationship between inflation and unemployment, therefore, refuting Phillips curve hypothesis of inverse relationship between the two macroeconomic variables in Nigeria. Darma and Onimisi (2017) employed annual data from 1980 to 2014 and the Autoregressive Distributed Lag (ARDL) technique to cointegration to investigate the relationship between inflation, unemployment and economic growth in Nigeria. The result of cointegration test revealed that a long-run relationship does not exist between the variables. In addition, the VAR estimates showed a non-significant relationship between economic growth and unemployment. In an evaluation of the relationship between unemployment and inflation in Nigeria, Salisu et al. (2018) adopted the Autoregressive Distributed Lag (ARDL) technique and annual data from 1961 to 2015 and established a positive relationship between the variables, thereby refuting the Phillips curve proposition of an inflation-unemployment trade-off in Nigeria.

Equally, Isa and Joel (2018) employed data from 1980 to 2016, Vector Autoregression (VAR) model and Impulse Response Function to investigate the presence of the Phillips curve in Nigeria as well as the period of such existence. The findings showed an inverse relationship between inflation and unemployment within the period under study. This result lends credence to the existence of the Phillips curve phenomena in Nigeria. Similar view was shared by Aliyu and Jelilov (2022) who employed the Autoregressive Distributed Lag (ARDL) technique and quarterly data from 1986 to 2016 to examine the relationship between unemployment and inflation and affirmed that there exist a negative relationship between the variables both in the short and long-run. Also, the work of Edema (2018) confirms the opinion of Aliyu and Jelilov as he disclosed that a negative but insignificant relationship exist between inflation and unemployment in both short and long-run in Nigeria. This was underscored in his study which examined whether the Phillips curve hypothesis exists in both the short and long-run in Nigeria from 1972 to 2015. Furthermore, Eje (2018) utilized the Ordinary Least Squares (OLS) technique and annual data from 1986 to 2014 in a related study to test for the validation of the presence of the Phillips curve in Nigeria. The results revealed that there exists a significant negative relationship between inflation and unemployment. This finding implies that the Phillips curve hypothesis holds for the Nigeria economy.

In addition, Nzidee and Chukwunweike (2019) employed the multiple correlation technique and annual data from 1980 to 2016 in another study to examine the inflation and unemployment trade-off in Nigeria so as to ascertain if the original Phillips curve hypothesis holds in the Nigerian economy. The findings revealed a positive and significant relationship between inflation and unemployment, thus, invalidating the original proposition on the Phillips curve hypothesis in Nigeria. Nurudeen (2019) utilized the ARDL method of cointegration, Canonical Cointegration Regression (CCR), Dynamic Ordinary Least Squares (DOLS), Fully Modified Ordinary Least Squares (FMOLS) and the Static Ordinary Least Squares (OLS) techniques of estimation to examine the inflation and unemployment trade-off as well as its stability in Nigeria from 1980 to 2016. The results revealed a long-run relationship between inflation and unemployment, indicating that the Phillips curve hypothesis holds for Nigerian economy. Employing the Generalized Method of Moments (GMM), Canonical Cointegration Regression (CCR) method and quarterly data from 2010 to 2018, Efayena



and Olele (2020) evaluated the presence or otherwise of a trade-off between inflation and unemployment with the aim of establishing whether the traditional Phillips curve hypothesis holds for Nigeria. The results showed that there exist a significant trade-off between inflation and unemployment, thus validating the presence of a Phillips curve in the Nigerian economy.

However, in a study on India, Pratinidhi and Verma (2020) used the polynomial regression model and graphical presentation to examine the Phillips curve shape during 1991 to 2015 as well as the recent economic slowdown situation between Jan 2018 to October 2019. The graphical presentation of Phillips curve shape showed that a short and long-run Phillips curve relationship exists from 1991 to 2015 in the Indian economy. This fact with the results of the long-run indicates proof that the Phillips curve trade-off exist in Indian economy. In addition, it showed that no short-run Phillips curve relationship exists from Jan 2018 to October 2019. Babatunde et al. (2020) in a related study utilized Johansen and Juselius cointegration test, VECM, ECM and Granger Causality test to explore the dynamic interrelationship between unemployment and inflation rates in Nigeria. The result of the test of co-integration showed the presence of a long-run relationship between unemployment and inflation rates in Nigeria. Also, the VECM result revealed that inflation and unemployment rates are significantly negatively related in the long-run. However, unemployment and inflation are positively related in the short-run. Furthermore, the Granger causality test showed that there is no causation between unemployment and inflation.

Time series data from 1981-2017 was used by Abubakar (2020) to assess the relationship between inflation and unemployment in Nigeria. Utilizing the ARDL method of cointegration, the findings revealed a long-run relationship between inflation and unemployment. In addition, the results revealed a positive relationship between inflation and unemployment in the long-run, while in the short-run, an inverse relationship between the variables was found. This fact with the result of the long-run indicates proof of stagflation in Nigeria. The Granger causality test revealed that both variables do not Granger caused each other. Likewise, Korkmaz and Abdullazade (2020) applied a panel Granger causality test to explore whether there is relationship between the inflation rate and the unemployment in nine randomly selected G6 countries namely: Australia, Brazil, Canada, France, Germany, Italy, the Russian Federation, Turkey, and the United Kingdom using annual time series data over the period of 2009 to 2017. The results of the Granger causality test revealed a unidirectional causality from inflation rate to unemployment rate.

Finally, annual data from 1980 to 2018 was utilized by Anoke et al. (2021) to assess the impact of inflation on unemployment in Nigeria. The VECM result revealed a positive significant relationship between inflation and unemployment both in the short and long-run, implying that no trade-off between inflation and unemployment in Nigeria. The VEC Granger causality test revealed a unidirectional causality between the variables. Utilizing cointegration, ARDL, Granger causality test and data from 1986 to 2021, Lawal (2023) as well investigated the relationship between inflation and unemployment rates in Nigeria and tested the presence of Phillips curve proposition. The co-integration test result revealed a long-run relationship among the variables. Also, the ARDL result revealed that inflation and unemployment rates are significantly positively related both in the short and long-run, indicating that the Phillips curve hypothesis does not hold in Nigeria. The Granger causality test revealed that both variables do not Granger caused each other. Using a panel dataset comprising of 26 sub-Saharan African countries over the period of 2009 to 2016, Ojonta and Obiefuna (2024) examined the dynamic relationship between inflation and unemployment in augmented expectation framework in the sub-Saharan African region. Utilizing the Two-Step System-GMM technique, the findings revealed a positive and significant relationship between inflation and unemployment in the region. However, the use of output gap as proxy for unemployment showed a negative relationship between the variables. This implies that no significant trade-off between inflation and unemployment augmented expectation framework in the regions.

Evidence from the growing literature from developing and developed economies reviewed indicates that the short and long-run connection between inflation rate and unemployment level has been explored widely using diverse econometric methodologies and datasets. The considerable empirical literature on the presence or otherwise of the Phillips curve hypothesis have resulted in varying results based on the data employed, models adopted, time frame of the study and the technique of estimation utilized for investigation. While some empirical studies found no support for the Phillips curve hypothesis (Umoru & Anyiwe, 2013; Qin & Wang, 2013; Orji, et al., 2015, Boateng, 2015; Iyeli & Ekpung, 2017; Darma & Onimisi, 2017; Salisu et al., 2018;

Nzidee & Chukwunweike, 2019; Anoke et al., 2021; Lawal, 2023; Ojonta & Obiefuna, 2024), others (Chang-Shuai & Zi-Juan, 2012; Furuoka & Munir, 2014; Isa & Joel, 2018; Aliyu & Jelilov, 2022; Edema, 2018; Eje, 2018; Nurudeen, 2019; Efayena & Olele, 2020; Pratinidhi & Verma, 2020; Babatunde et al., 2020) found support for the Phillips curve phenomenon.

However, facts from this expanding literature remain diverse and unconvincing, hence, calls for further studies. Besides, studies executed in the context of Nigeria did not include annual growth rate of the population and foreign direct investment as important variables while deliberating on factors that induce either rise in prices or rate of unemployment in Nigeria. The inclusion of the aforementioned variables was premised on the ground that a country's population growth rate and foreign direct investment are important and useful indicators of how much it is likely to maintain optimal inflation rate and minimal unemployment level. Hence, this study intends to bridge this knowledge gaps by incorporating the aforementioned variables as control variables while investigating the link between inflation and unemployment in Nigeria in isolation.

## METHODOLOGY AND MODEL SPECIFICATION

This study employed the ARDL bound test methodology to unearth the short-term and long-term relationships between inflation and unemployment in Nigeria. The choice of this technique hinges on the fact that it could be used regardless of whether the underlying regressors are stationary at 1(0) or at 1(1), or a mixture of both. In other words, it ignores the order of integration of the variables. The existence of unit root in the series was checked using the augmented Dickey Fuller (1981) and Philips-Perron (1988) unit root tests. After ascertaining that there is a mixed order of integration, the Wald-test under the bounds testing approach to cointegration was employed to unearth the presence of cointegration relationship among the variables. Given that the existence of cointegration among the variables in the models was established, the study proceeds to estimate both the short-run dynamics and long-run elasticities of the coefficients. Thereafter, the Toda and Yamamoto (1995) causality test was employed to determine the direction of causality among the variables. The performance of the estimated model was finally verified through the diagnostic test.

### Model Specification

The model is built around the Phillips Curve hypothesis which states that there is an inverse relationship between unemployment and inflation in the short-run. The assumption is that any fiscal stimulus to stimulate spending would increase aggregate demand in an economy, leading to a higher output. However, as demand for labour increases, the pool of unemployed workers subsequently decreases, forcing employers to raise wages to compete for a smaller skilled workforce. This would eventually increase firms cost of production resulting from wages rise as demand for labour increases, and in turn passed on to consumers in the form of price increases.. The logic is “to enjoy lower unemployment, a rise in inflation must be sacrificed” and vice versa. Based on the insight provided by Anoke et al (2021), a representation of the Phillips Curve model is generally specified as follows:

$$UNE = F(INFL) \tag{3.1}$$

It is important to note that this study differ from Anoke et al (2021) by incorporating the use of annual growth rate of the population as one of the factors that induce rise in rate of unemployment in Nigeria. Hence, Equation (3.1) is modified and stated functionally as:

$$UNE = F(INFL, AGRPOP, FDI) \tag{3.2}$$

Restating Equation 3.2 in ARDL form in line with the framework of Pesaran, Smith and Shin (2001) yields:

$$\begin{aligned} \Delta UNE_t = & \psi_0 + \sum_{i=1}^p \psi_1 \Delta UNE_{t-1} + \sum_{i=1}^p \psi_2 \Delta INFL_{t-1} + \sum_{i=1}^p \psi_3 \Delta AGRPOP_{t-1} \\ & + \sum_{i=1}^p \psi_4 \Delta FDI_{t-1} + \psi_5 UNE_{t-1} + \psi_6 INFL_{t-1} + \psi_7 AGRPOP_{t-1} + \psi_8 FDI_{t-1} + \varepsilon_t \end{aligned} \tag{3.3}$$

Where  $UNE$  = unemployment rate,  $INFL$  = inflation rate,  $AGRPOP$  = annual growth rate of the population,  $FDI$  = foreign direct investment,  $p$ ,  $\Delta$ ,  $\psi_0$ ,  $\varepsilon_t$ ,  $\psi_1 - \psi_4$  and  $\psi_5 - \psi_8$  denote the lag length, difference operator, the drift, disturbance term, parameters of the short-run dynamics and the parameters of the long-run relationship respectively. The decision concerning the existence of cointegration is guided by the following hypotheses:

$$H_0 : \psi_3 = \psi_6 = \psi_7 = \psi_8 = 0 \quad (\text{absence of cointegration})$$

$$H_1 : \psi_3 \neq \psi_6 \neq \psi_7 \neq \psi_8 \neq 0 \quad (\text{existence of cointegration})$$

The F-test was used to test the long-run relationship. If the estimated F-statistic is greater than the upper critical bound, this suggests a relationship among the variables. But if it is below the lower critical value bounds, this signifies no long-run relationship between the variables. However, if it falls between the lower and upper critical value bounds, no conclusion can be made from the result. Since at this point the variables are cointegrated, the study estimated the error correction model (ECM) as depicted in Equation 3.4.

$$\begin{aligned} \Delta UNE_t &= \psi_0 + \sum_{i=1}^p \psi_1 \Delta UNE_{t-i} + \sum_{i=1}^p \psi_2 \Delta INFL_{t-i} \\ &+ \sum_{i=1}^p \psi_3 \Delta AGRPOP_{t-i} + \sum_{i=1}^p \psi_4 \Delta FDI_{t-i} + \pi ECM_{t-1} + \varepsilon_t \end{aligned} \quad 3.4$$

Where  $\pi$  and  $ECM_{t-1}$  denote the speed of adjustment to long-run equilibrium following a shock to the system which is anticipated to be negative and significant to verify the existence of cointegration among the variables and the error correction term respectively. Other variables are as defined earlier.

Finally, the study investigated the direction of causality among the variables using the Toda and Yamamoto test for Granger non-causality. The following TY multivariate model guided this study:

$$\begin{aligned} UNE_t &= \alpha_1 \\ &+ \sum_{i=1}^{k+d \max} \lambda_{1i} UNE_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{1i} INFL_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{1i} AGRPOP_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{1i} FDI_{t-i} + \varepsilon_{1t} \end{aligned} \quad 3.5$$

$$\begin{aligned} INFL_t &= \alpha_2 \\ &+ \sum_{i=1}^{k+d \max} \lambda_{2i} UNE_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{2i} INFL_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{2i} AGRPOP_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{2i} FDI_{t-i} + \varepsilon_{2t} \end{aligned} \quad 3.6$$

$$\begin{aligned} AGRPOP_t &= \alpha_3 \\ &+ \sum_{i=1}^{k+d \max} \lambda_{3i} UNE_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{3i} INFL_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{3i} AGRPOP_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{3i} FDI_{t-i} + \varepsilon_{3t} \end{aligned} \quad 3.7$$

$$\begin{aligned} FDI_t &= \alpha_4 \\ &+ \sum_{i=1}^{k+d \max} \lambda_{4i} UNE_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{4i} INFL_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{4i} AGRPOP_{t-i} + \sum_{i=1}^{k+d \max} \lambda_{4i} FDI_{t-i} + \varepsilon_{4t} \end{aligned} \quad 3.8$$

## Data and their Sources

This study used time series data from 1981 to 2022 to estimate the model. The data was collected from the

National Bureau of Statistics (NBS) and World Bank’s (WB), World Development Indicators (WDI) database (see Table 1). The variable definitions, measures, apriori sign expectation and source are shown in Table 1.

Table 1. Variable definition measures, apriori sign expectation and data source.

Variable	Measure	Apriori sign expectation	Source
Dependent variable			
Unemployment rate (UNE)	Measured as the ratio of unemployed labour force to total labour force in the country (%).		NBS
Independent variables			
Inflation rate (INFL)	This is proxied by the consumer price index and measured in annual percentage (%).	-	WB, WDI
Annual growth rate of the population (AGRPOP)	Annual population growth rate (%).	+	WB, WDI
Foreign direct investment (FDI)	Foreign direct investment, net inflows (% of GDP)	-	WB, WDI

## RESULTS AND DISCUSION OF FINDINGS

This section displayed and analyzed the results of the study starting first with the results of descriptive statistics.

### Descriptive Statistics Test Results

The results in Table 2 indicate that unemployment rate (UNE) expressed as the ratio of unemployed labour force to total labour force records an annual average of 13% and a mean value of 12.25%. The maximum value of 37.70 indicates that the highest annual unemployment was 37.7% and this was recorded in 2022, implying that the COVID-19 pandemic and aftermath compounded the already high levels of unemployment as there was a freeze on employment in many public and private sector institutions. Meanwhile, inflation rate has the highest mean and median values of 18.95% and 12.94% respectively as well as the highest volatility as its range is the highest (16.45). The results further reveal that the means and medians of the other variables (AGRPOP, FDI) are very close, indicating that the variable have high tendency to be normally distributed.

Jarque-Bera is another important statistics reported in Table 2. The test compares the shape of a given distribution (skewness and kurtosis) to that of a normal distribution. However, we reject the null hypothesis that the residuals of a series are normally distributed when the probability associated with the JB test is significantly lower than the usual criterion of 0.05. On this note, the JB result of this study suggests that the variables are normally distributed. The skewness result obtained reveals that inflation rate (INFL) and foreign direct investment (FDI) were positively skewed, which means that the distribution is skewed to the right while unemployment rate (UNE) and annual growth rate of the population (AGRPOP) has no skew, thus revealing that the distribution is symmetrical on both sides of the tail. In the same vein, the kurtosis statistics reveal that INFL and FDI were leptokurtic, revealing that their distributions were more peaked and fat-tailed than the normal distribution while UNE and AGRPOP were platykurtic, suggesting that their distributions were flat relative to normal distribution.

Table 2. Results of Descriptive Statistics of the Indicators

Statistics	UNE	INFL	AGRPOP	FDI
Mean	13.00	18.95	2.58	2.60



Median	12.25	12.94	2.58	2.14
Maximum	37.70	72.84	2.71	10.83
Minimum	1.90	5.39	2.49	0.10
Std. Dev.	9.30	16.45	0.06	2.26
Skewness	0.69	1.88	0.17	1.77
Kurtosis	2.68	5.44	1.86	6.49
Jarque-Bera	3.56	35.05	2.47	43.19
Probability	0.17	0.00	0.29	0.00
Sum	546.10	795.81	108.37	109.31
Sum Sq. Dev.	3548.30	11101.36	0.17	210.22
Observations	42	42	42	42

Source: Researchers' Compilation (2024) using E-Views 9.

### Unit Root Test Results

The tests for unit root were evaluated at 5% level of significance. The ADF and PP unit root tests results in Table 3 show that INFL achieved stationarity at level, that is 1(0), while UNE, AGRPOP and FDI exhibited stationarity after differencing the series. That is to say that the series becomes 1(1) after first differencing. The findings depict that the results of the PP unit root test are a corroboration of those realized utilizing the ADF. Therefore, the unit root test results of 1(0) and 1(1) exhibited by the variables justify the usage of the ARDL technique to estimate the parameters of the model. However, we need to determine the optimal lag length before carrying out a cointegration test to see if there exists any relationship among the variables in the long-run.

Table 3. ADF and PP unit root test results

Variable	Augmented Dickey-Fuller (ADF)				Philip-Perron (PP)			
	At level Difference	1 <sup>st</sup> value	5% critical	1(d)	At level Difference	1 <sup>st</sup> value	5% critical	1(d)
UNE	-0.2462	-8.5708**	-2.9369	1(1)	-0.4465	-8.5451**	-2.9350	1(1)
INFL	-3.0505**	-	-2.9350	1(0)	-3.9168**	-	-2.9350	1(0)
AGRPOP	-1.4350	-4.3172**	-2.9389	1(1)	-2.5014	-4.6680**	-2.9350	1(1)
FDI	-3.3351	-8.8378**	-2.9369	1(1)	-3.2423	-14.1921**	-2.9350	1(1)

Note: \*\* implies significance at 5% level; Source: Researchers' Compilation (2024) using E-Views 9.

### Determination of Optimal Lag Length

Table 4 revealed that the four different information criterion namely: Akaike information criterion (AIC), Hannan-Quinn information criterion (HQ), Final prediction error (FPE) and Sequential modified LR test statistic suggests 2 as the optimal lag length for the model.

Table 4 Lag Length Selection

Lag Length	LogL	LR	FPE	AIC	SC	HQ
0	-330.27	NA	213.13	16.71	16.88	16.77
1	-251.42	137.98	9.25	13.57	14.42	13.88
2	-218.03	51.76*	3.98*	12.70*	14.22*	13.25*

Source: Researchers' Compilation (2024) using E-Views 9; Note: \* indicates lag selection by the criteria.

### Results of Bound Test

As indicated in Table 5, the bound tests result reveals that the calculated F-statistics (6.543168) is greater than the upper (4.35) critical value bound 1(1) at a 5% significance level, hence, we conclude that there is cointegration among the variables. In other words, long-run relationships exist among the variables employed in the model. The study therefore, estimates the short and long-run coefficients of the growth equation.

Table 5 Bound test results.

Test Statistic	Value	Lag	Significance level	Bound critical values	
				Lower Bound	Upper Bound
F-statistic	6.543168	2		I (0)	I(1)
			1%	4.29	3.77
			5%	3.23	4.35
			10%	2.72	5.61

Source: Researchers' Compilation (2024) using E-Views 9. Note: Lower and Upper Bounds critical values for the F-statistic at 5% significance level were taken from Narayan (2005) and Pesaran *et al.* (2001).

### Results of Diagnostic Tests

The diagnostic tests results in Table 6 show that the model passed all the tests conducted. This is because their probability values were greater than the chosen 0.05% level of significance. Based on the findings, the error terms are normally distributed. Also, there were no problems of heteroskedasticity, serial correlation and misspecification in our model.

Table 6. Diagnostic results

Test	Type of Statistic	Test Statistic	P-value
Jarque-Bera normality test	$X^2$	8.2022	0.2099
Heteroskedasticity Test: ARCH	$X^2$	0.8897	0.6409
Ramsey RESET test	$F$	0.2343	0.6316
Breusch-Godfrey Serial Correlation LM test	$X^2$	1.1165	0.5722

**Results of the Short-Run and Long-Run Relationships**

Table 7. Short-run and long-run estimates for unemployment model

Variables	Coefficient	Std. Error	t-Statistic	P-value
Long-run behaviour				
Dependent variable: UNE				
C	68.662086	45.838053	0.215123	0.8310
INFL	1.599597	6.440740	-0.248356	0.0854*
AGRPOP	3.376934	5.053456	-0.208733	0.0359**
FDI	-11.560850	6.143497	-0.220575	0.8267
Short-run dynamics				
D(UNE(-1))	-0.396397	0.181406	-2.185141	0.0359**
D(INFL)	-0.053891	0.059785	-0.901412	0.0737*
D(AGRPOP)	-3.568564	1.828241	-0.730881	0.4699
D(FDI)	-0.119967	0.459794	-0.260915	0.7957
ECM <sub>t-1</sub>	-0.433691	0.133592	-0.252191	0.0004***

Source: Summary of result compiled by researchers’ (2024) using E-Views 9. Note \*\*\*, \*\* and \* denotes significance at 1%, 5% and 10% levels, respectively.

Based on the long-run results represented in Table 7, the coefficient of unemployment in the past year was negative and significant. In addition, inflation had a positive and significant relationship with unemployment rate which defies theoretical expectation. This means that a unit increases in consumer price index (inflation) would yield about 1.60% rise in unemployment rate in Nigeria. This result is not in harmony with the Phillips Curve argument of an inverse relationship between inflation and unemployment. The implication of this result is that stagflation exists in the Nigerian economy which is characterized by high unemployment and rising prices. This result agrees with the findings of Umoru and Anyiwe (2013); Orji, et al. (2015); Iyeli and Ekpung (2017); Darma and Onimisi (2017); Salisu et al. (2018); Nzidee and Chukwunweike (2019); Emmanuel (2019); Anoke et al. (2021); Lawal (2023); Ojonta and Obiefuna (2024) but disagrees with Isa and Joel (2018); Aliyu and Jelilov (2022); Edema (2018); Eje (2018); Nurudeen (2019); Babatunde et al. (2020); Efayena and Olele (2020).

The annual growth rate of the population exerted a positive and significant relationship with unemployment rate as expected, implying that annual growth rate of the population increases unemployment in the long-run in Nigeria. The result means that if the growth rate of the population goes up by 1%, unemployment rate will increase by 3.38%. A possible reason for such an outcome could be that in the long-run, there is high imbalance between job opportunities and the growing number of young people entering the labour market each year in Nigeria. In other words, rising population without a relative rise in its utilization capacity leads to the alarming rate of unemployment in Nigeria. Furthermore, the result also revealed that foreign direct investment (FDI) had a negative relationship with unemployment in line with theoretical expectation. A unit increase in FDI would reduce unemployment by 11.56%. This implies that FDI is capable of creating opportunities for employment of idle resources, thus reducing the level of unemployment in the long-run in Nigeria.

The short-run result of inflation rate is a departure from the long-run result and is in line with the Phillips Curve proposition of an inverse relationship between inflation and unemployment. In the short-run, a unit increase in inflation would yield about 0.054% fall in unemployment rate in Nigeria. More so, annual growth rate of the population had a negative and insignificant relationship with unemployment rate contrary to the result of the long-run equation. A 1% increase in the growth rate of the population would lead to 3.57% decrease in unemployment rate. Furthermore, foreign direct investment had a negative relationship with unemployment rate in the short-run in line with results of the long-run unemployment equation. This result suggests that a unit increase in FDI would reduce unemployment by 0.12%. This finding corroborates with that of Anoke et al. (2021). The coefficient of the error correction model is negative and also highly significant, which supports the result of the cointegrating relationship among the variables. This implied that the speed of adjustment towards long-run equilibrium would be at 43%.

**Results of Toda and Yamamoto Multivariate Causality Test**

Table 8. Results of the granger causality test (TY Augmented Lags Methods)

Dependent Variable	Sources of Causation			
	UNE $X^2$	INFL $X^2$	AGRPOP $X^2$	FDI $X^2$
UNE	-	<b>0.915813</b> (0.6326)	<b>1.024393</b> (0.5992)	<b>0.224269</b> (0.8939)
INFL	<b>0.291521</b> (0.0644*)	-	<b>0.919729</b> (0.6314)	<b>3.082691</b> (0.2141)
AGRPOP	<b>14.42491</b> (0.0007)***	<b>3.474986</b> (0.1760)	-	<b>1.530416</b> (0.4652)
FDI	<b>1.563268</b> (0.4577)	<b>5.202555</b> (0.0742)*	<b>1.333370</b> (0.5134)	-

Note \*\*\* and \* indicate significance at the 1% and 10% levels, respectively. The figures outside bracket and those in bracket are the  $X^2$  -statistic with their respective p-values.

The TY estimation results depicted in Table 8 revealed the existence of a unidirectional Granger-causality between inflation and unemployment, annual growth rate of the population and unemployment, as well foreign direct investment and inflation for Nigeria. Nonetheless, the unidirectional causality running from inflation to unemployment indicates that the government concentration on controlling inflation has lead to unemployment surge in the country. This is in tandem with the findings by Korkmaz and Abdullazade (2020) and Anoke et al. (2021).

**CONCLUSION AND RECOMMENDATIONS**

Over the years, the argument on whether a trade-off exists between inflation and unemployment has attracted the attention of researchers and economists alike. The common belief is that achieving price stability will substantially reduce unemployment, particularly if the optimal threshold can be identified. Therefore, in other to validate the existence of a Phillips Curve hypothesis in Nigeria, this study used data sourced from World



Bank, World Development Indicator (WB, WDI) and National Bureau of Statistics (NBS) (2022) for the period of 1981 to 2022. Under the framework of the ARDL Bounds testing approach to cointegration, the result clearly showed that there exists long-run relationship among the variables employed in the model. The long-run findings revealed that inflation had a significant positive relationship with unemployment, pointing out that the Phillips Curve is invalid in Nigeria. This is glaring that the economy is currently experiencing high unemployment, rising prices and sluggish economic growth also known as stagflation. In the short-run however, inflation and unemployment were found to be inversely related, suggesting that the Phillips Curve is only valid in the short-run in Nigeria.

Equally glaring is that population growth affect unemployment the most compared to other factors in Nigeria. This can be seen from the coefficient and positive effect of this variable on unemployment which suggests that an increase in population is a hurt to job creation. Further findings showed that the alarming rate of unemployment in the country can be reduced through the attraction of foreign investors into the country. The implication is that increasing the flow of foreign direct investment provides crucial aid in modernizing the industrial sector which provides avenues for job creation, leading to unemployment reduction. The results of the causality test revealed a unidirectional causality from inflation to unemployment, from annual growth rate of the population to unemployment, as well as from foreign direct investment to inflation in Nigeria. On grounds of these findings, the study suggests that discretionary policy that would reduce unemployment by boosting government spending and at same time maintain stability in money supply should be adopted. In addition, government should create a more business friendly economy for the attraction of foreign direct investment into the economy for job creation. This can be done through the deliberate provision of essential infrastructures with a view to lowering the cost of doing business in Nigeria. Finally, the positive and statistically significant relationship between annual population growth rate and unemployment rate informed the advice for government to create opportunities for job openings in order to absorb the abundant population of the unemployed labour force in the country.

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