



## Inflation and unemployment nexus: Empirical evidence from Nigeria

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### Abstract

The discussion of the connection between unemployment and inflation crosses a range of economic topics. Researchers and economists focus on the issue since unemployment continues to be one of the global economies. It is generally agreed that achieving price stability will, other things being equal, have a favourable impact on employment and economic growth, particularly if the optimum threshold can be attained. The ideal compromise, meanwhile, seems difficult, and central banks all over the world are vying to boost employment levels without compromising price stability. In this analysis, we use annualised data from 1999 to 2021 to try to understand how unemployment in Nigeria responds to changes in the price level. The ARDL model and the Bound test analytical tools were employed to process the data set. According to the findings, a 1% change in the inflation rate resulted in a 0.13% increase in the unemployment rate in the long run. The parameter estimate indicates that when the exchange rate changed by 1%, the unemployment rate increased by 10.4%. On the other hand, GDP exerted a negative but insignificant influence on the unemployment rate and was correlated with about a 0.29% decline in the unemployment rate. Although there is a long-run relationship between unemployment and inflation, there is a divergence along the equilibrium part that is corrected at a 38 percent annual rate of adjustment. We recommend that, rather than relying solely on monetary targeting as a means of balancing unemployment and inflation levels, output targeting through economic deepening can play a supporting role in maintaining an optimal inflation rate and a minimal unemployment level.

**Keywords:** Unemployment, inflation, ARDL

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### 1. Introduction

The maintenance of price stability is still one of the primary focuses of the Central Bank's monetary policy. The Central Bank makes use of forecasts of inflation in order to accomplish this particular objective. These projections are helpful to policymakers because they assist in determining the appropriate stance of monetary policy, which can either be an expansionary or a contractionary stance (Omran & Bilan, 2021) <sup>[19]</sup>. According to Doh (2011) <sup>[9]</sup>, one of the most popular short-term predictors of inflation is the amount of slack in economic activity. The term "economic slack" refers to situations in which resources (like labour and capital) are not being utilised to their full potential in the economy. The Phillips curve is a mathematical model that economists use to describe the short-term relationship between a slow-moving economy and inflation (Crump, Eusepi, Giannoni & Şahin, 2022) <sup>[7]</sup>. The Phillips curve is a way of describing the cyclical components of the unemployment rate and inflation. It accomplishes this by using unemployment as a measure of economic slack. The Phillips curve shows that when the cyclical component of the unemployment rate goes up, there is a predictable downward pressure on the cyclical component of inflation (Doh, 2011) <sup>[9]</sup>.

The issue of unemployment has now reached a global scale and presents significant challenges to nations of both developed and developing states. Both fiscal and monetary policy strategies have struggled to plug this disturbing reality, despite the fact that the percentage of the working-age population that is unemployed has grown to an alarming rate in recent years (Fung & Nga, 2022) <sup>[11]</sup>. Unemployment is a condition that exists when there are not enough available jobs for all of the people who are actively participating in the labour force in a country, even though those people are willing and able to work. For a considerable amount of time, economists have operated under the assumption that there is a trade-off between unemployment and inflation, which is something that would be of great interest to policymakers (ECB, 2021). The conclusion that can be drawn from this is that a lower rate of unemployment might be attainable by accepting a higher rate of inflation. However, when looking at things from a more long-term perspective, that viewpoint is no longer shared by many. Some economists contend that full employment is achieved when every person who seeks gainful employment is offered a position, whereas it is an admirable objective of public policy to maintain a rate of unemployment that is as low as possible (Carnevali & Deleidi, 2020) <sup>[5]</sup>.

On the other hand, there are those who believe that full employment is achieved when the rate of unemployment is at its lowest and the rate of inflation is stable at the same time. This is the situation that economists refer to as the natural rate of inflation. It is, without a doubt, going to be very helpful for policymakers to determine what the natural rate of unemployment is. Inflation is characterised by a tendency to respond slowly to changes in monetary policy that are designed to control it, which is one of its characteristics (Daniel *et al.*, 2020) <sup>[8]</sup>. For instance, it's possible that the effects of an expansionary monetary policy stance on inflation won't become immediately apparent right away. In a similar vein, when the rate of inflation is rather high, there is a possibility that it will react slowly to contractionary monetary policy strategies that are designed to reduce it. These strategies are intended to bring the rate of inflation down. Because of this, and because there is a chance that actions taken to stop inflation could have short-term economic costs, most people think it would be better to keep the inflation rate as low as possible (Cashell, 2004; Boissay *et al.* 2021) <sup>[6, 4]</sup>.

Through the use of a graphical representation, Phillips (1958) presented a remarkable inverse relationship between the rate of unemployment and the rate of inflation. According to the Phillips curve, there is a positive correlation between improvements in labour market conditions (such as lower unemployment rates or higher employment levels) and the rate of price growth. In other words, the unemployment rate will rise in response to a decrease in the rate of inflation. Although it is generally accepted that this link does exist in the short-run, it is possible that it does not apply in the long-run when inflationary policies are unlikely to reduce unemployment. In the empirical research that Samuelson and Solow (1960) conducted on the correlation between unemployment and inflation in the United States, they made use of the Phillips' hypothesis. They made it very clear that there was an inverse relationship between the level of unemployment and the rate of inflation that they were discussing. They report that when unemployment rates were high, inflation rates were also low, and vice versa. It was

argued that pursuing monetary or fiscal expansion, which might result in inflation, would effectively trade for a lower rate of unemployment. In essence, this was the main point of the argument. In this situation, there is a trade-off, which means that it is difficult for governments to achieve full high employment while at the same time maintaining price stability within the economy (Kurniasih & Kartika, 2020) <sup>[16]</sup>. This is because there is a trade-off between full employment and price stability.

Despite the fact that government deficit spending will stimulate the economy, leading to an increase in gross domestic product and a decrease in the unemployment rate, the inflation rate will rise (Jeke & Wanjuu, 2021) <sup>[14]</sup>. This is the price that must be paid to enjoy minimal unemployment. However, if such a policy measure is successfully implemented, it may cause the inflation rate to rise to a level that threatens the nation's ability to maintain its current level of macroeconomic stability (Qin and Wang, 2013). According to Cashell (2004) <sup>[6]</sup>, any indicator that provides decision-makers with the information they need to avoid higher inflation rates in the first place would be of tremendous assistance. The concept of the non-accelerating inflation rate of unemployment is one that is an improvement on the natural rate of unemployment (NAIRU). In most cases, the NAIRU represents the level of unemployment below which inflation begins to rise. The idea is that if you want to keep prices stable, you have to let prices slowly go up and let unemployment stay at a certain level.

## 2. Empirical Review

For a considerable amount of time, the connection between unemployment and inflation has attracted attention not only among labour economists but also among analysts and researchers. We will investigate related works on this topic in order to better understand the dynamic nature of the two variables in relation to various economies around the world. For instance, in the South African economy, Vermeulen (2015) <sup>[27]</sup> applied the Engle-Granger Error-Correction approach when he investigated the effect that inflation had on employment in South Africa. He found that inflation had a negative correlation with employment. The primary purpose of the research was to determine whether or not higher inflation could result in the creation of new jobs. The findings indicate that there is a positive relationship between output and employment over the long run. This finding lends credence to the assertion that anything that has a negative impact on output (such as high inflation) will, by extension, hinder the creation of new jobs. In the short run, it was found that there was no real link between inflation and the creation of new jobs.

According to Qin, the Phillips curve is ineffective in determining the causal relationship between unemployment and inflation in China. They base their argument on the fact that the Phillips curve was developed in the United States. This was uncovered by an empirical study that looked at the correlation coefficient and the causal link between China's unemployment rate and inflation rate between the years 1978 and 2011. It was emphasised that the reason the Phillips curve cannot be applied to the communist state is because of the complexity of the Chinese economic system. This was the main reason given.

In a similar vein, Umoru and Anyiwe (2013) <sup>[2]</sup> came to the conclusion that the Phillips curve position on the relation between inflation and unemployment was incorrect. The

Vector Error Correction Technique was utilised in the research project so that the authors could evaluate the long-term trends of inflation and unemployment in Nigeria over a period of twenty-seven years. Within the time frame of the study, indicators of stagflation were discovered to be present in the Nigerian economy. However, Nitzan (1990) <sup>[18]</sup>, in his paper entitled "Macroeconomic Perspective of Unemployment and Inflation," emphasises that even though certain factors, such as stagflation, may have posed a serious challenge to the Phillips curve, such contentions only modify the hypotheses and do not nullify them entirely. He stated that because the inverse relationship between inflation and unemployment is too significant to be ignored, auxiliary factors may be introduced for the sole purpose of augmentation. It was found that there is a positive relationship between inflation and unemployment in Nigeria, which proves that the Phillips curve cannot be applied to the case of Nigeria. This finding proves that the Phillips curve cannot be applied to the case of Nigeria. However, the findings of the research that was carried out by Mirza and Mujahid (2015) <sup>[17]</sup> on the economy of Pakistan lend credence to the Phillips Curve postulation by demonstrating the existence of a correlation that is indirect between the unemployment rate and the inflation rate in Pakistan between the years 1973 and 2014. This research was carried out over the course of the period 1973–2014.

Hussein (2014) used the Johansen cointegration test and the Granger causality test to figure out if there was a trade-off between unemployment and inflation in Jordan between 1984 and 2011. The finding that there was no trade-off relationship between the two variables was indicated by the fact that the result showed there was no causal relationship between Jordan's inflation rate and unemployment rate during the time period covered by the study.

Panel data analysis was used in Gur's (2015) <sup>[13]</sup> study to investigate the factors that had an impact on unemployment in the BRIC countries (Brazil, Russia, India, and China) between the years of 2001 and 2012. According to the findings, inflation and population growth are the primary contributors to an increase in the level of unemployment in the BRIC nations. On the other hand, increases in GDP and industrial product growth are among the factors that contribute to a decline in the unemployment rate.

According to the research of Thayaparan (2014) <sup>[24]</sup>, the only factor that has a significant impact on the rate of unemployment reduction in Sri Lanka is inflation. On the other hand, the gross domestic product has a positive influence on unemployment, but this influence is not significant. The research that looked at how inflation and economic growth affected joblessness in Sri Lanka between the years 1990 and 2012 also established that there is a unidirectional causality between inflation and unemployment, as well as bidirectional causal relationships between unemployment and gross domestic product; and between inflation and gross domestic product in Sri Lanka.

Orji, investigated the correlation between inflation and unemployment in Nigeria with the intention of determining whether or not the conventional Phillips curve model is applicable to Nigeria in its original form. According to the findings of the study, unemployment is one of the primary factors that determines inflation, and the rate of inflation has been found to have a positive correlation with Nigeria's unemployment rate. The Phillips curve hypothesis was shown to be false in Nigeria by Umoru and Anyiwe (2013)

<sup>[2]</sup>, and their findings are consistent with these findings. On the other hand, Resurreccion (2014) <sup>[23]</sup> investigated the correlation between unemployment, inflation, and economic expansion in the Philippines from 1980 to 2009. Their findings were published in 2014. It was demonstrated that unemployment has a connection, albeit an indirect one, with both economic growth and inflation. The discovery lends credence to both Okun's Law and the Philips Curve in relation to the Philippines.

In a similar vein, Furuoka and Munir (2014) <sup>[12]</sup> contend that the Phillips curve hypothesis is valid when applied to the economy of Malaysia. The Error Correction Model (ECM) was utilised in the research project to investigate the connection between high unemployment and high inflation in Malaysia. The findings suggest that there is a relationship between the two variables that is stable over the long run, and they also discovered an inverse relationship between unemployment and inflation in Malaysia, which lends credence to the idea that the Phillips curve is an accurate representation of economic dynamics.

Umaru, Donga, and Musa (2013) <sup>[25]</sup> investigated the effects of unemployment and inflation on economic growth in Nigeria from 1986 to 2010, using the Johansen cointegration and the Granger causality test. Their research covered the time period from 1986 to 2010. According to the findings of the Causality test, unemployment and inflation are likely to be found to be causal for real GDP, while real GDP is unlikely to be found to be causal for unemployment and inflation. That is, there is only one chain of causation leading from unemployment and inflation to real GDP. The results of the Johansen cointegration tests demonstrate that there is, in fact, a relationship that exists over the long run between economic growth, unemployment, and inflation. The results also showed that a drop in unemployment and inflation can help the economy grow.

The Johansen cointegration, the Granger causality test, and regression analysis were the methods that Aurangzeb and Asif (2013) <sup>[1]</sup> used in their investigation of the macroeconomic factors that determine unemployment rates. Their research covered the time period 1980–2009 and focused on India, China, and Pakistan. According to the findings of the Granger causality test, there is no evidence of a bidirectional chain of causation between the rates of unemployment, inflation, and economic growth in any of the three countries. The results of the cointegration test showed that there is, in fact, a long-term relationship between the three variables and all of the models.

Examined the trade-off relationship between unemployment and inflation in Malaysia using ARDL bounds testing to cointegration, ECM based ARDL, and Toda-Yamamoto techniques for the period of 1975–2007 in Malaysia. In this study, the authors focused on the period in Malaysia. The research revealed that there is a long-run relationship between inflation and unemployment, as well as a unidirectional causal relationship running from inflation to unemployment. This indicates that inflation is a factor in unemployment, as it points to the fact that inflation has an influence on unemployment. This study eventually came to the conclusion that there is a trade-off relationship between inflation and unemployment in Malaysia.

Umaru and Zubairu (2012) <sup>[26]</sup> studied the correlation between unemployment and inflation in the Nigerian economy between the years 1977 and 2009. Their findings were published in 2012. According to the findings, inflation

has a detrimental effect on the level of unemployment. In Nigeria during the time period of the study, the Granger causality test found that there was not a link that could be considered causal between unemployment and inflation. The Johansen cointegration test showed that the two variables are linked in a way that is important in the long run.

**3. Data and Methodology**

Secondary data used in the study is obtained from the World Bank’s World Development Indicators (WDI) over the period, 1999-2021. Before applying more advanced econometric estimations to our data, we have to make sure that they are stationary because the time frame of our investigation is over an extended period of time. For the purpose of determining whether or not our variables are stationary, we will be utilising the Augmented Dickey-Fuller (ADF) unit root test. Given that there is a mixed order of integration, the Bound test for cointegration and the Autoregressive Distributed Lag (ARDL) model form the key analytical techniques used to estimate the relation between unemployment and inflation.

The ARDL specifications is fashioned after the above model but modified to take into account our selected indicators under a time series procedure. The dynamic models are therefore represented thus:

$$\Delta UER_t = \sum_{j=1}^{p-1} \lambda_j \Delta UER_{t-j} + \sum_{j=0}^{q-1} \delta_j \Delta INF_{t-j} + \sum_{j=0}^{q-1} \delta_j \Delta GDPG_{t-j} + \sum_{j=0}^{q-1} \delta_j \Delta InEXR_{t-j} + \varphi_1 [UER_{t-1} - \{\beta_0 + \beta_1 INF_{t-1} + \beta_2 GDPG_{t-1} + \beta_3 InEXR_{t-1}\}] + \varepsilon_{it} \tag{1}$$

Where equations (1) model the unemployment and inflation function. *t* denotes time period, and *UER* = unemployment rate, *INF* = inflation rate, *GDPG* = gross domestic product growth rate, *InEXR* = natural logarithm of exchange rate, and  $\varepsilon$  = error term.  $\lambda$  and  $\delta_j$  represent the short-run parameters of lagged dependent and independent variables respectively, and  $\Delta$  is a differencing operator.  $\beta_1 - \beta_3$  are the long-run coefficients, and  $\beta_0$  is the intercept.  $\varphi$  is the coefficient of speed of adjustment towards the long-run equilibrium.

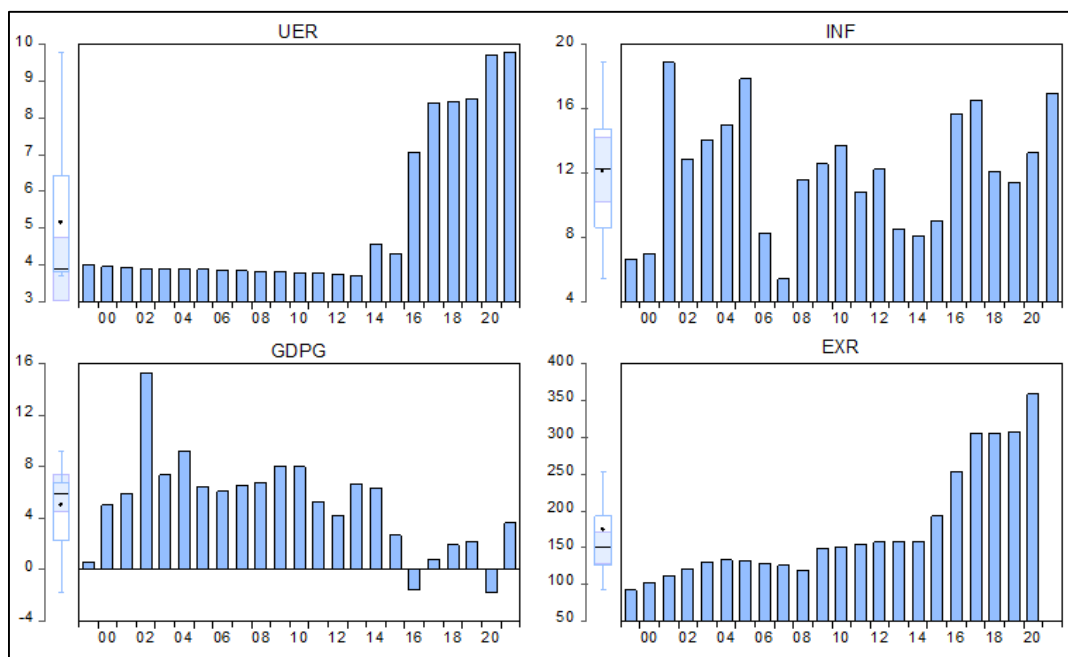
**4. Results and Analysis**

**4.1 Descriptive statistics**

**Table 1:** Descriptive statistics of variables

Statistic	UER	INF	GDPG	EXR
Mean	5.152739	12.09389	5.029811	174.6454
Max.	9.714000	18.87365	15.32916	358.8108
Min.	3.700000	5.388008	-1.794253	92.33810
S.D	2.189369	3.754029	3.784043	77.86984
Obs.	23	23	23	22

Table 1 explains statistical description of each variable over the period, 1999-2021. It can be observed that UER rose at an average rate of 5.15% and was at its highest peak in 2020 at 9.71%. Inflation rate and GDP growth rate averaged 12.09% and 5.03%, respectively while the mean of exchange rate stood at 174.65 within the coverage period. The trends of the selected variables are further illustrated in Figure 1 which depicts the variants in trend patterns across years.



Source: WDI (2022).

**Fig 1:** Graphical representation of variable proxies

**4.2 Unit root test**

**Table 2:** Augmented Dickey-Fuller (ADF) Unit root Test.

Variables	ADF Test Statistic	Critical Value at 5%	Order of Integration
<i>UER</i>	-4.445650	-3.644963	1(1)
<i>INF</i>	-4.074618	-3.644963	1(0)
<i>GDPG</i>	-4.409032	-3.632896	1(0)
<i>InEXR</i>	-3.225385	-3.012363	1(1)

The representation in Table 2 shows that all the variables do not have unit root and therefore are stationary at 5% level of significance. UER and InEXR attained stationarity at first difference whereas INF and GDPG are stationary at level. This outcome permits us now to estimate our model using the ARDL approach.

**Bound Test for cointegration**

**Table 3:** Cointegration Test Results

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	6.850032	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Table 3 presents the bound test. The result revealed that the critical F-statistic value of 6.85 is greater than the lower and upper bound values at 5% levels of significance. This is an indication that the estimated series are cointegrated. In other words, unemployment rate and the rate of inflation have long-run relationship, and move together in the long run.

**4.3 Regression Results**

**Table 4:** ARDL Short Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-5.957347	2.264457	-2.630807	0.0175
UER(-1)	-0.376624	0.107314	-3.509557	0.0027
INF	0.047697	0.028501	1.673511	0.125
GDPG(-1)	-0.125963	0.042196	-2.985178	0.0083
InEXR	3.655014	1.174851	3.111045	0.0064
D(GDPG)	-0.067280	0.035166	-1.913226	0.0727
CoIntEq(-1)	-0.376624	0.056693	-6.643273	0.0000

The result of the short run dynamics models as represented in table 4 above indicates that lagged unemployment rate is negatively and significantly related to current unemployment rate. The result also shows that inflation rate directly associated with increase in unemployment rate. It can be observed that a unit change in inflation rate led to about 4.8 increase in inflation rate in the short-run. On the other hand, exchange rate was found to have correlate with 3.6% increase in unemployment rate, which GDP exerted negative but insignificant influence on unemployment rate. The error correction term (ECT) demonstrates the speed of adjustment to long-run equilibrium and suggests that about 38% of deviations from long-run equilibrium is corrected each year.

**Table 5:** ARDL Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	0.125657	0.078357	1.603650	0.1283
GDPG	-0.286805	0.149328	-1.920634	0.0728
InEXR	10.39224	2.621942	3.963568	0.0011
C	-17.63746	6.213444	-2.838597	0.0119

Table 5 presents the result of the long-run estimations which reveals that inflation rate is positively associated with unemployment rate – suggesting that 1% change in inflation rate brought about 0.13% increase in unemployment rate in the long-run. Exchange rate is also shown to have positive

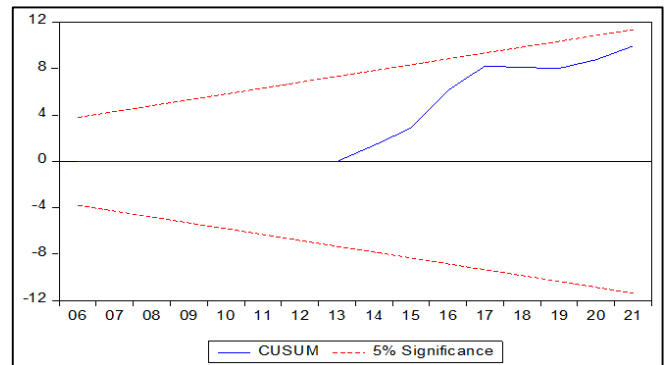
and significant relation with unemployment rate. The parameter estimate indicates that when exchange rate change by 1%, unemployment rate increased by 10.40%. On the other hand, GDP exerted negative but insignificant influence on unemployment rate, and correlated with about 0.29% decline in unemployment rate.

**4.4 Diagnostics Test**

The Serial Correlation and the Heteroskedasticity diagnostic test result are presented in Table 5. The serial correlation test result in the first panel confirmed the Durbin Watson stat in Table 4 that the model variables do not have traits of autocorrelation. Heteroskedasticity test result in the second panel suggests that the model is homoskedastic since the probability values of observed R-squared is greater than 5% probability level. The stability of the regression coefficients is also confirmed in Figure 1 with the Cumulative Sum (CUSUM) recursive estimate where the middle line fell within the upper and lower bound.

**Table 6:** The Serial Correlation and the Heteroskedasticity Tests

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	1.153475	Prob. F(2,14)	0.3438
Obs*R-squared	3.253817	Prob. Chi-Square(2)	0.1965
Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.785236	Prob. F(6,16)	0.5940
Obs*R-squared	5.232019	Prob. Chi-Square(6)	0.5144
Scaled explained SS	3.182339	Prob. Chi-Square(6)	0.7856



**Fig 2:** CUSUM Test

**5. Conclusion and Recommendation**

The question of whether or not there is a connection between unemployment and inflation is relevant to a wide range of economic interests. Researchers and economists are interested in this topic because unemployment continues to be one of the most significant challenges that developing and emerging economies around the world are currently facing. When all other factors are held constant, it is a commonly held belief that achieving price stability will have a beneficial impact on both growth and unemployment, particularly if the optimal threshold can be identified. However, finding the optimal compromise appears to be quite difficult, and central banks all over the world are struggling to boost employment rates without upsetting price stability. Consequently, the purpose of this research is to determine how changes in the general level of prices affect the unemployment rate in Nigeria using annualised data spanning the years 1999 to 2021. According to the findings of the research, inflation is positively associated with unemployment rate both in the short-run and long-run, whereas economic growth and

exchange rate were found to be positively related to unemployment rate during the period. Despite the fact that unemployment and inflation have a long-term relationship, there is a divergence along the equilibrium part that is corrected at a 38 percent annually. We suggest that, rather than relying solely on monetary targeting as a means to strike a balance between unemployment and inflation levels, output targeting, achieved through economic deepening, can play a supporting role in maintaining an optimal inflation rate and a minimal unemployment level.

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