MEASURING THE ASYMMETRIC PASS-THROUGH OF MONETARY POLICY RATE TO UNEMPLOYMENT IN NIGERIA: Evidence from Nonlinear ARDL

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ABSTRACT

Given the persistent rise in the rate of unemployment in Nigeria over time despite the frequent changes in the monetary policy rate (MPR) and the fact that most studies in the literature simply assume a linear relationship in considering the pass-through of monetary policy instruments to unemployment, the current study investigated the asymmetric pass-through of monetary policy rate to unemployment in Nigeria using the asymmetric ARDL model over the period 2000Q1–2018Q4. The study found dissimilar long-run effects of tightening and easing the MPR on unemployment. While tightening the MPR had positive, elastic and statistically significant effect on unemployment, implying complete pass-through, easing the MPR had negative, inelastic and statistically insignificant effect on unemployment, suggesting incomplete pass-through. Similarly, the short-run effects of tightening or easing the MPR were dissimilar. Furthermore, the result of the cumulative multiplier indicated that the cumulative effects of tightening the MPR on unemployment dominated the cumulative effects of easing the MPR on unemployment in Nigeria. It is therefore recommended that to curb unemployment using the interest rate channel, the monetary authority (Monetary Policy Committee) should ease the MPR by a higher magnitude compared to the magnitude that is required to tighten it for the purpose of price stability.

JEL classification: E5, J16, C32

1. Introduction

Generally, monetary policy is regarded as the system or strategy through which the central bank of a country regulates the supply and circulation of money, controls inflation and the demand for goods and services, as well as the demand for the requisite labour that is involved in the production of those goods and services. Monetary policy is either expansionary or contractionary. It is expansionary when it is aimed at reducing the rate of interest in order to encourage investment borrowing and reduce the rate of unemployment, and contractionary when the aim is to raise interest rate and stabilize inflation (Ebele & Iorember, 2016). Leahy (1993) noted that both expansionary and contractionary monetary policy have substantial impact on the economy by way of altering the composition of consumption, savings or investment. Blue (2013) observed that during periods of high unemployment, it is rational to maintain low levels of interest rates in order to boost investment. Similarly, it is logical to maintain high interest rates in times of low unemployment to avoid inflation.

The Keynesian economists in the 1930s debated that both monetary and fiscal policy can be deplored to check unemployment in an economy. On the monetary side, the Keynesians advocated the use of interest rates while government expenditure was seen as the fiscal tool for reducing unemployment. On the other hand, the Hayek economists in the 1940s countered the Keynesian position and stated that increasing the supply of money is the only veritable tool for keeping the levels of unemployment low (Essien et al., 2016; Blinder, 2008; Arevuo, 2012). Despite the controversy surrounding the influence that monetary policy has on unemployment, the role it plays in stabilizing the aggregate economy cannot be overemphasized (Essien et al., 2016; Altavilla & Ciccarelli, 2009).

Regarding the transmission effect of monetary policy on economic aggregates, Ndekwu (2013) noted that the exact process through which a change in monetary policy transmits to achieving the core economic policy objectives of full employment, economic growth, price stability and favourable balance of payments has been a subject of long-time controversy. Taylor (1995) observed that there are five key transmission channels of monetary policy, which include interest rate channel, asset prices channel, credit channel, exchange rate channel and expectations channel. However, importance is often attached to the interest rate (monetary policy rate) channel due to its quick pass-through effects on aggregate output, demand and prices, which have direct links to unemployment in an economy. In a related way, studies by Choudhry (2013) and Sellon (2004) show that both the monetary authorities on the US and England often use interest rate to either slow or spur economic activities and as well track the rate of unemployment in their respective economies.

In Nigeria, there are other instruments (such as the cash reserve ratio) that the Central Bank of Nigeria (CBN) can use to conduct monetary policy, but the monetary policy rate (MPR), which involves lowering or raising the interest rate, is the most prominent. The MPR serves as the nominal anchor and provides signals that guide the determination of interest rates. For instance, in the last 15 years, monetary policy decisions have included easing the monetary policy rate (MPR) eight times including once during the recession in 2016 and tightening the MPR fifteen times including twice during the recession in 2016 (Teriba, 2017). These changes in the MPR have obvious pass-through effects on the economy given the ability to stimulate growth and investment on the easing side and curb inflationary pressures on the tightening side. Specifically, the pass-through effects of the changes in MPR on unemployment call for investigation due to the persistent rise in the rate of unemployment over time (from 6.40% in 2014Q4, to 23.10% in 2018Q3) (National Bureau of Statistics, 2018) despite the frequent changes in the MPR. In view of the above, this study focuses on the pass-through effect of monetary policy rate on the rate of unemployment as it relates to the objective of full employment. This is because unemployment is a critical economic challenge that if left unchecked would have devastating effects on the economy (Doğrul & Soytas, 2010). Hence, it is important that monetary authorities understand whether easing the MPR (reducing it) or tightening (raising) it have varying or mirror effects on unemployment in Nigeria.

The objective of this paper therefore, is to simultaneously analyse the effect of increases and decreases in monetary policy rate on unemployment in Nigeria. The major contributions of this study are threefold. First, the study measures MPR and unemployment rate in quarters in order to investigate the pass-through of the changes in MPR to unemployment in Nigeria. Second, the study applies the Zivot-Andrews unit root test developed by Zivot and Andrews (1992) to check the stationarity properties of the series. The use of this test circumvents the chance of spurious results as it accounts for structural breaks, unlike other common stationarity tests which do not provide information about structural break dates in the series. Third, the study applies the flexible asymmetry/nonlinear autoregressive distributed lag (NARDL) model, which has enviable advantage over the linear models that are used extensively in the literature. Specifically, the NARDL model estimates long-run and short-run asymmetric/nonlinear pass-through of MPR to unemployment simultaneously. The model, therefore, uses the symmetry bounds testing procedure of Shin, Yu and Greenwood-Nimmo (2014) to establish the long-run relationship among the variables. The bounds testing procedure also does not follow the underlying assumption that all the variables must be integrated of the same order. It performs well even when the series/variables are integrated of mixed order.

The rest of this paper is structured as follows. Section 2 presents a brief theoretical and empirical literature review while section 3 focuses on the data and describes the methodology used in the study. Section 4 presents the results and discussion. Finally, section 5 provides the conclusion and policy recommendations.

2. Brief Literature Review (Theoretical and Empirical)

2.1 Theoretical review

The theoretical underpinning of this study is the Keynesian transmission mechanism (interest rate transmission channel) which could be explained using the IS-LM framework. The theory argues that as long as there is no liquidity trap, expansionary or contractionary monetary policies have effects on interest rate and economic activities. That is, expansionary monetary policy leads to decrease in the real interest rate which in turn reduces the cost of capital and causes investment spending to increase. This ultimately leads to increases in aggregate demand, output and as well, the demand for labour in the production process (Mishkin, 1996). Conversely, contractionary monetary policy results in increases in the real interest rate and decreases in investment spending, and consequently low levels of output and employment opportunities.

2.2 Empirical literature review

Literature on the effect of monetary policy on unemployment is scanty. Some of the few studies in this area include the study by Korenok and Radchenko (2004) which employed the plucking factor augmented vector autoregressive

(PFAVAR) model to investigate the effect of monetary policy on business cycle fluctuations in the US from 1959Q2 to 2002Q3. The results of the study reveal that contractionary monetary policy shocks result in decreases in the rate of employment. Similarly, the study by Ravn and Simonelli (2007) using the structural vector autoregressive (SVAR) model showed that contractionary monetary policy shocks lead to a rise in unemployment. On the other hand, Alexius and Holmlund (2007) deployed structural VAR (S-VAR) to assess the response of unemployment rate in Sweden to changes in monetary policy using quarterly data from March 1980 to March 2005 for unemployment, output gap and other economic aggregates. The study found that output gap and unemployment rate respond positively to expansionary monetary policy shocks. Also Benazic and Rami (2016) conducted a study on the impact of monetary policy on unemployment in Croatia using the ARDL approach. The result of the study revealed that the effect of monetary policy on unemployment is marginal. Similarly, Altavilla and Ciccarelli (2009) employed the Bayesian model to analyse the effects of monetary policy on unemployment in the United States and the Euro area, using quarterly data for the period 1970:1 to 2007:4. The results showed that the effect of monetary policy shocks on the two countries was a declining one, with significant variations in the rate of the transmission mechanism. Lakstutiene, Krusinskas & Platenkoviene (2011) associated the 2002 high rate of unemployment in Russia to the financial crisis of 1998 and the contractionary monetary policy at the time.

In Nigeria, Essien et al. (2016) used the vector autoregressive model on quarterly data covering 1983-2014 to ascertain whether monetary policy influences unemployment. The study established that an increase in monetary policy rate results in a rise in unemployment. Similarly, the results of the study by Attamah, Anthony and Ukpere (2015) showed that interest rate has a positive and significant effect on unemployment in Nigeria. Applying the error correction model, Ibekwe (2018) found that monetary policy has a negative effect on unemployment rate in Nigeria. In another study, Amasoma and Francis (2015) employed Pairwise Granger causality approach and found that monetary policy has a unidirectional relationship with unemployment, implying that monetary policy Granger causes unemployment. Employing ARDL, Ani et al. (2019) examined the effect of monetary policy (exchange rate) on unemployment in Nigeria for the period 1986-2017. The results of the study revealed a positive relationship between exchange rate and unemployment in Nigeria.

From the reviewed literature, no previous studies, especially in Nigeria, focused specifically on the effect that MPR has on unemployment despite its importance in regulating economic activities in an economy. Similarly, most of the studies in the literature used linear models such as VAR, SVAR or symmetric ARDL, irrespective of the presence of asymmetries in the relationship or not. Another critical aspect of literature that has not been adequately addressed in this area is the use of tests that account for structural changes in the variables of interest. This paper aims to fill this gap by focusing specifically on the effect that MPR has on unemployment in Nigeria, using the asymmetric or non-linear ARDL (NARDL) which accounts for the presence of asymmetries (i.e. whether easing the MPR or tightening it have varying or mirror effects on unemployment in Nigeria).

3. Methodology

3.1 Data

The study uses quarterly data on monetary policy rate (MPR) and unemployment rate (UNEMP) over the period 2000Q1–2018Q4. The use of quarterly data is appropriate for proper capturing of the asymmetric/nonlinear effects. The data on MPR was sourced from the Statistical Bulletin of the Central Bank of Nigeria (2018) while data on unemployment (total number of active unemployed persons as a percentage of the labour force) was sourced from International Monetary Fund (IMF) database. Both the MPR and the unemployment rate are measured in percentages which technically implies growth impact or elasticities.

3.2 Model specification

In the case of symmetric or linear ARDL, the effect of easing or tightening MPR which represents positive or negative changes in unemployment is similar except for differences in the signs. This may not represent the ideal situation as positive and negative changes may produce varying magnitudes. To solve for this, the study employs the nonlinear autoregressive distributed lag (NARDL) technique by Shin, Yu and Greenwood-Nimmo (2014). The NARDL model accounts for asymmetries or nonlinearity through partial sum decomposition in the standard model of Pesaran, Shin and Smith (2001). Thus, the NARDL model for this study is in line with the specification of Shin, Yu and Greenwood-Nimmo (2014) which is unambiguous relative to other nonlinear models and is suitable for both I(0) and I(1) processes (Usman et al., 2020a; Iorember, Usman and Jelilov, 2019; Olofin & Salisu, 2017). The NARDL is expressed as:

$$\Delta UNEMP_t = \alpha_0 + \alpha_1 UNEMP_{t-1} + \alpha_2 MPR^{+}_{t-1} + \alpha_3 MPR^{-}_{t-1} + \sum_{i=0}^{p} \rho_1 \Delta UNEMP_{t-is}$$
$$+ \sum_{j=1}^{q} (\rho_2 \Delta MPR^{+}_{t-j} + \rho_3 \Delta MPR^{-}_{t-j}) + \varepsilon_t \quad (1)$$

where MPR_t^+ MPR_t^- represent partial sums of positive and negative changes in MPR_t defined as:

$$MPR_t^+ = \sum_{i=1}^{t} \Delta MPR_i^+ = \sum_{i=1}^{t} max(\Delta MPR_i, 0) \quad (2)$$

$$MPR_t^- = \sum_{i=1}^{t} \Delta MPR_i^- = \sum_{i=1}^{t} min(\Delta MPR_i, 0) \quad (3)$$

To account for the speed of adjustment, equation (1) is restated as:

$$\Delta UEMP_t = \lambda ECT_{t-1} + \sum_{i=1}^{p} \rho_i \Delta UNEMP_{t-i} + \sum_{j=0}^{q} (\rho_j^+ \Delta MPR^{+}_{t-j}$$
$$+ \rho_j^- \Delta MPR^{-}_{t-j}) + \varepsilon_t \quad (4)$$

where all the variables remain as defined above, Δ is the difference operator, *p* and *q* are the lag orders, ECT_{t-1} is the error-correction term which measures the long run equilibrium in the NARDL and λ is associated with the adjustment coefficient that explains the speed at which it takes for the disequilibrium to convergence to the new equilibrium due to a shock. The ECT_{t-1} is calculated as $ECT_{t-1} = UNEMP_{t-1} - \phi_0 - \phi_1 MPR^{+}_{t-1} - \phi_2 MPR^{-}_{t-1}$ whereas of positive and negative changes in MPR on UNEMP are equivalent of $\varphi_2 = \frac{-\alpha_2}{\alpha_1}$ $\varphi_3 = \frac{-\alpha_3}{\alpha_1}$ respectively. Also, the short-run effect of increasing and decreasing MPR on UNEMP is shown by ρ_2 a ρ_3 respectively.

Similarly, the short-run nonlinear (asymmetric) effect is captured by the cumulative dynamic multiplier of a change in MPR_t^+ MPR_t^- as shown in Equation 5.

$$dm_g^+ = \sum_{j=1}^{g} \frac{\partial MPR_{t+j}}{\partial MPR_{t-1}^+},\ dm_g^- = \sum_{j=1}^{g} \frac{\partial MPR_{t+j}}{\partial MPR_{t-1}^-},\ g = 0, 1, 2, \ldots$$

Note that as $g \to \infty,\ dm_g^+ \to \varphi_2,$ and $dm_g^- \to \varphi_3$

Also, in order to capture the identified structural breaks, we extend the NARDL in equation (1) to include the relevant break dummies as:

$$\Delta UNEMP_t = \alpha_0 + \alpha_1 UNEMP_{t-1} + \alpha_2 MPR_{t-1}^+ + \alpha_3 MPR_{t-1}^- + \sum_{i=0}^{p} \rho_1 \Delta UNEMP_{t-is}$$

$$+ \sum_{j=1}^{q} (\rho_2 \Delta MPR_{t-j}^+ + \rho_3 \Delta MPR_{t-j}^-) + \sum_{r=1}^{k} D_i B_{it} + \varepsilon_t \qquad (6)$$

where B_{rt} is a break dummy variable defined $B_{rt} = 1 \Rightarrow t \geq T_{B_r}$, otherwise $B_{rt} = 0$ T_{B_r} . is the brea D_r ate, and is the break dummy coefficient.

Unit Root Test

As a precursor, we tested for the presence or otherwise of unit root in the variables using the Zivot-Andrews (1992) test. Unlike other common unit root tests (Augmented Dickey-Fuller, Phillips-Perron, Ng-Perron, and Kwiatkowski, Phillips, Schmidt, and Shin), the Zivot-Andrews (Z-A) unit root test has the capability of testing for the presence or otherwise of structural breaks in the variables of the model (Usman, Iorember & Olanipekun, 2019). This is of great essence in that most of the time series cut across periods of great economic shocks capable of making them deviate significantly from the preceding periods. This can be said of the period for this study (2000Q1–2018Q4). In addition to this, the high predictive ability of the test makes it superior to the other tests.

The null hypothesis of the Z-A test is that a series has a unit root and the alternative is that there is none. Equations 7, 8 and 9 represent models with a break point in the intercept, a break point in the trend and a break point in both the trend and the intercept respectively (Usman et al., 2020b; Iorember et al., 2019; Usman & Elsalih, 2018).

Model A: $\Delta x_t = \beta_0 + \beta_1 + \gamma x_{t-1} + \rho DU_t + \sum_{j=1}^{m} \partial_j \Delta x_{t-j} + \upsilon_t$

Model B: $\Delta x_t = \pi_0 + \pi_1 + \gamma x_{t-1} + \eta DT_t + \sum_{j=1}^{m} \partial_j Dx_{t-j} + \upsilon_t$ (8)

Model C: $\Delta x_t = \chi_0 + \chi_1 + \gamma x_{t-1} + \rho DU_t + \eta DT_t + \sum_{j=1}^{m} \partial_j Dx_{t-j} + \upsilon_t$

Following equations 7, 8 and 9, DU_t is the dummy variable, indicating the mean shift in the break date (T_j^b) ; DT_t is the dummy variable showing the mean shift in the trend variable. $DU_t = 1 \Rightarrow t > T_j^b$ and 0 if alternatively. Also, $DT_t = t - T_j^b \Rightarrow t > T_t^b$ and 0 if alternatively.

Asymmetric Cointegration Test

The study examines the cointegration or long-run relationship among the variables in levels form using the approach of Shin et al. (2014), which involves using both the refined F and *t* statistics. The null hypothesis for each is that there is no cointegration. Rejecting it implies there is cointegration. The condition for both cases is that the absolute value of the test statistic must be above the upper bound critical value for the null hypothesis to be rejected.

4. Discussion of Results

As a precursor for the choice of model and appropriateness of estimation techniques, we began the analysis by graphing the series/variables as shown in figures 1, 2, 3, and 4. The graphs of the time plots reveal evidence of break dates without trends in the series. The absence of trends in the series plus the presence of structural breaks (especially in first difference) imply that using a model with intercept and information about structural breaks is most appropriate (Balcilar Beyene, Gupta & Seleteng, 2013). Table 1 presents the results of the Z-A unit root test, showing evidence of structural breaks in the series with I(1) processes for all the series.

Table 1. Structural Break Unit Root Test Results (Zivot-Andrews)

	Level form		First difference form	
	Test-Statistic	Break Date	Test-Statistic	Break Date
UNEMP	-2.357(4)	2009Q4	-5.151*(4)	2009Q2
MPR	-2.593(4)	2004Q1	-8.167**(3)	2010Q3
Sig. Level	**Critical Values**			
1%	-5.34			
5%	-4.93			
10%	-4.58			

Note: Optimal lags are in ( ). ** and * imply stationarity at 1% and 5% levels of significance respectively. The text is based on intercept following Balcilar et al. (2013).

Further, from the unit root test, the asymmetry property of the model was examined by testing whether the long-run and short-run effects are asymmetric using the asymmetry Wald test. The test tests the null hypothesis that there are no asymmetries in the model. That is, positive changes and negative changes in MPR are insignificant, implying that, decomposing the effects into positive and negative changes does not matter, otherwise, it matters. Simply put, the asymmetry Wald test tests the null hypothesis of no asymmetries against the alternative that there are asymmetries as shown in table 2. Evidently, the results confirm that the null hypothesis in both the long-run and short-run is rejected, suggesting that there exist asymmetries in the relationship under investigation and that an increase or decrease in MPR would impose dissimilar or varying long-run and short-run impact on UNEMP, as can be seen from the cumulative dynamic multiplier in figure 9.

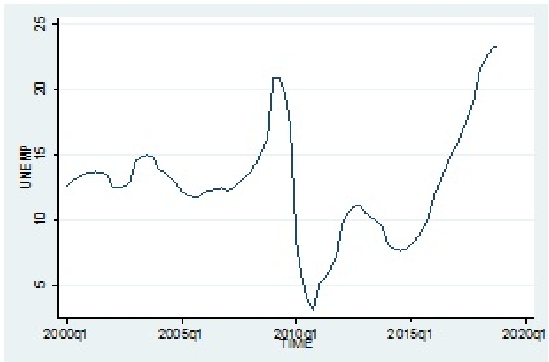

Figure 1Time Pot of UNEMP in Level

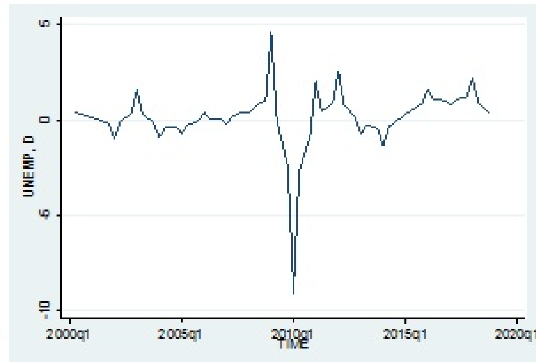

Figure 2 Time Pot of UNEMP in First Difference

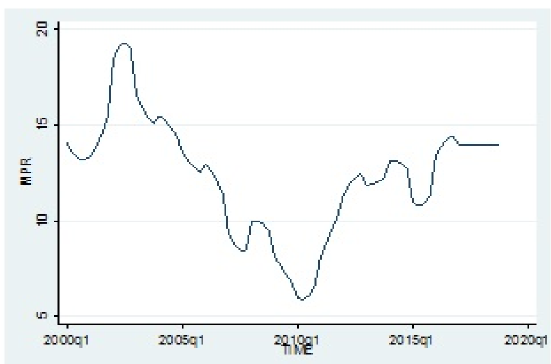

Figure 3 Time Pot of MPR in Level

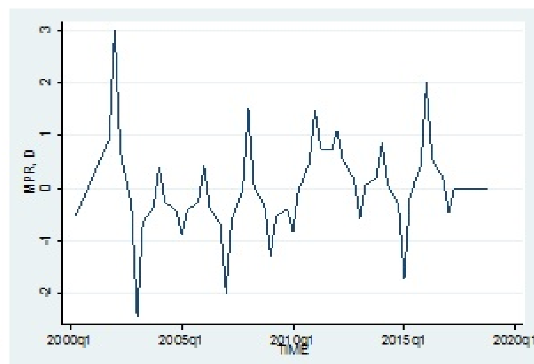

Figure 4 Time Pot of MPR in First Difference

Figures 1-4. Time Plots of the Series in Level and First Difference.

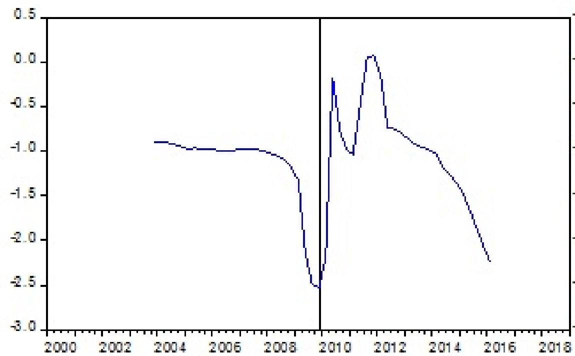

Figure 5: Z-A Test for UNEMP with Break point Date

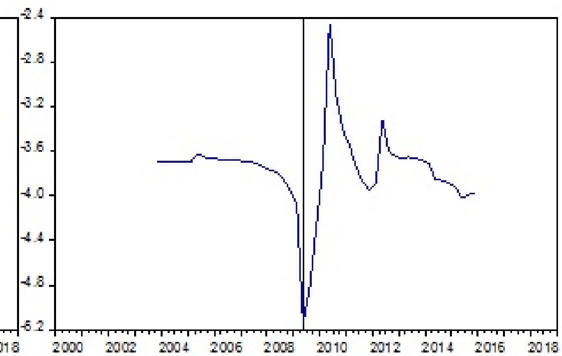

Figure 6: Z-A Test for D(UNEMP) with Break point Date

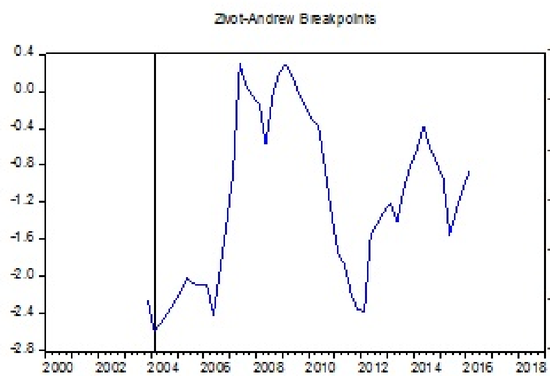

Figure 7: Z-A Test for MPR with Break point Date

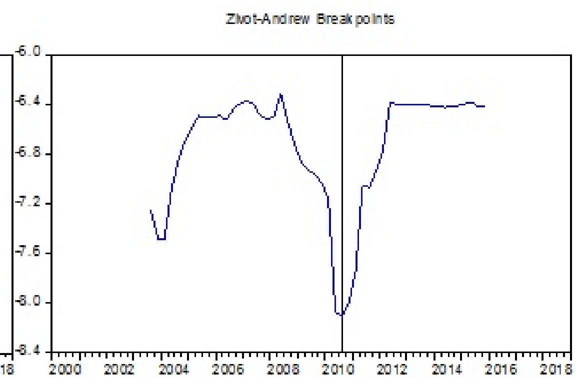

Figure 8: Z-A Test for D(MPR) with Break point Date

Figures 5-8: Graphs of Zervot-Andrews Unit Root Test of the Series in Levels and First Difference

Table 2. Wald-Test Results with Structural Breaks (Test for Asymmetry)

	Wald Statistic		**Does Asymmetry Exit?**	
Variable	L-R Asymmetry	S-R Asymmetry	L-R	S-R
MPR	7.247(0.009)**	9.690(0.003)**	Yes	Yes

Notes: L-R and S-R stand for long run and short run. ** denotes rejection of the null hypothesis at 1% level of significance. The probabilities are in ( ).

Following from the results of the structural break unit root test and the asymmetry Wald test which reveal that all the series are I(1) and are non linear, we further examine the long-run relationship (cointegration) between the variables employing the asymmetric or nonlinear bounds test (see table 3). This is because, just like the linear ARDL, the long run is estimated only if there is evidence of cointegration. Thus, pre-testing for cointegration is necessary under the NARDL model. This involves using the bounds testing procedure to test whether cointegration exists or not. The results of the cointegration test show that the values of the F and t-test statistics (F_{PSS} and t-$_{BDM}$) clearly exceed the upper critical bounds I(1) at 5% level of significance. Therefore, the null hypothesis of no cointegration between UNEMP and MPR is rejected, implying that evidence exists to support the existence of cointegration between UNEMP and MPR in Nigeria.

Table 3. Asymmetric Bounds Test with Structural Breaks

	Test-Statistic	I(0)	I(1)	Decision
Nigeria				
F_{PSS} (Asymmetric)	6.5132*	2.72	3.77	Cointegrated
t-$_{BDM}$ (Asymmetric)	-4.0034*	-2.57	-3.46	Cointegrated

Note: F-$_{PSS}$ and t-$_{BDM}$ are the cointegration test statistics. * denotes rejection of the null hypothesis at 5% level of significance. I(0) and I(1) denote Lower Bound and Upper Bounds reported in Pesaran et al. (2001) respectively. For K = 1, the critical values of I(1) in Pesaran et al. (2001) case III.

Table 4 presents the long and short-run results of the flexible asymmetric/nonlinear ARDL model with structural breaks as determined by the Zivot-Andrews test. We then incorporate the break dummy as a fixed regressor in the asymmetric ARDL model to account for the break dates of 2009Q2/2010Q3 which happens to coincide with the period of recovery from the 2008 financial crises. The results in table 4 show the dynamic effects of MPR on

UNEMP using the appropriate lag length. The long-run coefficient indicates that the effect of tightening (positive or increase) the MPR on UNEMP is positively elastic and statistically significant $(\alpha^{+} = 1.247, P < 0.005)$. The implication is that a 1% increase in MPR brings about a 1.25% increase in UNEMP. On the other hand, the results reveal that the effect of easing (negative or reduction) the MPR on UNEMP is negative, inelastic and statistically insignificant $(\alpha^{-} = -0.220, P < 0.508)$, which implies that a 1% reduction in MPR leads to about 0.22% decrease in UNEMP. The striking finding here is that the long-run result confirms the dissimilar effects of positive (tightening) and negative (easing) changes in MPR on UNEMP. It shows that tightening the MPR by a certain magnitude causes unemployment to rise by more than easing the MPR by the same magnitude in order to save jobs. Tightening the MPR automatically results in higher cost of borrowing and reduced investment, the effect of which is reduced rates of employment and economic growth. On the flip side, easing the MPR leads to reduction in the cost of borrowing, and increase in investment spending. The increase in investment spending translates to high demand for labour, thereby reducing the rates of unemployment. This finding concurs with the findings of Korenok and Radchenko (2004), Ravn and Simonelli (2007) and Lakstutiene et al. (2011), who in their studies attributed high level unemployment to tightening monetary policy such as the MPR. Similarly, the finding agrees with the findings of Essien et al. (2016) and Attamah et al. (2015) who established that unemployment responds positively to positive changes in policy rate in Nigeria.

Turning to the coefficient of the short-run asymmetric/non-linear pass-through, the results indicate that the effects of tightening or easing the MPR on UNEMP are positive, inelastic, but statistically insignificant and dissimilar, $(\rho^{+} = 0.187, P < 0.517)$ $(\rho^{-} = 0.468, P < 0.138)$.

decrease in MPR causes UNEMP to rise by 0.19% and 0.47% respectively. The non significance of both effects implies that monetary policy through the interest rate channel (i.e. the use of MPR) is not effective relative to unemployment in the short run. This can be explained by the lag period that is involved in taking investment decisions on the basis of interest rate signals.

Table 4. Asymmetric Long-run and Short-run ARDL Coefficients

Dependent Variable: UNEMP

Variable	Coefficient	t-statistic	Prob.
MPR_t^+	1.247*	8.709	0.005
MPR_t^-	-0.22	0.4436	0.508
DUM	-2.018*	7.515	0.008
$UNEMP_{t-1}$	0.361*	3.1	0.003
ΔMPR_t^+	0.187	0.65	0.517
ΔMPR_t^-	0.468	1.5	0.138
ΔDUM	4.636*	4.05	0
Model Diagnostics			
χ^2_{SC}	19.83	0.9748	
χ^2_{H}	2.1528	0.2502	
χ^2_{FF}	2.3611	0.3526	
χ^2_{N}	3.2147	0.1045	

Notes: * denote significance at 1% and 5% levels of significance. χ^2_{SC} χ^2_{H} χ^2_{FF} and χ^2_{N} denote Portmanteau test for serial correlation, Breusch-Pagan test of heteroscedasticity, Ramsey's RESET test of functional form and Jarque-Bera test on normality respectively.

This dissimilarity between tightening and easing the MPR on unemployment in the long run and shortrun shows strongly that the pass-through of MPR to unemployment is asymmetrical. Also evident from the results is that the inclusion of structural break dummy in the model is valid. This is because accounting for the breaks substantially alters the results of the asymmetric case without breaks.[1] Similarly, the significant effect of the dummy variable (DUM) in both the long run and the short run accentuate the inclusion of structural breaks in the model.

[1] The results of the asymmetry Wald Test without structural breaks is not presented but can be made available on request.

Furthermore, we conducted the cumulative dynamic multiplier shown in figure 9 to show the pattern of adjustment of unemployment to changes in MPR in Nigeria. The broken green and red lines stand for positive and negative changes respectively, while the blue line and the shaded (grey) area is the line of asymmetry and the 95% bootstrap confidence interval. We conducted the cumulative dynamic multiplier using 40 quarters or horizons. Figure 9 clearly shows that tightening the MPR has positive effects on UNEMP as shown by the green line, while easing the MPR has decreasing effect on UNEMP. Also evident from the figure is that the cumulative effects of tightening the MPR or a positive change in MPR dominate the cumulative effects of easing the MPR or a negative change in MPR in Nigeria.

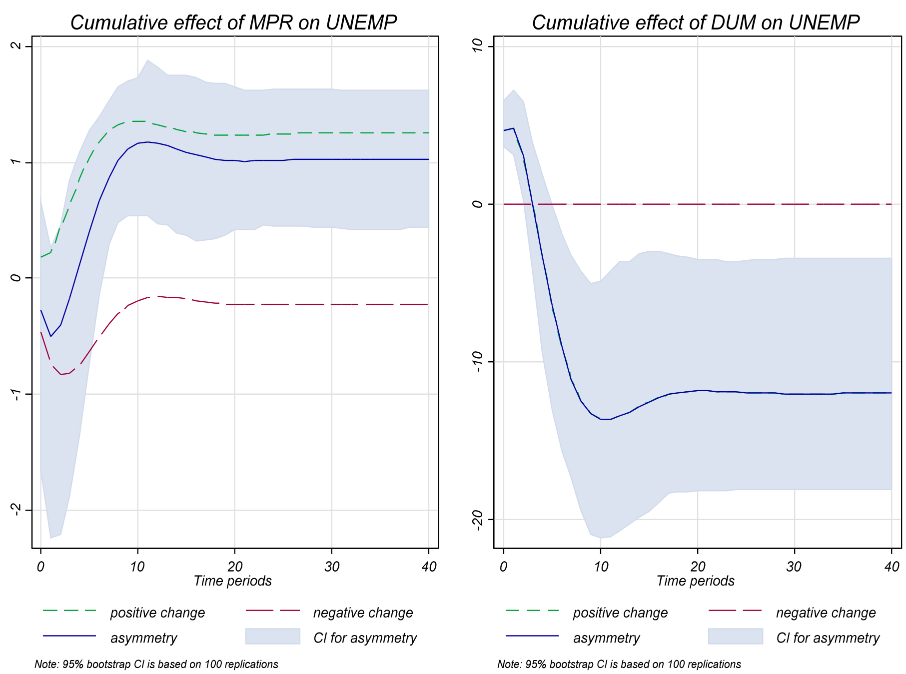

Figure 9. Dynamic Cumulative Multiplier Effects of MPR on UNEMP in Nigeria.

The results of the diagnostic tests beneath table 4 reveal the absence of serial correlation and conditional heteroskedasticity in the residuals. In addition, the Ramsey RESET test of model specification and the Jarque-Bera test of normality show that the model is specified correctly and the residuals are normally distributed.

5. Conclusion and Policy Recommendations

This paper investigated the asymmetry pass-through of the MPR to unemployment in Nigeria using asymmetric ARDL model over the period 2000Q1–2018Q4. Given that most studies simply assumed a linear relationship in considering the pass-through of monetary policy variables to unemployment, this study makes a major contribution to the extant literature by accounting for possible dissimilar positive and negative effects (asymmetric relationship) of MPR on unemployment. We tested for the unit root property of the dataset using the Z-A unit root test with structural breaks and found the variables stationary at I(1). Further, we checked for long-run and short-run asymmetries using the Wald test and the results showed evidence of asymmetries in both cases. Also, the results of the asymmetric bound test using F_{PSS} and t_{BDM} indicated the existence of a unique cointegration in the model. Based on the analysis of the asymmetric NARDL coefficients, the study found dissimilar long-run effects of tightening and easing the MPR on unemployment. While tightening the MPR has positive, elastic and statistically significant effect on unemployment implying complete pass-through, easing the MPR has negative, inelastic and statistically insignificant effect on unemployment suggesting incomplete pass-through. Similarly, the short-run effects of tightening or easing the MPR are dissimilar. Further to these analyses, the results of the cumulative multiplier indicate that the cumulative effects of tightening the MPR or a positive change in MPR on unemployment dominate the cumulative effects of easing the MPR or a negative change in MPR on unemployment in Nigeria. It is therefore recommended that to curb unemployment using the interest rate channel, the monetary authority (Monetary Policy Committee) should ease the MPR by a higher magnitude compared to the magnitude that is required to tighten it for the purpose of price stability.

References

Alexius, A., & Holmlund, B. (2007). Monetary policy and swedish unemployment fluctuations. *IZA Discussion Paper* No. 2933. Retrieved from http://ftp.iza.org/dp2933.pdf

Altavilla, C. & Ciccarelli, M. (2009). The effects of monetary policy on unemployment dynamics under model ncertainty: Evidence from the US and the Euro Area. *European Central Bank Working Paper Series* No. 1089.

Amassoma, D., & Francis, O.E. (2015). Efficiency of monetary policy variables in reducing unemployment in Nigeria. *International Finance and Banking*, 2(2), 52–71.

Ani, E.C., Joel, E., & Baajon, M.A. (2019). Exchange rate and unemployment in Nigeria: An analysis. *International Journal of Family Business and Management*, 3(2), 1–7.

Arevuo, M. (2012). Review: Keynes Hayek, The clash that Defined Modern Economics. Extracted from http://www.adamsmith.org/research/.

Attamah, N., Anthony, I. & Ukpere, W. (2015). The impact of fiscal and monetary policies on unemployment problems in Nigeria (Managerial Economic Perspective). *Risk Governance and Control: Financial Markets Institutions, 5*(2), 102–109.

Balcilar, M., Beyene, A., Gupta, R., & Seleteng, M. (2013). 'Ripple' effects in South African house prices. *Urban Studies*, 50(5), 876–894.

Benazic, M., & Rami, J. (2016). Monetary policy and unemployment in Croatia. *Economic Research-Ekonomska Istraživanja*, 29(1), 1038-1049.

Blinder, A. S. (2008). Keynesian economics. In: David R. Henderson (ed.). *Concise Encyclopedia of Economics* (2nd ed.). Indianapolis: Library of Economics and Liberty.

Blue, K. (2013). How does unemployment affect interest rates? *LoanLove.com*. http://www.prweb.com/pdfdownload/11100504.pdf

Central Bank of Nigeria. (2018). *Annual Report*. www.cenbank.org

Choudhry, M. (2013). Linking interest rates to unemployment: Logical or Dangerous? http://www.cnbc.com/id/.

Doğrul, H. G. & Soytas, U. (2010). Relationship between oil prices, interest rate, and unemployment: Evidence from an emerging market. *Energy Economics*, 32: 1523–1528

Ebele, E.J. & Iorember, P.T. (2016). Commercial bank credit and manufacturing sector output in Nigeria. *Journal of Economics and Sustainable Development,* 7(16), 189–196.

Essien, S.N., Garba A. Manya, M. O., Arigo, A. Kufre J. B., Suleiman F. O., Ojegwo, D. G. & Ogbuehi, F. (2016). Monetary policy and unemployment in Nigeria: Is there a dynamic relationship? *CBN Journal of Applied Statistics*, 7(1b), 209–231.

Ibekwe, E.E. (2018). The impact of monetary policies on Nigeria's unemployment: Lessons for poverty reduction in Nigeria. *Equatorial Journal of Finance and Management Sciences*, 3(1), 1–16.

Iorember, P.T., Usman, O. & Jelilov, G. (2019). Asymmetric effects of renewable energy consumption, trade openness and economic growth on environmental quality in Nigeria and South Africa. Available at: https://econpapers.repec.org/paper/pramprapa/96333.htm

Korenok, O., & Radchenko, S. (2004). Monetary policy effect on the business cycle fluctuations: Output vs. index measures of the cycle. *Rutgers University and University of North Carolina at Charlotte, RePEc*, 1-45. Retrieved from http://econwpa.repec.org/eps/mac/papers/0409/0409015.pdf

Lakstutiene, A., Krusinskas, R., & Platenkoviene, J. (2011). Economic cycle and credit volume interaction: Case of Lithuania. *Inzinerine Ekonomika-Engineering Economics*, 22(5): 468–476.

Leahy J. (1993). Investment in competitive equilibrium. The optimality of myopic behaviour. *Quantitative Journal of Economics*, 108, 1105 – 1133.

Mishkin, F. (1996). The channels of monetary transmission: Lessons for monetary policy. *Nber Working Paper Series* No. 5464.

National Bureau of Statistics. (2019). *Statistical Bulletin 2018*.

Ndekwu, E.C. (2013). An analysis of the monetary policy transmission mechanism and the real economy in Nigeria. *Central Bank of Nigeria Occasional Paper* No. 43.

Olofin, S. O. & Salisu A. A. (2017). Modelling oil price-inflation nexus: The role of asymmetries and structural breaks. *Centre for Econometric and Allied Research, University of Ibadan Working Papers Series, CWPS 002*

Pesaran, M.H., Shin, Y., & Smith, R.J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Economics*, 16(3): 289–326.

Ravn, O. M., & Simonelli, S. (2007). Labor market dynamics and the business cycle: Structural evidence for the United States. *Centre for Studies in Economics and Finance Working Paper Series*, 182, 1-41.

Sellon, G.H. (2004). Expectations and the monetary policy transmission mechanism. Economic Review, Federal Reserve Bank of Kansas City; https://www.kansascityfed.org/

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In: Festschrift in Honor of Peter Schmidt (pp. 281-314). Springer, New York, NY.

Taylor, J.B. (1995). The monetary transmission mechanism: An empirical framework. *Federal Reserve of San Francisco Working Papers in Applied Economic Theory*, 95:07. Available from http://ideas.repec.org/p/fip/fedfap/95-07.html.

Teriba, A. (2017). It is time to resolve Nigeria's monetary policy conundrum. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2947533

Usman, O. & Elsalih, O.M. (2018). Testing the effects of real exchange rate pass-through to unemployment in Brazil. *Economies*, 6(49), 1–13.

Usman, O., Iorember, P.T., & Olanipekun, I.O. (2019). Revisiting the environmental Kuznets curve (EKC) hypothesis in India: The effects of energy consumption and democracy. *Environmental Science and Pollution Research*, 26(13), 13390–13400.

Usman, O., Iorember, P.T., & Uzner, G. (2020a). Measuring the pass-through of disaggregated energy prices in the US: Evidence from a nonlinear ARDL approach. *International Journal of Strategic Energy and Environmental Planning*, 2(1), 60–77.

Usman, O., Olanipekun, I.O., Iorember, P.T. and Goodman, M.A. (2020b). Modelling environmental degradation in South Africa: The effects of energy consumption, democracy, and globalization using innovation accounting tests. *Environmental Science and Pollution Research*, 27, 8334–8349.

Zivot, E. & Andrews, D. (1992). Further evidence of great crash, the oil price shock and unit root hypothesis. *Journal of Business and Economic Statistics*, 10, 251-270.