



Research Article

Inflation and Unemployment in Nigeria: An ARDL-Approach

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This study examines the effect of inflation on unemployment in Nigeria. Unemployment is a major problem in Nigeria, even with the growth rate of 7% within the study period, the problem is still on the increase. The study uses the period 1977 to 2011 in analyzing the long run impact of inflation on unemployment in Nigeria, based on the Phillips curve hypothesis, instead of relying on the traditional ballpark figure made by Nigerians. Real gross domestic product is also used as control variable. The study employed an Autoregressive Distributed Lag (ARDL) Model to test for bounds co-integration, the long run and the Error Correction Adjustment. The co-integration bound test showed that the variables are co-integrated. Our Findings validate the Phillips curve hypothesis as well, contradict the belief by Nigerians about the coexistence of unemployment and inflation in the country.

Keywords: Inflation; Unemployment; Phillips Curve; Autoregressive Distributed Lag; Nigeria

INTRODUCTION

Inflation and unemployment are related. Inflation is the general level of price increase over a lengthy period. When inflation increases, investors or employers feel insecure about their finances due to the increased cost of production. This can lead to job losses, because of the increased cost. If employment increases, there will be more income to purchase goods in the economy. This in turn leads to inflation. Economists have been trying to explain the correlation between inflation and unemployment using the Phillips curve in both the short and the long run, (Umaru and Zubairu, 2012). A rough inverse correlation exists between inflation and unemployment in the short run Phillips curve, and this has presented a problem to regulators who want to limit both. In the long run, it has been observed that the two variables are not related, (Umaru & Zubairu, 2012). Classical economists believed that the supply of money is the primary cause of inflation, thus; $(\text{money supply}) \times (\text{speed of its circulation}) = (\text{level of price}) \times (\text{measure of output})$. They expect that speed of circulation and output are not dependent and comparably steady. As money supply

increases, prices increase to keep the equation in balance. This price increase is called inflation. It is accepted by classical economists that there exists a natural rate of unemployment. This level is referred to as the equilibrium level of unemployment of a given economy. This level is otherwise known as the Phillips curve in the long run. The long run Phillips curve is vertical as the classical view of inflation is not associated with unemployment in the long run. Therefore, unemployment will simply be at a given level regardless of the level of inflation.

In the classical perspective, the point where the short-term Phillips curve converges with the long run Phillips curve is the normal level of inflation. To the left of that point, genuine inflation is higher than anticipated. To the right, real inflation is lower than anticipated.

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Ordinarily an unemployment rate below the natural unemployment leads to a level of inflation that is higher than expected while unemployment that is above the natural unemployment leads to a level of inflation lower than it is expected. The natural rate of unemployment reflects the microeconomic features of the labour market, whereas the Non-Accelerating Inflation Rate of Unemployment, (NAIRU) is predominantly an empirical macroeconomic relationship dependent on both the supply and demand sides of the economy and the stance of monetary policy. Prior research has focused not on estimating the natural rate of unemployment, but instead around estimating the NAIRU, typically from the empirical Phillips curve relationship.

According to neo-classical economists, inflation is a direct consequence of a supply of money that continues increasing. This view-point is contrary to the classical economists. They deal with the institutional crises that people may encounter whenever the price level increases. Keynesians contend that business organizations raise wages to keep their laborer's cheerful. Firms then raise cost to pay for that and continue making a benefit. This causes an expansion in both wages and prices, and demands an increment of cash supply to keep the economy running. In this way, the government then issues more cash to stay aware of inflation (Keynes, 1937). This varies from the Classical model. The classical perspective is that inflation is influenced by changing money supply, while Keynesians view inflation as the reason for changing money supply. Inflation and unemployment are problems that are unique and can threaten both the social and economic life of every nation. Umaru and Zubairu (2012) argued that unemployment is one of the many serious setbacks to social progress. Raheem (1993) said unemployment signifies a massive waste of a country's manpower resources and spawn's welfare loss in terms of lower output thereby leading to lower income and well-being. In Nigeria, unemployment is a serious issue; Kano and Yobe States recorded that 67 percent and 60.6 percent (respectively) of their labour force were unemployed in 2011, (the Central Bank of Nigeria report, 2012). The desire to curb the unwanted impacts created by unemployment has uncovered the importance of fighting this disaster, and made unemployment amelioration programs appear very popular in the developmental policies of many developing and less developed nations of the world.

The relationship between inflation and unemployment based on early theories were proposed on the basis of information sourced from the developed western world, particularly the United Kingdom and the United States of America. These economies are considered developed and open. Therefore, major economic variables are relatively determined within these economies. In the case of developing economies like Nigeria, economic variables are highly determined by forces outside the economy.

Moreover, it is believed that Phillips curve does not always hold in developing countries; for example, a study by Tomety (2011) confirmed the coexistence of inflation and unemployment in Ghana. This finding may be an indication that the Phillips curve hypothesis may be limiting in the case of developing countries. In Nigeria, a study by Umaru & Zubairu (2012), using OLS estimation has confirmed the presence of the Phillips curve; however, no study, to the best of our knowledge used the ARDL model combined with control variables such as real GDP growth. The prior statements justify a study of the relationship between unemployment and inflation using real GDP as a control variable based on data sourced within the Nigerian economy. The result will better address the Nigerian inflation and unemployment situation. The study would solve the problem in a Nigerian way, with the aim of finding lasting solutions to unemployment and inflation problems in the country.

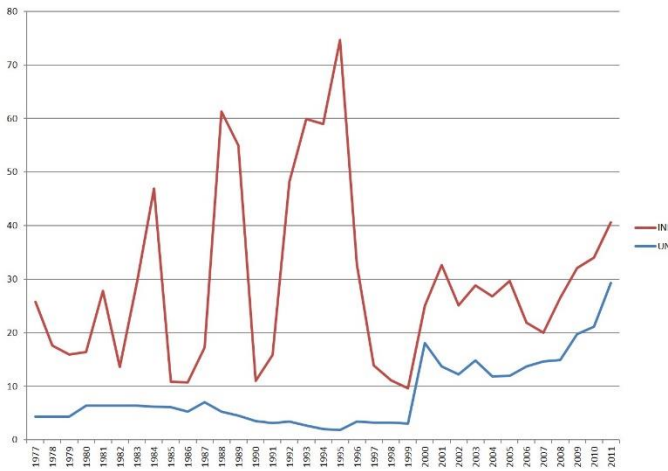
Phillips (1958) theorised that there is a stable negative relationship between the level of unemployment and the rate of wages, with high levels of unemployment accompanied by falling wages and low unemployment accompanied by rising wages. Keynes (1937) stated that there are bound to be shocks in an economy whereby unemployment will be affected without necessarily affecting inflation; this is known as the shifting Phillips curve. Friedman (1977) developed an alternative hypothesis that distinguished between the short term and long-term impact of an unanticipated change in overall nominal demand. If from the initial stable position, there is an anticipated acceleration of overall nominal demand. This will appear to all producers as an unexpectedly favourable demand. In an economy in which changes are always occurring in the relative demand for various products, the producer may not have knowledge on whether this change is in his favour or not.

Despite numerous studies on the Phillips curve, there is still a lack of systematic empirical analysis, which examines the hypothesis in the context of a developing country, considering that most of research had focused on the developed nations (Furuoka 2007). The relationship between unemployment and inflation in Nigeria has been investigated by Onwioduokit (2006) and discovered that there is a negative relationship between the two. This agrees with the Phillips hypothesis, but a causality test between unemployment and inflation uncovers no causality between unemployment and inflation in Nigeria. Umaru and Zubairu (2012) found a negative relationship between unemployment and inflation. Recently, Vermeulen (2017), found that inflation harms employment opportunities in South Africa.

Inflation in Nigeria is surely an old problem. It remains the country's major problem for many years. Adebayo (1997) defined inflation as general rise in the price level over a long period in an economy. The macroeconomic goals,

which governments strive and Central Bank to achieve, are to maintain stability in local or home goods price level and to ensure that full employment is attained. These goals can be to eradicate the cost of either unemployment or inflation and the instability that is associated with price precariousness or high rate of unemployment. The impact of unemployment and inflation on development can be examined considering that a nation will develop quicker in genuine terms if unemployment and inflation diminish to a minimum level. It ought to be mentioned here that inflation is not inconsistent with development, however, according to information from the Nigerian National Bureau of Statistics, the unemployment rate in 2011 was 29.3% indicating that unemployment has increased in the past five years. Unemployment in Yobe is 60.6% and 67% in Kano, evident from the number of youths wandering the roads without employment.

Figure I. Inflation and Unemployment in Nigeria; 1977-2011



Source; CBN Database, 2013

Figure I above reveal that both inflation and unemployment are increasing in recent years, especially since 2007. In general, the trend revealed a trade-off between unemployment and inflation. The inflation rate is volatile while the unemployment rate is stable. Part two of this paper discusses the data and methodology, results and discussion are in part three, and the last part of the study is the conclusion.

METHODOLOGY

This study uses Autoregressive Distributed Lag (ARDL) Model, in estimating the cointegration relationship between inflation and unemployment. Dataset for the study covers from 1977 to 2011, which was collected from the Central Bank of Nigeria and the National Bureau of Statistics. Models such as the cointegration, long run and short run error correction adjustment were considered as follows:

Cointegration test

The cointegration test confirms the existence of the long run relationship among the variables of interest using F-statistics. Cointegration is tested by transforming the model into an unrestricted error correction model (UECM). In the following cointegration model, unemployment is considered as the dependent variable while inflation is an independent variable:

$$\Delta \ln UN_t = \alpha_0 + \sum_{i=1}^m \theta_i \Delta \ln UN_{t-i} + \sum_{i=0}^m \partial_i \Delta \ln RGDP_{t-i} + \sum_{i=0}^m \varphi_i \Delta \ln INF_{t-i} + \beta_1 \ln UN_{t-1} + \beta_2 \ln RGDP_{t-1} + \beta_3 \ln INF_{t-1} + \mu_t \quad (1)$$

Where, $\ln UN$ is log of unemployment, $\ln RGDP$ is log of real gross domestic product per capita growth and $\ln INF$ is log of inflation, α_0 is constant, $\beta_1, \beta_2, \beta_3$ are the parameters.

The null hypothesis of no cointegration is that: $H_0: \beta_1 = \beta_2 = \beta_3 = 0$. The alternative hypothesis that cointegration exists is: $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$. The sample size for this study is 35 years; therefore, the F-statistics should be compared to the critical bounds suggested by Narayan (2005). If $F\text{-statistic} > F\text{-critical upper bound}$ of the Narayan table, then the null hypothesis is rejected which means cointegration exists. It would be inconclusive or no cointegration if $F\text{-statistic}$ falls in-between the bounds or less than $F\text{-critical lower bound}$, respectively. The maximum lags for this small sample size according to Narayan (2005) is 2.

The Long Run Model

$$\ln UN = \alpha_t + \sum_{i=1}^m \theta_{1i} \ln UN_{t-i} + \sum_{i=0}^m \varphi_{1i} \ln INF_{t-i} + \sum_{i=0}^m \partial_{1i} \ln RGDP_{t-i} + V_t \quad (2)$$

To calculate the long run coefficient, use the Wald Coefficient test and each variable has single long run coefficient only, thus:

$$\beta_i = \sum_{i=0}^m \beta_i / 1 - \sum_{i=1}^m \partial_i$$

Error Correction (short run) Model

$$\ln UN = \alpha_t + \sum_{i=1}^m \theta_{1i} \ln UN_{t-i} + \sum_{i=0}^m \varphi_{1i} \ln INF_{t-i} + \sum_{i=0}^m \partial_{1i} \ln RGDP_{t-i} + \cap ECM_{t-1} + \epsilon_t \quad (3)$$

α , is the ECM_{t-1} coefficient. The ECM represents the possible effects of departures from the long run equilibrium, (Baharumshah, et al., 2009). The adjustment coefficient of the ECM should be negative, less than one, and significant to conform to the cointegration relationship. Before testing for the above cointegration, long run, and short run models, it is required to conduct a unit root test. This is to check for the integration level of the variables as the ARDL approach is only valid for variables that are stationary at first difference $[I(1)]$.

RESULTS AND DISCUSSIONS

The discussion of the results starts with the unit root test result, which examined the stationarity of the dataset. This was followed by the discussion of the cointegration bounds test result, the long run impact result, the short run and error correction result and the diagnostic checks results.

Table I: Results of the Unit Root Test at First differenced I (1)

Variables	ADF		PP	
	Intercept	Trend with Intercept	Intercept	Trend with Intercept
LUN	-6.3903*** (0.000)	-6.8345*** (0.000)	-6.3947*** (0.000)	-6.8345*** (0.000)
LRGDP	-3.6078** (0.004)	-5.7204*** (0.000)	-4.0236*** (0.003)	-5.7239*** (0.000)
LINF	-5.8805*** (0.000)	-5.8105*** (0.000)	-9.4224*** (0.000)	-10.178*** (0.000)

Note: ***, **, * indicate significance level at 1%, 5% and 10% respectively. Values in parenthesis are probability values.

The results of the unit root test contained in Table I showed that all the variables became stationary only at first difference. The augmented Dickey-Fuller (ADF) and Phillips Perron (PP) are applied for the tests. This indicates that the use of Johansen Juselius and Engel-Granger based cointegration cannot be feasible, hence the employment of the Autoregressive Distributive lag (ARDL) approach. However, the approach does not allow for testing of variables that are integrated of order 2 (Liu 2009).

Table II: ARDL- Bounds Test for Cointegration

F-Statistic	1% Critical Value		5% Critical Value		10% Critical Value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
5.3873**	6.140	7.607	4.183	5.333	3.393	4.410

K = 2, N = 35

Critical value Based on Narayan (2005) table; Unrestricted constant without Trend

The cointegration test results in Table II revealed that cointegration among variables of interest exists and significant at 5% level. This can be explained by the fact that the F-statistics having a value (5.3873) greater than

the values of the lower bound (4.183) and the upper Bound (5.333) of the Narayan (2005) table. This confirms that cointegration exists between the variables. Because the existence of long run relationship between the variables, the coefficient of their long run relationship is estimated, (Pesaran, et al. 2001)

Table III: ARDL- Results for Long Run Model

Variables	Coefficients	Standard Error	P - Value
<i>lninf</i>	-0.8706***	0.2287	0.001
<i>lnrgdp</i>	1.1351***	0.2792	0.000
<i>inpt</i>	-25.842***	7.6215	0.002

Note: *Inun* = Dependent Variable; Lag lengths are 1, 2, 0 selected based on SBC

Table III presents the values of the estimated long run coefficients; the dependent variable is unemployment. The coefficient of the rate of inflation is -0.87062, which means that in the long run, unemployment is negatively related to the inflation rate in Nigeria. It explains further that a 1% increase in inflation leads to a 0.870% decrease in unemployment, and the relationship is significant at the 1% level. This finding is in conformity with the Philips curve theory which stated that unemployment is negatively related to inflation. The finding is also consistent with the conclusion drawn by Umaru & Zubairu (2012), King; Stock & Watson (1995) also found that Inflation is better predicted by changes in the unemployment rate. This long run negative relationship is moreover, conforms to the findings of Coibion and Gorodnichenko (2015) that Phillips curve is the most useful concept towards understanding the relationship between price changes and macroeconomic situations.

Table IV Results for Short Run and Error Correction Model

Variables	Coefficients	Standard Error	P - Value
$\Delta lninf$	-0.1758**	0.08546	0.049
$\Delta lnrgdp$	0.5984***	0.2053	0.007
$\Delta inpt$	-13.6248	5.2601	0.015
ecm_{t-1}	-0.5272***	0.1340	0.001

Note: *Inun* = Dependent Variable; Lag length s : 1, 2, 0 selected based on SBC

Table IV contains the results of the short run and error correction model (ECM). The results reveal that unemployment is negatively related to inflation at the 5% significance level as indicated by the probability value of **0.049**. This is similar to the estimates of the long run values. The findings also correspond to the Phillips curve theory. On the other hand, the value of the error correction model is negative, significant at 1% and less than one (-0.5272). This means that the speed of adjustment from the long run back to equilibrium is about 53% annually, (Baharumshah, et al. (2009). The negative and significant coefficient of the ECM is also in line with the cointegration relationship suggested by Pesaran, et al. (2001).

The negative relationship discovered by this study, both in the short run and in the long run is crucial to sustainable economic growth. Inflation and unemployment are messes and they hinder macroeconomic conditions of every nation, thereby slowing the growth of the economy. Allowing inflation to go high, although, increases employment opportunities, might also have some unwanted effects to the economy as production cost continue to increase. Having a low rate of inflation on the other hand might increase unemployment which is threat to social security. Therefore, the government and policy makers are advised to make strong polices that will neutralize both inflation and unemployment. The government should not necessarily provide direct employment, but can do so by making the economic environment suitable for inward foreign direct investment, just like the Korea republic and other Asian tigers.

Table V: Diagnostic Test Results

Diagnostic Test	LM Version	F Version
Serial Correlation	CHSQ(1)=1.2601 [0.262]	F(1, 26)=1.0323 [0.319]
Functional Form	CHSQ(1)=0.91638 [0.762]	F(1, 26)=0.072401 [0.790]
Normality	CHSQ(2)=36.5351 [0.000]	Not applicable
Heteroscedasticity	CHSQ(1)=0.33471 [0.563]	F(1, 31)=0.31764 [0.577]
R-Squared 0.85527		
DW-statistic 2.2610		

Table V contains diagnostic test results of the variables under study. It shows that the Durbin Watson statistic is slightly above two (2.2610), indicating the absence of serial correlation in the model. The results also show that the model is free from functional form misspecification which means that it accounts for some important nonlinearity. There is also non-existence of heteroscedasticity, which validate the statistical test of significance. The existence of heteroscedasticity is a problem in the application of regression analysis as it invalidates statistical significance (Baharumshah et al, 2009).

CONCLUSION

This paper examines the relationship between unemployment and inflation in Nigeria using the Autoregressive Distributed Lag model. We found, after conducting unit root test that there exists a negative and significant relationship between inflation and unemployment both in the long run and in the short run. A finding, that conforms to the Philips curve theory. The Error Correction Model (ECM) shows that the speed of adjustment from the long run to equilibrium is about 53% annually, as being indicated by a negative and less than one coefficient of the ECM (-0.5272). Therefore, the

empirical findings of this paper suggest that Phillips curve hypothesis exists in the case of Nigeria, contrary to the coexistence of unemployment and inflation believed by the Nigerians. Hence the paper concludes that contrary to what Nigerians decry, that there is coexistence of inflation and unemployment in the country. Moreover, as letting the rate of one variable to rise would be at the expense of the other, this paper suggests the implementation of policies that enhance favorable economic environment to induce inflow of foreign direct investment like the Asian Tigers.

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