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Responsiveness of Unemployment to Inflation: Empirical Evidence from Nigeria

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ABSTRACT

The debate on the link between inflation and unemployment cuts across various economic interests. Researchers and economists pick on the subject since unemployment remains one of the greatest challenges facing the developing and emerging economies of the world. Other things being equal, achieving price stability is widely acknowledged to have positive effect on unemployment and growth especially if the ideal threshold can be marked. However, finding the perfect trade-off seems quite elusive and Central Banks across the globe contend to achieve high level of employment without sacrificing price level stability. Hence in this study we attempt to determine the response of unemployment to variation in price level in Nigeria using annualized data from 1989 to 2014.The error correction Model (ECM) and the Johansen analytical tools were employed to process the data set. The results of the findings show that inflation impact negatively on unemployment while money supply and exchange rate were found to have positive influence on unemployment. Although unemployment and inflation have long-run association, there is divergence along the equilibrium part which is corrected at 65 percent speed of adjustment each year. We recommend rather than relying solely on monetary targeting as means balance between unemployment and inflation level, output targeting through economic deepening can play a supporting role in maintaining optimal inflation rate and minimal unemployment level.

Keywords: Inflation, Unemployment, Phillips Curve, Error Correction Model.

I. INTRODUCTION

Price stability remains the central objectives of Central Bank monetary policy. To achieve this very objective, the Central Bank employs forecasts of inflation. These forecasts are useful to policymakers as they help to determine the appropriate stance of monetary policy; either expansionary or contractionary stance. Doh (2011) writes that slack in economic activities is one of the most commonly used short-term predictors for inflation. Economic slack reflects the underutilization of resources (such as labour and capital) in the economy. Economists use the Phillips curve to describe the short-term relationship between slow-moving economy and inflation. Using unemployment as an indicator of economic slack, the Phillips curve describes the cyclical components of the unemployment rate and inflation. The Phillips curve demonstrates that an increase in the cyclical component of the unemployment rate predictably exerts downward pressure on the cyclical component of inflation (Doh, 2011).

Unemployment has become a global problem, and poses serious challenge to both developed and developing countries. The proportion of the active population that is out of employment has grown to alarming rate and both fiscal and monetary policy strategies have struggled to plug this disturbing reality. Unemployment is a condition where the active population of a country who are willing and able to work stay out of job because there is no opportunity for them to work. Economists have for some time held the assumption that there is a trade-off between unemployment and inflation, which would be of great interest to policymakers. It then can be

inferred that lower unemployment could be achieved by bearing a higher rate of inflation. But then, as regards the long-run, that perception is no longer widely held. While it is a desirable policy goal to keep unemployment at a minimal level, some economists argue that full employment is a situation where everyone who wants a job automatically gets employed. However, some would contend that full employment is realized when unemployment rate is the lowest and inflation rate is at the same time stable; a situation economists refer to as the natural rate of inflation. Determining the natural rate of unemployment will no doubt be very useful to policymakers. One of the characteristics of inflation is that it tends to respond slowly to monetary policy changes designed to control it. For instance, the effects of expansionary monetary policy stance on inflation might not be immediately evident. Similarly, sometimes when rate of inflation is rather high, there is the likelihood that it will respond slowly to contractionary monetary policy strategies designed to reduce it. As a result of such attribute, and given the fact that policy measures aimed at curtailing inflation possibly will have short-term economic costs, it is generally believed that it would be a better option to keep inflation rate as low as possible (Cashell, 2004).

Phillips (1958) graphically represented a remarkable inverse relationship between the unemployment rate and the rate of inflation. The Phillips curve demonstrated that decreases in unemployment rate (or increase in employment level) correlate with increase in the rate of inflation. In other words, at a lower rate of inflation, unemployment level will increase. While this link is widely acknowledged to subsist in the short-run, it may however not be applicable in the long-run when inflationary policies are unlikely to decrease unemployment. Samuelson and Solow (1960) adopted the Phillips' hypothesis in their empirical study on the unemployment-inflation connection in U.S. They made explicit the fact that there is inverse relationship between unemployment level and that rate of inflation. They state that when unemployment was high, inflation was low, and vice versa. In essences, it was adduced that pursuing monetary or fiscal expansion, which might trigger inflation, would effectively exchange for lower rate of unemployment. In this case there is a trade-off, which entails that it is difficult for governments to achieve full high employment and at the same time maintain price stability within the economy. While government deficit spending stimulate the economy, increasing the gross domestic product and lowering unemployment rate, inflation rate would increase, which is the cost of enjoying minimal unemployment. However, if such policy measure is effectively executed, it could push inflation rate to a level capable of undermining the nation's macroeconomic stability (Qin and Wang, 2013). According to Cashell (2004), any indicator that helps policymakers prevent higher Inflation rate in the first place would be exceedingly useful An improvement over the natural rate of unemployment concept is the non-accelerating inflation rate of unemployment (NAIRU). NAIRU is typically the level of unemployment below which inflation rises. The assumption is that while gradual increases in prices are allowed, unemployment is tolerated and managed at a certain level that would ensure stable rate of inflation

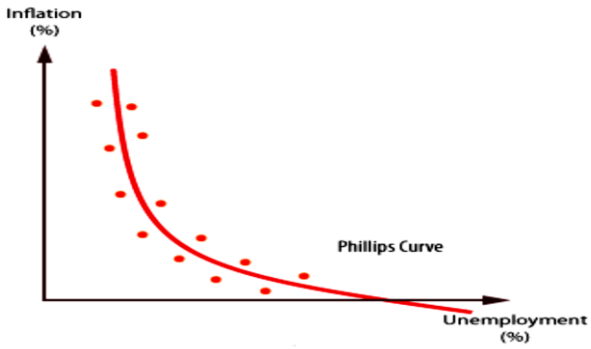

Figure 1. Phillips Curve

The figure above which illustrates the Phillips curve explains that as the demand for labour increases, unemployment rate decreases and workers might well demand for wage increase. Conversely, when demand for labour decreases, unemployment level increases and workers are unlikely to have the opportunity to demand for higher wages (Hussein, 2014). Wage and inflation expectations could also have some effects on the formation of the current wage as well as inflation. A study by Zilli (2015) analyzed the ability of the Phillips curve to explain the dynamics of Brazilian inflation, utilizing aggregate data from 2002 to 2014. It was discovered that the expected inflation had greater impact on the formation of the current inflation than the past inflation; a confirmation of the theory of rational expectation.

II. METHODS AND MATERIAL

A. Empirical Review

The link between unemployment and inflation has long been attracting attention not only from labour economists but from analysts and researchers. We will explore related works on this subject in other to embrace dynamic nature of the two variables in different economies of the world. For instance, on the South African economy, Vermeulen (2015) applied the Engle-Granger Error-Correction approach as he investigated the effect of inflation on employment in South Africa. The main objective of the study was to the sole aim of find out whether higher inflation could lead to employment creation. The findings reveal that a positive long run relationship between employment and output, which supports the claim that anything that negatively effects output (such as high inflation), will by extension impair employment creation. In the short-run, it was found that the relationship between inflation and employment creation was not significant.

Qin and Wang (2013) argue that the Phillips curve is ineffective in determining the causal relationship between unemployment and inflation in China. This was revealed in the empirical study which investigated the correlation of coefficient and causal link between unemployment and inflation rate in China between 1978 and 2011. It was stresses that the non-applicability of the Phillips curve on the communist state was as a result of the complexity of the Chinese economy.

Similarly, the findings of Umoru and Anyiwe (2013) opposed the Phillips curve position on inflation-unemployment relation. The study assessed the dynamics of inflation and unemployment in Nigeria over a twenty seven years period, using the Vector Error Correction Technique. Evidence of stagflation was found in the Nigerian economy within the period covered by the study. But Nitzan (1990) in his paper, macroeconomic perspective of unemployment and inflation stresses that though some factors like stagflation may have posed serious challenge to the Phillps curve, such contention only modifies and do not nullify the hypotheses. He stated that in inverse relation between inflation and unemployment is too significant to be discarded hence auxiliary factor may come in simply to augment.

In contrast to the inverse relation represented in the Phillips curve, it was revealed a positive relationship between inflation and unemployment in Nigeria thereby invalidating the Phillips curve on the case of Nigeria. However, the outcome of the study conducted by Mirza and Mujahid (2015) on Pakistani economy supports the Phillips Curve postulation by disclosing the existence of indirect relationship between unemployment rate and inflation rate in Pakistan within the period 1973 and 2014.

Using the Johansen cointegration test and the Granger causality test, Hussein (2014) investigated a trade-off relationship exists between unemployment and inflation in the Jordan between 1984 and 2011. The result showed there was no causal relationship between inflation rate and unemployment in Jordan within the period covered by the study, indicating that no trade-off relationship existed between the two variables.

Gur (2015) used panel data analysis in examining the factors that affect unemployment in the BRIC countries (Brazil, Russia, India and China) from 2001 to 2012. The results indicated that inflation and population growth are the causes of rising unemployment among the BRIC countries, whereas growth in GDP and industrial product growth are among the factors that lead to reduction in unemployment level.

Thayaparan (2014) contends that for the case of Sri Lanka, only inflation has a significant effect in reducing unemployment while the gross domestic product exerts positive but non-significant positively influences on unemployment. The study which examined the effect of inflation and economic growth on unemployment in Sri Lanka within the period 1990 and 2012 also established a unidirectional causality between inflation and unemployment, and bidirectional causal relationships between unemployment and gross domestic product; and between inflation and gross domestic product in Sri Lanka.

Orji, Orji and Okafor (2015) examined the inflation and unemployment connection in Nigeria with the aim of finding out if the original Phillips curve proposition

holds for Nigeria. The result revealed that unemployment is a major determinant of inflation and that there is a positive relationship between inflation and unemployment rate in Nigeria. This is in line with the findings of Umoru and Anyiwe (2013) which invalidated the Phillips curve hypothesis in Nigeria. On the contrary, Resurreccion (2014) evaluated the linkage between unemployment, inflation and economic growth in Phillipines for the period 1980 to 2009. It was shown that unemployment has indirect relationship with inflation and economic growth. The finding confirms Okun's Law and Philips Curve in the Philippines.

Similarly, Furuoka and Munir (2014) argue that the Phillips curve hypothesis holds in the Malaysian economy. In the study, the Error Correction model (ECM) to analyse the relation between unemployment and inflation in Malaysia. The results indicate there is long-run equilibrium relationship between the two variables, and also found an inverse relationship between unemployment and inflation in Malaysia thereby supporting the validity of the original proposition of the Phillips curve.

Umaru, Donga and Musa (2013) employed the Johansen cointegration and the Granger causality test to investigate the effect of unemployment and inflation on economic growth in Nigeria from 1986 to 2010. The results of Causality suggest that unemployment and inflation are causal for real GDP and not real GDP is not causal for unemployment and inflation. In other words it is a one-way causality running from unemployment and inflation to real GDP. The Johansen cointegration tests confirm the existence of long run relationship between economic growth, unemployment and inflation. The results also showed that unemployment and inflation exert a positive impact on economic growth.

Aurangzeb and Asif (2013) examined the macroeconomic determinants of the unemployment for India, China and Pakistan for the period 1980 to 2009, using the Johansen cointegration, Granger causality test and regression analysis. The result of granger causality indicates that bidirectional causality does not exist between unemployment, inflation and economic growth for all three countries. Cointegration result revealed that long term relationship does exist among the three variables for all the models.

Kogid, *et al* (2013) 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. The study showed the existence of the long-run relationship between inflation and unemployment, and revealed unidirectional causal relationship running from inflation to unemployment, which points to the fact that inflation influenced unemployment. This study eventually found that there is inflation-unemployment trade-off relationship in Malaysia.

Umaru and Zubairu (2012) investigated the relationship between unemployment and inflation in the Nigerian economy within the period 1977 and 2009. The results indicate that inflation has negative impact on unemployment. The Granger causality test revealed that there is no causal link between unemployment and inflation in Nigeria during the period of study. Johansen cointegration test showed that a long-run relationship exists between the two variables.

B. Data and Methodology

Research design for this study is *ex post-facto* which entails that the event we are studying indeed taken place already. We are therefore using secondary data sourced from World Bank National account data files and the OECD National accounts data files. Variables of interest include the unemployment rate, inflation rate, money stock and exchange rate. This study covers the period 1960 to 2014. Because our study period is long-term and we are using time series data, there is therefore the need to ensure that our data is stationary before we subject them to higher econometric estimations. This measure will ensure that in the end our result will not be spurious hence reliable. The Augmented Dickey-Fuller (ADF) unit root test will be used to ascertain if our variables are stationary or not. Further techniques of analysis employed to evaluate the linkage between unemployment and inflation are the Johansen co-integration test, Error Correction Model (ECM).

Model Specification

This study is patterned after Furuoka and Munir (2014) which examine inflation-unemployment relation in

Malaysia. The model adopted by the authors is of the form:

$$IFR_t = \alpha_0 + \gamma_1 \Delta UER_{t-1} + \varepsilon_t - - - - - - - - - - - - (1)$$

Where α_0 = constant, γ_1 = slope coefficient, *IFRt* =inflation rate in the year *t*, *UERt* = unemployment rate in the year *t*, and $\varepsilon_t$is the errorterm. We modified the above model to arrive at our baseline equation, which accommodates our peculiar variables. We represent our distinct model thus:

$$UER_t = \beta_0 + \beta_1 INFL_t + \beta_2 MS_t + \beta_3 EXR_t + \varepsilon_t - - (2)$$

Where UER = unemployment rate, INFL = inflation, β_0 = constant, $\beta_1 - \beta_4$ = parameter estimates, MS = broad money stock relative to GDP, EXR = exchange rate, and ε = error term.

There are three stages to our estimation. First we test our variables for stationarity using the Phillip-Perron unit root test. Time-series data is stationary if its mean and variance are constant over time (Gujarati, 2003). The Phillip-Perron is based on the following model:

$$\Delta y_t = \mu + \alpha_{t-1} t + \sum_{i=1}^{n} \gamma_i \Delta \gamma_{t-1} + \varepsilon_t - - - - - - - (3)$$

where*t* = linear time trend, μ = constant, Δ = differencing operator, and $\varepsilon t$is the error term. If the variables are stationary or integrated at order zero, 1(0), we can employ the Ordinary least square (OLS). However, if our variables are integrated of order one, 1(1), we will have the justification to run the Johansen co-integration test.

This second stage enables us find out if long run relationship exist among the variables. If at this point our variables are co-integrated, we then move on to the third stage where we the run the Error Correction model (ECM) by modifying our baseline equation thus:

$$\Delta UER_t = \beta_0 + \sum_{i=0}^{n} \beta_1 \Delta UER_{t-1} + \sum_{i=0}^{n} \beta_2 \Delta INFL_{t-1} + \sum_{i=0}^{n} \beta_3 \Delta MS_{t-1} + \sum_{i=0}^{n} \beta_4 \Delta EXR_{t-1} + \beta_5 ECT_{t-1} + \varepsilon_t - (4)$$

Where ECT_{t-t} = lagged value of the error correction term.

III. RESULT AND DISCUSSION

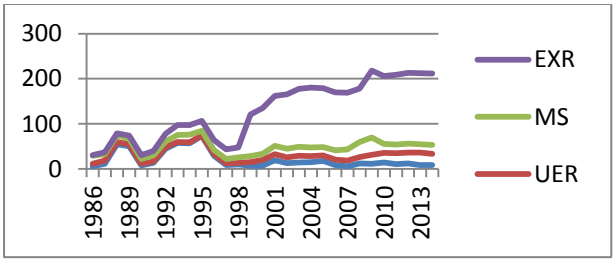

Figure 2. Graphical representations of proxied variables

Table 1. Descriptive Statistics

	UER	INFL	MS	EXR
Mean	10.94138	20.82897	17.36207	79.44724
Median	11.90000	12.22000	17.70000	101.7000
Maximum	27.40000	72.84000	38.00000	158.4300
Minimum	1.800000	5.380000	8.600000	1.750000
Std. Dev.	7.937232	19.34240	6.399186	61.97985
Skewness	0.601332	1.427411	1.493655	-0.062328
Kurtosis	2.162715	3.579714	5.758168	1.225971
Jarque-Bera	2.594831	10.25401	19.97557	3.821616
Probability	0.273237	0.005934	0.000046	0.147961
Sum	317.3000	604.0400	503.5000	2303.970
Sum Sq. Dev.	1763.990	10475.60	1146.588	107562.0
Observations	29	29	29	29

Source : Authors

Table 2. Unit root test at level

VARIABLES	ADF Statistic	CRITICAL VALUE			REMARK
		1%	5%	10%	
UER	-0.357574	-3.653730	-2.957110	-2.617434	Non-Stationary
INFL	-2.330254	-3.661661	-2.960411	-2.619160	Non-Stationary
MS	-2.521482	-3.653730	-2.957110	-2.617434	Non-Stationary
EXR	-2.463775	-3.653730	-2.957110	-2.617434	Non-Stationary

Source: Authors Eviews result

The result of the unit test as presented in the table 4.1 above shows that all the variables included in the model are all not stationary at level. This however will take us to the next step in ADF approach which requires differencing of the variables to see if it will be stationary at first difference.

Table 3. Unit root test at first difference

VARIABLES	ADF Statistic	CRITICAL VALUE			REMARK
		1%	5%	10%	
UER	-3.848396	-3.653730	-2.976263	-2.617434	Stationary
INFL	-3.484005	-3.484005	-2.998064	-2.619160	Stationary
MS	-4.871434	-3.653730	-2.976263	-2.617434	Stationary
EXR	-5.012615	-3.653730	-2.976263	-2.617434	Stationary

Source: Authors Eviews result

Table 4.2 presents the results of unit root test at first differencewhich indicates that all the variables are stationary at 5% level of significance. The stationarities so attained are all at order one, 1(1), and are therefore integrated at same order. This result now allows us to run the Johansen coinegration test to establish if the variables move along together in the long-run.

TEST FOR LONG-RUN ASSOCIATION

Johansen Cointegration Test

Table 4 : Result of Johansen Co-Integration Analysis

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None *	0.704655	66.86688	47.85613	0.0003
At most 1 *	0.541628	33.93735	29.79707	0.0158
At most 2	0.333186	12.87535	15.49471	0.1195
At most 3	0.069116	1.933746	3.841466	0.1643

Source: Authors'Eview Result

The results of Johansen Cointegration test in table 4.3 show that the variables are cointegrated, which means they have long-run relationship. The trace statistic revealed this long run association and is confirmed by the max-Eigen statistic. The implication is that unemployment, inflation, money stock and exchange rate move together in the long-run.

REGRESSION RESULTS

Table 5. Error Correction Model (ECM) Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.267161	0.362941	0.736101	0.4698
D(INFL-1)	-0.014075	0.022204	-0.633885	0.5330
D(MS-1)	0.053677	0.078569	0.683182	0.5020
D(EXR-1)	0.076563	0.023012	3.327028	0.0032
ECT(-1)	-0.650515	0.004450	-3.066066	0.0014

Source: Eview result

The result of the short run dynamics model as represented in table 4.4 above indicates that MS,has a positive and insignificant impact on UER. EXR has a positive and significant effect on the UER in the short run. In other words it also shows that in the short run INFRT has a negative and statistically insignificant impact on the UER in Nigeria. The error correction term (ECT) demonstrates the speed of adjustment to long-run equilibrium. ECT is negative and significant, and the coefficient value of -0.650515 indicates that 65% of deviations from long-run equilibrium is corrected each year. Generally, table 4.4 shows that the overall regression is significant and the Durbin-Watson statistic indicate that our model estimation has no autocorrelation problem.

Table 6. Result of The Long-Run Regression Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.326896	2.280445	1.020369	0.3173
INFL	-0.025186	0.038035	-0.662185	0.5139
MS	0.012021	0.130102	0.092394	0.9271
EXR	0.112406	0.014640	7.678210	0.0000
R-squared	0.840219	F-statistic	43.82125	
Adjusted R-squared	0.821045	Prob(F-statistic)	0.000000	
Durbin-Watson stat	1.698344			

Source: Authors Eview result

Table 4.5 is the estimation of the long run equation. The regression results reveal that inflation has negative effect on unemployment in the long run but not significant in explaining it. This finding is in line with theoretical expectation which explains that inflation impacts negatively on unemployment level. The results also show that money stock has positive and insignificant impact on unemployment while exchange rate exerts positive and significant effects on unemployment. The result of the long run analysis is in line with that of the short run dynamic model which suggest that the effect of the variables included in the model exert the same level of impact on the explained variable in both the long and the short run.

IV. CONCLUSION AND RECOMMENDATION

The debate on the link between inflation and unemployment cuts across various economic interests. Researchers and economists pick on the subject since unemployment remains one of the greatest challenges facing the developing and emerging economies of the world. Other things being equal, achieving price stability is widely acknowledged to have positive effect on unemployment and growth especially if the ideal threshold can be marked. However, finding the perfect trade-off seems quite elusive and Central Banks across the globe contend to achieve high level of employment without sacrificing price level stability. Hence in this study we attempt to determine the response of unemployment to variation in price level in Nigeria using annualized data from 1989 to 2014. The results of the findings show that inflation impact negatively on unemployment while money supply and exchange rate were found to have positive influence on unemployment. Although unemployment and inflation have long-run association, there is divergence along the equilibrium part which is corrected at 65 percent speed of adjustment each year. We recommend rather than relying solely on monetary targeting as means balance between unemployment and inflation level, output targeting through economic deepening can play a supporting role in maintaining optimal inflation rate and minimal unemployment level.

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