



RELATIONSHIP BETWEEN INFLATION AND UNEMPLOYMENT: TESTING THE APPLICABILITY OF PHILIPS CURVE TO NIGERIA

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ABSTRACT

This paper attempted an empirical validation of the Phillips curve hypothesis (inflation and unemployment trade-off) applicability in Nigeria from 1991 to 2021. The study sourced its data from the World Bank, and National Bureau of Statistic (NBS). The study first, examines the stochastic properties of the variables through Augmented Dickey Fuller (ADF) test, and the result reveals that inflation rate, unemployment rate and gross domestic product data series are stationary at first difference, heteroskedasticity test through Breusch-Pagan-Godfrey and Serial Correlation through Breusch-Godfrey LM Test were performed, which find the data set to be free from heteroskedasticity and serial correlation, also the long run relationship between the variables has been examined through regression model (OLS). The result of the model reveals that inflation rate is statistically significant in explaining unemployment, this implies that there is a trade-off relationship between the variables, which confirms the validity of the Phillips curve hypothesis for the Nigerian economy within the timeframe of 1991 to 2021. It's therefore recommended that the Nigerian economy adopt a policy-mix which will maximize employment of labour, while creating cushions for inflationary trends. Given that a negative relationship exist between the variables.

KEYWORDS: *inflation, unemployment, Phillips curve hypothesis, Nigerian economy*

1.0 INTRODUCTION

Macroeconomic policies of all governments are geared towards attaining economic stability in various sectors. Among targets of such policies are increase economic development accompanied with a reduction in inflation and unemployment. Inflation, which implies the general increase in the price level, is broadly an average measure because at any point in time, prices may be increasing, decreasing or constant; a persistent increase in prices hurts the economy, especially the lower class who have little or no savings to mitigate the rising prices. The average person in any household knows when the money in his possession can only purchase less quantity of goods and services than was previously possible. Generally, economic agents (households, private sector and government) would raise an alarm because their earnings have declined in real terms due to rising prices. It is even worse when uncertainty follows price increases. (Nwaobi, 2009).

The Nigerian economy has suffered immensely from the shackles of inflation and its attending effects, the annual inflation rate in Nigeria accelerated for the ninth straight months to 21.09% in October of 2022 from 20.77% in the prior month (NBS), it was the highest reading since September of 2005, even after a recent 150 bps rate hike by the Central Bank, largely due to a weaker currency, supply disruption caused by widespread flooding that rise the costs



of imported products. However, the concern is not always with single-digit rates of inflation (less than 10 per cent), but with the benchmark desirable for that economy, because even very low rates of inflation (disinflation) can be harmful to an economy. So the question is which rate is very high/low?

Another disturbing but significant macroeconomic variable is the rate of unemployment. The rate of unemployment represents the percentage of those willing and able to work but cannot find employment, it captures the frequency duration and incidence of unemployment. A high rate of unemployment results in output loss to the economy. The Nigerian economy is also grappling with the challenges of unemployment. In 2022 the unemployment rate in Nigeria is estimated to reach 33%. This figure was projected at 32.5 percent in the preceding year (NBS), chronological data show that the unemployment rate in Nigeria rose constantly in the past years, this data has been recycled in other reports on unemployment in Nigeria even though the recent massive migration of young talents to well-developed countries to seek gainful employment points to the escalating unemployment crisis in the country. Since 2014, Nigeria's working age population's unemployment rate has spiked drastically, leading to a massive efflux of skilled workers migrant from Nigeria over the last few years. A report on the website of the UK medical council in July 2020, showed that the number of Nigerian doctors working in the UK had risen to 7,875 in less than a week and had surpassed a thousand by the beginning of the following month.

However, the Phillip curve hypothesis argued against the simultaneous attainment of reduction in inflation and unemployment. The Phillips curve is concerned with the controversy over the relationship between inflation and unemployment and is one of the most famous relationships in macroeconomics. It should be noted that the first statistical study investigating the relationship between unemployment and inflation was carried out by Irving Fisher in 1926. However, the curve that bears A.W. Phillips's name was derived from a statistical investigation published in 1958 into the relationship between unemployment and the rate of change of money wages in the UK over the period 1861–1957. Philip (1958) stated that, there is a trade-off relationship between the two undesirables (inflation and unemployment). This means that there is a negative relationship between unemployment and inflation.

Scholars, such as, Samuelson and Solow (1960), Phelps (1967), Friedman (1968), Lucas (1973) and Fischer (1977) empirically demonstrated that, there exists an inverse relationship between the variables of unemployment and inflation. That is, when unemployment rate increases, inflation will take a downward trend; but when unemployment rate decreases, inflation will invariably increase. Such a scenario entails a trade-off between the two variables and this becomes an issue of great concern to policy makers, as whether to accept a higher rate of inflation which will lower the rate of unemployment or vice versa. Invariably, this situation entails that government cannot achieve the objectives of full employment and at the same time maintain price stability, rather such calls for the establishment of an appropriate threshold that could prevail as it becomes almost practically impossible to simultaneously maintain low inflation rate and low rate of unemployment. Consequently, policymakers ought to decide what rate of inflation should be sacrificed for an acceptable rate of unemployment.

2.0 LITERATURE REVIEW

Numerous studies in the literature have examined theoretical and empirical relationships between inflation and unemployment, but what was learnt from the literature is that the argument is still ongoing. This is as a result of the several conflicting and contrasting results obtained by some of these studies. One of the issues which have captured most of the debate is whether the propositions of Phillips hold true in reality or not. Thus, this current study is relevant to enable us identify the true empirical situation in Nigeria, with respect to the Phillip's curve and also make necessary policy recommendations.

2.1 Theoretical Literature

In 1958 British economist A.W. Phillips published the results of an empirical analysis of historical data from the U.K. labour market. Phillips's study was intended to help answer one of the basic questions in macroeconomic theory, which concerns the cause of inflation. He hoped to find empirical support for the Keynesian view that the rate of wage inflation that is, the rate of increase in nominal (money) wage rates depended on the tightness of the labour market. Since the level of unemployment was a readily observable indicator of the tightness of the labour market, Phillips's immediate goal was "to see whether 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.



The logic behind Phillips's theory is very simple, if for some reason the demand for labour were high relative to its supply then equilibrium wage rates would be expected to rise above current wage levels, and there would be upward pressure on nominal wages as firms bid for additional workers. As additional workers were actually hired, the unemployment rate would fall. The larger the discrepancy between the quantity of labour demanded and the quantity supplied, the stronger the upward or downward pressure on wage rates. The opposite would be true when there was excess supply of labour and rising unemployment. Phillips found, as he expected that from 1861 to 1957, the growth rate of nominal wages was negatively correlated with the rate of unemployment that is low unemployment rates tended to be associated with rapidly rising wages while high unemployment rates were associated with slowly rising wages. Phillips also found that the strength of the unemployment versus wage-change relationship seemed to depend on the level of unemployment. When unemployment was low, decreases in unemployment tended to be associated with big increases in wage inflation while when unemployment was high, decreases in the unemployment rate seemed to produce small increases in wage growth rates.

The Modified Phillips Curve

The Philips curve enjoyed some success as it became a popular element of macroeconomic theories soon after and had great influence on governments policies of the 1960s. Because it was regarded as an instrument for economic policy, the government thought they could achieve low unemployment as long as they were willing to tolerate higher inflation and attain price stability through tolerating a higher Unemployment. (Blanchard & Illing, 2009).

However, during the 1970s the inverse relation between inflation and unemployment however broke apart and the most of the OECD member states observed stagflation which means high inflation as well as high unemployment. But although the Phillips curve could not explain stagflation, a new relation between unemployment and inflation was discovered, namely the inverse relation of unemployment and changes in inflation. This relationship was the foundation for the modified Phillips curve and is still valid and applicable for many developed countries. It has evolved under the pressure of events and the progress of economic theorizing, incorporating at each stage such new elements as the natural rate hypothesis or the NAIRU (non-accelerating inflation rate of unemployment), the adaptive expectations mechanism, and most recently, the rational expectations hypothesis.

2.2 Empirical Literature

Due to country-specific individualities, the review of literature will mostly cover those carried out in Nigeria as a spring board to validate economic contrast and decision-making. The studies on the validation of the Phillips curve hypothesis have resulted in varying results based on the adopted techniques and time frame of the studies.

For instance, Uche (2019) embarked on an investigation of the nature of relationship which exist between inflation and unemployment in Nigeria using data ranging from 1981 to 2017. Empirical findings from the Fully Modified Least Square Regression (FMOLS) showed that the Phillips curve is applicable in the Nigerian case, since a 1 percent reduction in unemployment will be achieved only if the economy will sacrifice a 49 percent increase in inflation, and vice versa. Again, Onwioduokit (2006) investigated the relationship between unemployment and inflation in Nigeria and found that there is negative relationship between unemployment and inflation with the coefficient of -0.412, this validates the Philips hypothesis. However, the results of the causality test indicate no causality between unemployment and inflation in Nigeria.

Moreover, Ola-David and Oluwatobi (2012) investigated the existence of an Okun-type relationship for the Nigerian economy during the period 1970 to 2009. The results showed that a long run inverse relationship exists between unemployment and output in Nigeria. The Okun coefficient was 1.75 percent indicating that a one percent decrease in unemployment rate is accompanied by a 1.75 percent increase in GDP.

Similarly, Ogujiuba and Abraham (2013) examined the existence of the Philips curve hypothesis in Nigeria over the 1970-2010 period by employing the generalized error correction model. The results illustrate that there is a negative but insignificant relationship between unemployment and inflation in the short-run. On the other hand, the results suggest that in the long-run, inflation and unemployment are positively related. In the same vain, Umaru and Zubairu (2012) assessed the inflation-unemployment relationship in Nigeria from 1977 to 2009 using the cointegration method and Granger causality test, and the ARCH and GARCH approaches to check the series' volatility. The results suggest that the variables are cointegrated, and inflation has a negative impact on



unemployment. In addition, the results of the causality test show the absence of any causal relationship between inflation and unemployment.

However, Manu, Suleiman, Yakubu and Usman (2018) examined the relationship between inflation and unemployment within the context of Nigerian economy from 1961-2015. The study focuses on examining the existence and applicability of Philips curve theory or otherwise in Nigeria during the period under study. The study applied augmented Dickey-Fuller and Philip Perron technique to examine the unit root property of the data. ARDL-bound Umaru and Ayinwe (2013) used the vector error correction technique to investigate the dynamics of inflation and unemployment in Nigeria from 1986 to 2012. The results indicate the presence of high inflation and unemployment rates (stagflation) in Nigeria, thus refuting the proposition of the short-run Phillips curve. Notwithstanding, Umaru et al. (2013) evaluated the effects of inflation and unemployment on Nigeria's economic growth using the ordinary least squares and cointegration methods, including Granger causality tests, over the 1984-2010 period. The results of the causality tests indicate that there is an absence of a causal relationship between inflation and unemployment.

3.0 METHODOLOGY

Annual data series was employed for the time frame covering 1991 to 2021, with a total of 30 observations for each individual variable with respect to the Nigerian economy. The data were sourced from the World Bank and the National Bureau of Statistic (NBS). The study adopts a quantitative method to evaluate the empirical evidence of the relationship between unemployment rate, inflation rate and gross domestic product annual growth rate in Nigeria. The method of analysis has been an econometric technique using the ordinary least square (OLS) regression technique. In statistics, ordinary least squares (OLS) or linear least squares is a method for estimating the unknown parameters in a linear regression model. Thus, the model reads as;

$$Y = \beta_1 + \beta_2 X + \beta_3 X + et \dots\dots\dots (1)$$

Where:
Y = the dependent variable and
 β_1 and β_2 are the intercept and slope respectively.
X represent the independent variables
While 'et' is the error term which is independently and identically distributed with stochastic mean and a constant variance. Equation (1) can be re-written as:

$$UNEM = \beta_1 + \beta_2 INF + \beta_3 GDPR + et \dots\dots\dots (2)$$

Where:
UNEM = Unemployment Rate
INF = Inflation Rate
GDPR = Gross Domestic Product (Annual Growth Rate)
 β_1 = Constant Parameter
 β_2 = Coefficient of independent variable
et = Error term

Variables Description

Unemployment Rate: is the percentage of the labour force without a job. It is a lagging indicator, meaning that it generally rises or falls in the wake of changing economic conditions, rather than anticipating them.
Inflation Rate: is the rate at which prices increase over time, resulting in a fall of the purchasing power of money, consumer price index (CPI) is the most widely used measure of inflation, the CPI measure the overall change in consumer prices based on a representative basket of goods and services over time.
Gross Domestic Product (Annual Growth Rate): GDPR was used in this study as a controlled variable it compares the year-over-year (or quarterly) change in a country's economic output to measure how an economy is doing.



4.0 RESULTS AND DISCUSSION

This section contains detailed presentation and discussion of data analysis and the result of this study. The findings are presented under the following tables; Augmented Dickey Fuller unit-root Test, Heteroskedasticity test Breusch-Pagan-Godfrey, Breusch-Godfrey Serial Correlation LM Test and Regression Analysis

Unit Root Test Results

Since we are dealing with time series variables which are generated through a stochastic process, we are first going to determine if this stochastic process is stationary. For this purpose, the Augmented Dickey-Fuller test is used. A variable is stationary if the absolute ADF value ($|\tau|$) is greater than any of the absolute tau critical values. The Augmented Dickey Fuller (ADF) test was applied to find the existence of unit root in each of the time series.

Table-1.ADF Unit Root Test for Stationarity

Variables	ADF Test Statistics	1% ADF Critical Value	Order of Integration
UNEM	-4.332501	-3.679322*	I(1)
INF	-4.310232	-3.689194*	I(1)
GDPR	-7.604632	-3.679322*	I(1)

Source***&****indicates stationarity at 1%,5%&10% level of significance

The ADF test for unit root shows that INF, UNEM and GDPR were stationary at first difference on this basis, the null hypothesis of non-stationarity is rejected, and we conclude that the variables are stationary at first difference.

Heteroskedasticity test

In statistics, Heteroskedasticity happens when the standard errors of a variable, monitored over a specific amount of time, are non-constant, the Heteroskedasticity test Breusch-Pagan-Godfrey was performed and the result shows that the data set are homoscedastic, because the probability of chi-square is greater than 0.05%.

Table 2: Heteroskedasticity test Breusch-Pagan-Godfrey

F-statistic	1.990419	Prob. F(2,28)	0.1555
Obs*R-squared	3.858747	Prob. Chi-Square (2)	0.1452

Source; computed using Eviews8.

Serial Correlation LM Test

Serial correlation or auto correlation occurs in a time series when a variable and a lagged version of itself are observed to be correlated with one another over periods of time, it measure the relationship between a variable's current value given it pass value, Table 3 below shows the result of a Breusch-Godfrey Serial Correlation LM Test and the result clearly shows that there is no auto/serial correlation, because the probability of the observed R^2 is greater than 5%.

Table 3: Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.109136	Prob. F(15,13)	0.0920
Obs*R-squared	21.97162	Prob. Chi-Square (15)	0.1086

Source; computed using Eviews 8

Ordinary least squares regression (OLS)

OLS is a common technique for estimating coefficients of a linear regression equations which describe the relationship between one or more independent quantitative variables and a dependent variable



Table 4: A Regression Analysis: UNEM (Dependent Variable)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.99938	0.699499	9.578189	0.0000
INF	-0.037826	0.020819	-0.816905	0.0800
GDPR	-0.277343	0.089490	-0.089490	0.0044

Source; computed using Eviews 8

Table 4 presents a regression analysis conducted between unemployment as dependent variable inflation rate, and gross domestic product as the independent variables. The main reason for regressing the series is to test the validity of the Philips Curve hypothesis to the Nigerian economy which postulated that a negative and significant relationship exist between Inflation rate and Unemployment rate,

The result shows that 1 unit increase in inflation rate will lead to a decrease in the country`s unemployment rate by - 0.037826, and the relationship is statistically significant at 8%, also if GDP increases by 1 percent unemployment will decrease by -0.277343which is highly significant at 1% (10% level of significant was used as the threshold level of rejecting the null hypothesis in this study).

This is consistent with the postulation of the Phillips curve hypothesis of a negative and significant (inverse) relationship between inflation and unemployment rate.This finding agrees with the work of Abu (2019) who examined the Phillipscurve hypothesis (inflation and unemployment trade-off) and its stability in Nigeria from1980 to 2016 using the Autoregressive Distributed Lag (ARDL) bounds testing approach. The result indicated that there is a trade-off relationship between the variables, and higherunemployment leads to lower inflation in the long-run.

On the contrary, the result is not consistent with the work of Kairo, Solomon&Bitrus (2019). They used the OLS and the ARDL as a result of the unit root test to investigate the dynamics of inflation and unemployment inNigeria from 1989 to 2018. The results indicate that the Philip's curve theory failed to hold in Nigeria thus refuting the proposition of the shot runPhillips curve.

SUMMARY OF MAJOR FINDINGS

In this study, we set out to empirically determine the existence of the Phillips curve hypothesis in Nigeria between 1991 and 2021. Secondary data was used and the sources of data included the World Bank, National Bureau of Statistics (NBS). In order to achieve the objectiveof the study, econometric model was estimated using the Ordinary Least Square (OLS). In the model, unemployment rate was regressed against inflation rate and gross domestic product, and result shows thatthe Philip's curve theory hold for the Nigeria economy.

The results shows thatthere exist a negative and significant relationship between inflation rate and unemployment. The implication of this result is that no single economy can fully eradicate both inflation and unemployment and perform optimally

The result also shows that growthdomestic product is a very significant determinant of unemployment in Nigeria.

POLICY RECOMMENDATIONS

The Governor, Central Bank of Nigeria, Mr Godwin Emefieleexpressed an optimism with the current efforts of the apex bank which will make inflation rate in 2023 fall below 15% as projected by the international monetary fund IMF.However, the concern is not always with lowrates of inflation (less than 15 per cent), but with the benchmark acceptable for the economy to performed optimally because If policy makers formulate policies to stabilize inflation, the country has to accept high unemployment rate and vice versa. This is because of the trade-off relationship that exist between inflation rate and unemployment rate.



So with the target of 15% inflation by 2023, based on our analysis if the target is archived the unemployment rate will decrease to 5.8%.

Therefore it is appropriate for Government, most especially the monetary authorities to address the rising inflationary trend, address insecurity issue which will increase production capacity, Increase interest rates to mop up excess liquidity, however the emphasis should be placed on the employment sphere by creating job hubs for the general public.

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