Monetary Policy and Unemployment in Nigeria: Is there a Dynamic Relationship?

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This paper examines the link between unemployment and monetary policy in Nigeria using a vector autoregressive (VAR) framework for the period 1983q1 – 2014q1. The paper investigates the effect of structural change by identifying three structural breakpoints and incorporating them into the VAR model as dummy variables. The results show that a positive shock to policy rate raises unemployment over a 10 quarter period. In addition, all the variables used as proxy in the model jointly Granger cause unemployment, implying the existence of a dynamic relationship between monetary policy and unemployment in Nigeria.

Keywords: Investment, Monetary Policy Rate, Money supply, Unemployment

JEL Classification: E24, E51, E52

1.0 Introduction

Monetary policy rests on the relationship between the price at which money can be borrowed and the total supply of money in the economy. It is generally referred to as being expansionary or contractionary, where an expansionary policy increases the total supply of money in the economy rapidly, and contractionary policy decreases the total money supply, or increases it slowly. When a central bank embarks on an expansionary monetary policy, it does so to stimulate domestic economy and reduce unemployment, while contractionary policy involves raising interest rates to combat inflation (Engler, 2011). According to Leahy (1993), expansionary or contractionary policy (also known as interest rates adjustment) do have a substantial influence on the rate and pattern of economic growth by influencing the volume and disposition of saving as well as the volume and productivity of investment. Bernanke and Kuttner (2005) also reported that tightening of money supply increases risk premium that will be needed to compensate

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investors for holding risky assets as it signifies a deceleration of economic activity, and may influence unemployment dynamics.

Monetary policy has a dual mandate of guaranteeing high employment rate and price stability. At one time or another, economic agents around the globe have also tried to use monetary policy to achieve almost every conceivable economic objective with economic growth and low level unemployment often high in the list. As a case in point, Sellon (2004) posited that when the Federal Reserve of the United States raises its target for the federal funds rate, other rates rise, reducing interest-sensitive spending and slowing the economy, and when it is lowered, other rates tend to fall - stimulating spending and spurring economic activity. Choudhry (2013) also reported that the Bank of England follows the U.S. Federal Reserve to link changes in its base interest rate to the rate of unemployment. According to Doğrul and Soytas (2010), unemployment is an important macroeconomic problem due to its social and economic consequences and therefore essential for policy makers to identify the factors that are affecting it the most.

In Nigeria, the Central Bank of Nigeria (CBN) reviews developments in the economy over a period to examine the risks to price stability as the core objective of monetary policy and formulates policies to mitigate its effect. Since 1980 when the country was engulfed in a serious economic crisis, Nigeria's economy has witnessed several structural changes with varying effects on the level of unemployment[2] which is one of the major threats to macroeconomic stability in the country. As part of its monetary policy strategy, the monetary authority in Nigeria has also been focusing on adjusting the monetary aggregates, the policy rate or the exchange rate, depending on the level of development in the economy, especially the financial sector, in order to affect the variables which it does not control directly. The policy process which is fairly complex in practice majorly involves using a price-based nominal anchor that targets interest rate as a potent instrument for stabilizing inflation and output over the business cycle. Relative to the repressed regime era of 1980s, interest rate in Nigeria upswings, particularly

[2] The Nigerian National Bureau of Statistics (NBS) defines unemployment as the proportion of those in the labour force (not in the entire economic active population, nor the entire Nigerian population) who were actively looking for work but could not find work for at least 20 hours during the reference period to the total currently active (labour force) population. Thus, in variant with the ILO definition, the definition of unemployment here covers persons (aged 15–64) who during the reference period were currently available for work, actively seeking for work but were without work (NBS, 2015; Olarewaju, 2015; Kale and Doguwa, 2015).

during 1998-2006, except for the period between 1993 -1998 referred to as period of "guided deregulation" (Soludo, 2008).

According to Ndukwe (2013), the change in the interest rate which is engineered by the CBN unambiguously accounts for three market rates (prime lending rates, the interbank rates and the Treasury Bills rates) which also change in the same direction with a change in the interest rate. Since monetary policy decisions are expected to affect the economy in general and the price level in particular, the variability of the short-term nominal interest rate (monetary policy rate) in response to a variety of economic events including crises in domestic and foreign financial markets has become a prominent feature in the Nigerian economy. As studies on the effects of monetary policy advances, the way in which it relates with real variables like unemployment varies significantly from country to country, and in many developing nations like Nigeria, there are few studies conducted to explore their relationship.

This paper seeks to shed more light on the dynamic relationship by investigating the response of unemployment in the face of monetary shocks from the era of controlled interest rate to the liberalized era. Based on Fasanya *et al.* (2013) who posited that monetary policy innovations have real and nominal effects on economic parameter, this paper incorporates money supply and investment[3] for analyzing unemployment dynamics in Nigeria. Also included in the investigations is the causality relationship between monetary policy and unemployment in Nigeria. In this context, and to the best of our knowledge, this study presents significant innovation to the literature and is relevant not only to policy makers but also to academia.

The rest of the paper is organized as follows: Section 2 presents stylized facts on monetary policy and unemployment in Nigeria, and reviews related literature; Section 3 gives the empirical framework and econometric models; Section 4 undertakes the empirical analyses and presents results; and Section 5 concludes the paper with policy implications.

2.0 Stylized Facts on Monetary Policy and Unemployment in Nigeria

Monetary policy is generally viewed as a process through which monetary authority of a country controls the supply of money primarily through interest rate adjustment to ensure price stability and also to contribute to economic

[3] Smith & Zoega (2009) canvassed that investment has been a driving force of unemployment in the OECD countries since 1960s.

growth. The various channels through which monetary policy actions impact real variables can be described as shown in Figure 1. The monetary transmission mechanism describes how policy-induced changes in the nominal money stock or the short-term nominal interest rate impact real variables such as aggregate output and employment. In Nigeria, the Central Bank conducts monetary policy primarily to achieve price stability using monetary policy rate (MPR) that signals the direction of interest rates as nominal anchor (CBN, 2013). Prior to the 1986 structural adjustment programme (SAP) introduced by the Federal Government and the financial sector reforms of 1987, the conduct of monetary policy was by direct control of the Bank. Consequently, nominal interest rates was lowest during this period, but with high inflation, while real interest rates were generally negative leading to low savings, low investment and low growth as a result of the repressed regime (Soludo, 2008). According to NBS (1988), the desired policy objective of enhancing investment and growth in the real sector was not achieved as the composite consumer price index for all items increased from 204.8 per cent in 1980 to 516.6 per cent in 1987, while food price index rose from 199.7 per cent in 1980 to 541.9 per cent in 1987.

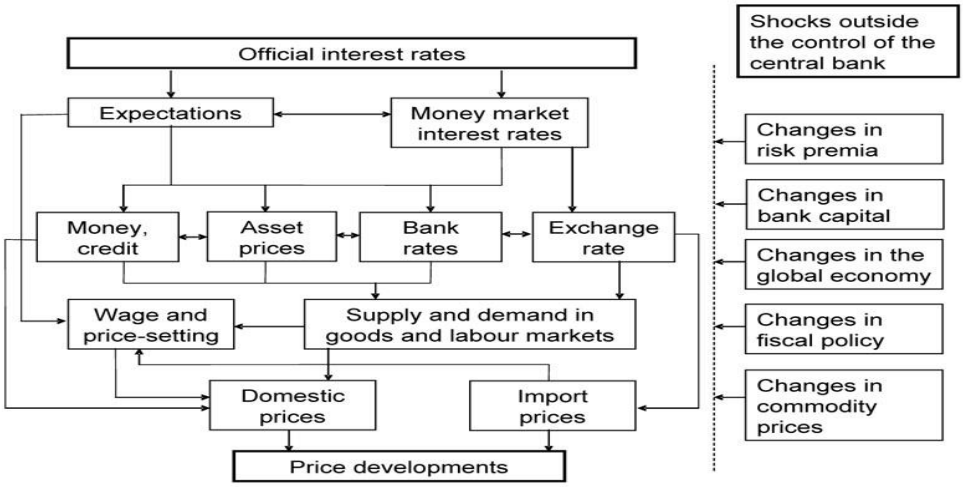

Figure 1**:** The Transmission Channel of Monetary Policy[4]

The rapid increase in the general price level impacted negatively on the economy and caused unemployment rate to rise to 11 per cent in 1982(based on the International Labour Organization's definition of unemployment) but 8.7 per cent (based on the revised definition), and declined relatively thereafter (Figure 2).

[4] Extracted from European Central Bank Monetary policy framework and CBN (2011).

According to Alade (2013), the SAP and financial sector reforms led to the deregulation of the banking industry and liberalization of interest rates. Since then, interest rate have risen relative to the repressed regime era with significant moderation in inflation rate, particularly during 1998-2006, except for the aberration between 1993-1998, the period of "guided deregulation". Some of the structural factors that encompass interest rates dynamics under the liberalized regime include the structure of the banking industry. According to NBS (2010), the Nigerian economy performed well in this period with a consistent growth in the gross domestic product (GDP) especially between 2006 and 2010 except for 2008 (global financial crisis) where the prime and maximum interest rates averaged 16.9 per cent and 20.2 per cent, respectively, within the same period, and were assumed to impede investment by both large and small scale investors. On the other hand, the official unemployment rate steadily increased from 12.3 per cent in 2006 to 23.9 per cent in 2011 (ILO) while the revised rate records shows an increase from 12.3 per cent in 2006 to 19.7 per cent in 2009, but declined to 6.0 per cent in 2011. Between 2013 to first quarter 2014, the unemployment rate rose from 24.7 per cent to 25.1 per cent (ILO), while the revised rate shows a decrease from 10.0 per cent to 7.8 per cent as summarized in Figure 2 (NBS Report, 2011; Salami, 2013).

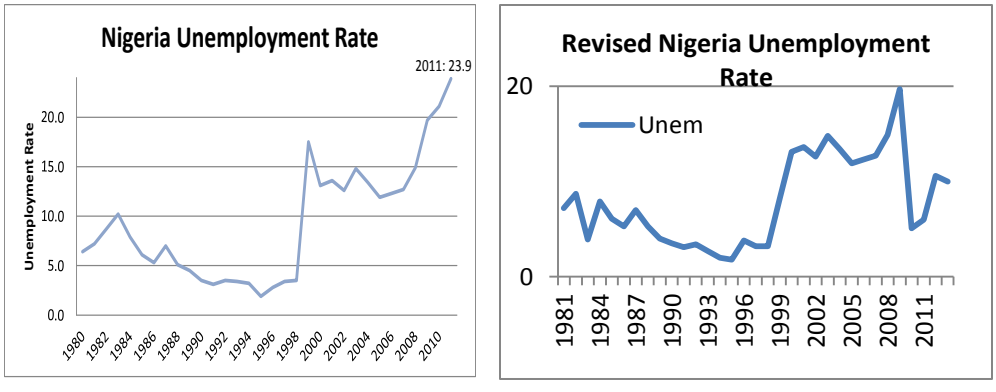

Figure 2: Nigeria's ILO and Revised Unemployment Rate (1980 – 2013)
Data Sources: Extracts from NBS Report (2011 and 2015); Olarewaju (2015).

Figure 3 presents graphical plots of the variables under investigation, which include unemployment rate *(Unem)*, monetary policy rate *(MPR)*, money supply growth (which can be used as quantity-based nominal anchor for monetary policy) (*M2g (or M2G)*, and investment growth denoted by *GFCg (or GFCG)* based on quarterly data from 1983Q1 – 2014Q1.

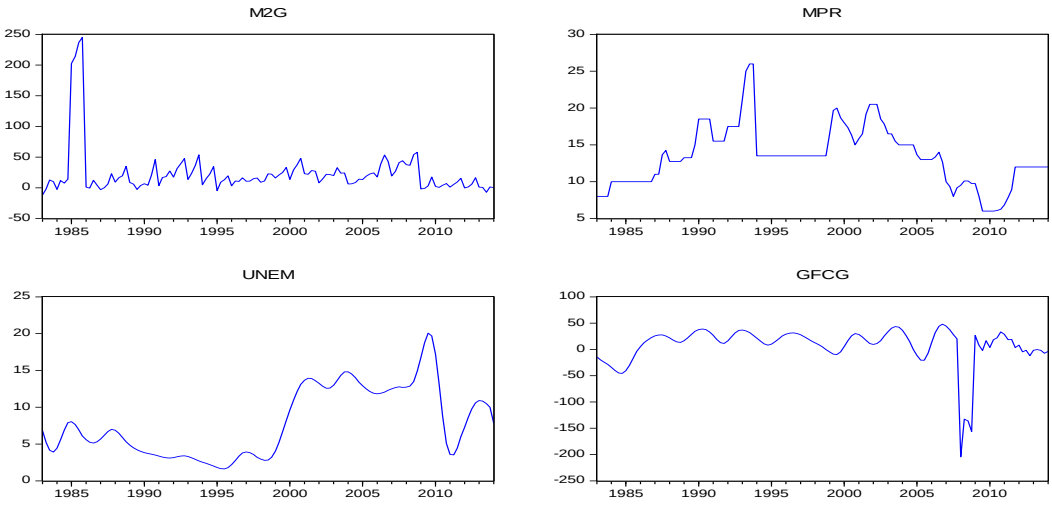

Figure 3**:** Graphical Analysis of the Four-Variable Series (1983q1 – 2014q1)

Although the series in Figure 3 show no stable connection between unemployment rate and the monetary policy variables, a significant reflection of structural shift are evident in each series. Regression analysis of these variables is expected to determine the dynamic relation between them following Keynesian interest rate channel (Ireland, 2006).

2.1 Literature Review

Broadly speaking, there are two major views in the literature on monetary policy focus: the monetarist and the Keynesian. The Keynesian believes that monetary policy should be directed towards interest rates rather than money supply and that it should be subsidiary to fiscal policy, while the monetarist argues that the control of money supply should be the main concern of the monetary authorities (Sullivan and Steven, 2003). Following the Great Depression era, Keynesian economists and another school of thought, the Hayek economists also have sharply contrasting views relating to monetary policy and unemployment.

The Keynesian economists often debates that unemployment is a natural consequence that can be reduced through some combination of two approaches: "a reduction in interest rates (monetary policy), and Government investment in infrastructure (fiscal policy)". On the other hand, the Hayek economists argue that this Keynesian policy of reducing unemployment would result in inflation and that money supply would have to be increased by the central bank to keep levels of unemployment low, which would in turn keep increasing inflation (Blinder, 2008; Sanz-Bas, 2011; Arevuo 2012).

The leading advocates of creating central banks that act as monetary authorities in all nations in the 1920s were visionary in their research on the influence of monetary policies on economic and employment stability (Fleming and Enders, 1995). Economists in the International Labour Organization (ILO) conducted several studies across a range of nations during the interwar years to help quantify and raise awareness of the linkages between monetary stability, prices and unemployment. According to Bhattacharyya (2012), the ILO economists' advocacy of a scientific approach to setting monetary policy based on the price level and employment during this period were quantified in a seminal paper by Taylor (1993) to describe the actual behaviour of the Federal Reserve in setting U.S. monetary policy in the 1970s and 1980s.

According to Blue (2013), "when unemployment is high the Fed often chooses to keep interest rates low, in hopes that this will encourage businesses to invest in furthering their business. Conversely, when the unemployment rate is low, the Fed may move to increase interest rates to avoid inflation".

Despite the uncertainty about the nature of its relationship, it is generally accepted that monetary policy has a significant impact on domestic economic activity and employment (Altavilla and Ciccarelli, 2009).

Considering credit friction as a combined effect of changes in interest rate and money supply, Bernanke and Blinder (1992) in a study on the relationship between bank credits and unemployment ratio in US using monthly data concludes that narrowing in credit volume increases unemployment ratio at the same time.

Friorentini and Tamborini (1999) examined the effects of long-run bank lending channel for Italian economy using an inter-temporal macroeconomic equilibrium model. The result showed a permanent effect of credit variables on employment and output through the supply side of the economy by altering credit supply conditions to firms. On the other hand, Ordine and Rose (2008) evaluated the relationship between bank loans efficiency and employment for Italy through credit channel and found that a 10% increase in banking sector supply of credit increases employment rate by 5%.

Raskin (2011) reports that the conventional tool of monetary policy to influence unemployment is to modify the near-term path of interest rates, including a reduction in current short-term rates and a corresponding downward shift in private-sector expectations about the future path of such

rates, in order to reduce borrowing rates for households and businesses. Lakstutiene *et al*. (2011) attributes the Russian high level unemployment of 2002 to the 1998 financial crisis and the subsequent tightening of monetary policy.

Loganathan *et al.* (2012) analyze the integration and dynamic interaction between monetary shock and overall unemployment in Malaysia for the period of 1980-2010. The study applied various unit root tests, Gregory-Hansen cointegration test, VECM and Granger causality test with considering the possibility of the structural break. The results show a structural break in the middle of 1990s with a long run co-integration between monetary shock and unemployment. However, there was no causality relation between both variables.

Cambazoğlu and Karaalp (2012) analyze the effectiveness of narrow credit view on employment and output for Turkey using money supply, total loans, employment rates and industrial production index monthly variables in a vector autoregressive (VAR) framework. It was found that changes in money stock (m2) impacts on employment and output.

Göçer (2013) examines the relationship between changes in money supply in terms of total lending of the banking sector and unemployment in fourteen selected European Union countries for the 1980-2012 period using panel data analysis method that takes into consideration structural breaks and cross-section dependence. The analysis shows a reduction in unemployment rate in these countries being attributed to increase in lending.

There seem to be paucity of empirical literature that focuses prominently on the relationship between monetary policy and unemployment in developing economies like Nigeria. However, related studies in Nigeria include Udoka and Ayingang (2012) who investigate the effect of interest rate fluctuation on the economic growth of Nigeria before and after the interest rate deregulation regime. Data collected from 1970-2010 were analyzed and tested using the ordinary least square multiple regression method, and the result shows that increase in interest rate decreases economic growth in Nigeria.

Aliero *et al.* (2013) examined the relationship between financial sector development and unemployment with a time series data from 1980 to 2011 in an auto regressive distributed lag framework. The study reported a persistent unemployment in Nigeria and concluded that formal credit allocation in rural areas has both short run and long run effect in reducing unemployment. The

study recommends that monetary authority be strengthened and financial services be deepened, particularly deposit money banks, to provide necessary credit facilities to the teeming unemployed youth in the country.

Akeju and Olanipekun (2014) examined the relationship between unemployment rate and economic growth in Nigeria under the theoretical proposition of the Okun's law using error correction model and Johasen cointegration test. The result shows that there exists both short and long run relationship between unemployment rate and output growth in Nigeria. The study also recommended that foreign direct investment (FDI) should be increased to reduce the high rate of unemployment.

According to Innocent (2014), "with global unemployment projected to reach over 215 million by 2018, experts fear that Africa, particularly Nigeria's share of the global scourge might increase disproportionately, with attendant unsavory consequences unless the country immediately adopts pro-active and holistic approach to halt the rising youth unemployment".

Salif *et al.*(2014) also reported a statement credited to the Director-General, West African Institute for Financial and Economic Management (WAIFEM), Prof. Akpan Ekpo, that despite the 'healthy growth' of the economy in Nigeria, unemployment has been rising with increased incidence of poverty, noting that Nigeria's rising unemployment is "a looming time bomb and a national crisis".

Apart from direct focus on unemployment and monetary policy, another important part of the literature that has not been covered in Nigeria, to the best of our knowledge, includes construction of tests that allow inference to be made about the presence of structural changes witnessed in the country since 1980 and the number of breaks using the revised unemployment data. This paper sets out to fill these gaps.

3.0 Empirical Framework and Data Sources

The VAR model was used in this study for investigating the link between monetary policy and unemployment in Nigeria. The model has proven to be especially useful for describing the dynamic behaviour of economic and financial time series as well as for forecasting. The model comprises equations

of unemployment rate (*Unem*), monetary policy rate (*MPR*)[5], a change in money supply (*M2g*) and a change in investment proxied by gross fixed capital formation (*GFC*)[6]. All the variables are endogenously determined. The generalized VAR model consists of a set of *K* endogenous variables $\boldsymbol{Y}_t = (y_{1t}, \cdots y_{kt})$ for $k = 1, \cdots, K$ and is defined as

$$\boldsymbol{Y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \cdots + A_p y_{t-p} + \varepsilon_t} \quad (1)$$

where $\mathbf{Y}_t$ is a $k \times 1$ column vector representing the time series variables of interest expressed as a function of its past (lagged) values and past values of the other variables, c is a k x 1 vector of constants (intercept), A_i are (K x K) coefficient matrices (for every $i = 1, \ldots, p$) and ε_t is a k x 1 vector of error terms with the following properties:

$E(\varepsilon_t) = 0$; $E(\varepsilon_t \varepsilon'_t) = \Omega$ and $(\varepsilon_t \varepsilon'_{t-k}) = 0$.

After choosing a suitable order *p* using the model selection criteria and testing for stability of the process by evaluating the characteristic polynomial:

$$det(I_K - A_1 z - \cdots - A_p z^p) \neq 0 \quad for\ |z| \leq 1. \quad (2)$$

Suppose that the solution of Equation (2) has a root for $z = 1$, then either some or all the variables in Equation (3) are of order I(1), which also suggests that cointegration might have existed between the variables. If this holds, further analysis will be under the framework of vector error correction model.

We specify our model based on Equation (1) as

$$Unem_t = f(Unem_{t-1}, GFCg, M2g, MPR) \quad (3)$$

Equation (3) suggests that the real effects of monetary policy shocks are likely to vary with policy variability which is dependent on three factors: (i) the elasticity of money demand with respect to a change in the interest rate, (ii) the elasticity of money supply with respect to a change in interest rate, and (iii) the elasticity of aggregate investment with respect to a change in the interest rate.

[5] MPR accounts for the three market rates (prime lending rates, the interbank rates and the Treasury Bills rate) which are in the lending outlets of DMBs as they change in the same direction with a change in the MPR (Ndekwu, 2013).

[6] Karanassou *et al.* (2003) and Karanassou *et al*. (2004) found decline in gross fixed capital formation to be essential for understanding the unemployment experience within the European Union in the 1970s and 1980s.

After the estimation of VAR, we investigate the statistical properties of Equation (3) and other diagnostic tests which include testing for the absence of autocorrelation and non-normality in the error process. Further structural analyses include diagnosing the empirical model's dynamic behaviour through impulse response functions and forecast error variance decomposition as well as examining the causal inference using Granger causality test.

3.1 Unit Root Test

In any time series analysis, identification of the order of integration of the variables has always been the first step taken to avoid spurious regression problem. Since the testing of the unit roots of a series is a precondition to the existence of cointegration relationship, this study first employs the popular Augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) unit root tests to investigate the stationarity of all the variables used. According to Glynn *et al.* (2007), incorporating non-stationary or unit root variables in estimating the regression equations using OLS method always give misleading inferences but if variables are non-stationary, the estimation of long-run relationship between those variables should be based on the cointegration method. Perron (2005) posited that there is an intricate interplay between unit root and structural changes that creates particular difficulties in applied work, given that both are of definite practical importance in economic applications. Given the possible reflection of structural shift in our data, the paper employs Zivot-Andrews unit root test to determine the existence of breakpoint endogenously from the data, following Zivot and Andrews (1992). Perron (1989) also emphasized the importance of structural breaks when testing for unit root processes, arguing that failure to allow for an existing break leads to a bias that reduces the ability to reject a false unit root null hypothesis.

3.2 Unit Root with Structural Break

Zivot and Andrews (1992) proposed determining a break point endogenously from the data. The test is a sequential test which utilizes the full sample and uses a different dummy variable for each possible break date. The break date is selected where the t-statistic from the ADF test of unit root is at a minimum (most negative). Subsequently, a break date is chosen where the evidence is least favourable for the unit root null. The framework involves conducting a unit root test on the time series, *Unem, GFCg, M2g or MPR* by specifying three different regression equations under the assumptions of structural break in levels, trend or trend /intercept. The process is defined as:

$$y_t = \hat{\mu}^P + \hat{\delta}^P DU_t(\hat{\theta}) + \hat{\beta}^P t + \hat{\alpha}^P y_{t-1} + \sum_{j=1}^{k} \hat{R}_j^P \Delta y_{t-\mathrm{j}} + \hat{e}_t, \quad (4)$$

$$y_t = \hat{\mu}^Q + \hat{\beta}^Q t + \hat{\gamma}^Q D\pi_t^*(\hat{\theta}) + \hat{\alpha}^Q y_{t-1} + \sum_{j=1}^{k} \hat{R}_j^Q \Delta y_{t-\mathrm{j}} + \hat{e}_t\,, \quad (5)$$

and

$$y_t = \hat{\mu}^R + \hat{\delta}^R DU_t(\hat{\theta}) + \hat{\beta}^R t + \hat{\gamma}^R D\pi_t^*(\hat{\theta}) + \hat{\alpha}^R y_{t-1} + \sum_{j=1}^{k} \hat{R}_j^R \Delta y_{t-\mathrm{j}} + \hat{e}_t \quad (6)$$

where the dummy: $DU_t(\theta) = 1\ if\ t > \pi\theta,\ 0\ otherwise$; and $D\pi_t^*(\theta) = t - \pi\theta$ if $t > \pi\theta,\ 0\ otherwise$. The estimated values of the break fraction is denoted by θ,while $\delta\ and\ \gamma$ are parameter estimates that endogenously account for the structural break at levels and trend respectively, and Δ is first difference operator. For all models corresponding to equations 4 – 6, the asymptotic distribution of the test statistic is given as $inf_{\lambda\in\Lambda} t_{\hat{\alpha}^i}(\lambda),\ i = P, Q, R$, with the size α left-tail critical value from the asymptotic distribution being $k_{inf,\alpha}^i$. Hence, the null hypothesis of a unit root is rejected if $\inf_{\theta\in\Lambda} t_{\hat{\alpha}^i}(\theta) < k_{inf,\alpha}^i\ \ i = P, Q, R.$

3.3 The Bai-Perron Tests for Break Point

Following Bai and Perron (1998), this test detects the break dates in the variables we are analyzing endogenously by testing the null hypothesis of 'n' breaks against an alternative of *'n+1'* changes sequentially. It also allows for consistent determination of the appropriate number of changes present in a specific to general modelling strategy by minimizing the sum of squared residuals from dynamic ordinary least squares (DOLS) regressions over a closed subset of break fractions. The process is defined as:

$$y_t = x_t'\beta + z_t'\delta_i + u_t t = T_{i-1} + 1, \ldots, T_i, for\ i = 1, \ldots., n+1. \quad (7)$$

where y_t is the observed dependent variable at time t; $\underset{(p\times 1)}{x_t}$ and $\underset{(q\times 1)}{z_t}$ are vectors of covariates, β and $\delta_i\ (i = 1, \ldots., n+1)$ are the corresponding vectors of coefficients; u_t is the disturbance at time t. The indices $(T_1, \cdots, T_n)$,

or the break points, are explicitly treated as unknown (the convention that $T_0 = 0$ and $T_{n+1} = T$ is used).

For a multiple linear regression with n breaks (or n + 1 regimes), this technique estimates the unknown regression coefficients together with the break points when T observations on (y_t, x_t and z_t) are available. This is called partial structural change model as the parameter vector β is not subject to shift and is estimated using the entire sample. According to Carrion-i-Sylvestre and Sans´o (2006), it is a more powerful test and also beneficial in terms of obtaining more precise estimates. This method of estimation is based on the least-squares principle. Thus, for each ($T_1, \ldots, T_n$) denoted as $\{T_i\}$, the associated least-squares coefficients β and δ_i are obtained by minimizing the sum of the squared residuals:

$$\sum_{j=1}^{n+1} \sum_{t=T_{j-1}+1}^{T_j} [y_t - x_t'\beta - z_t'\delta_j]^2 \quad (8)$$

with the resulting estimates given as $\hat{\beta}(\{T_i\})$ and $\widehat{\delta}(\{T_i\})$. Substituting the resulting parameters into the objective function and denoting the resulting sum of squares as $S_T(T_1, \cdots T_n)$, the estimated breakpoints $(\widehat{T_1}, \ldots, \widehat{T_n})$ are such that:

$$(\widehat{T_1}, \ldots, \widehat{T_n}) = argmin_{T_1, \cdots, T_n} S_T\ (T_1, \ldots, T_n), \quad (9)$$

where the minimization is taken over some set of admissible partitions. The regression parameter estimates are the estimates associated with the *n*-partition $\{\widehat{T_i}\}$.

3.4 Data Sources

This study uses four series of data which are unemployment rate, monetary policy rate, money supply growth rate and growth rate of gross fixed capital formation (a proxy for investment). These data were sourced from both CBN statistical bulletins of various years and NBS data portal. The sample period covers from 1983Q1 – 2014Q1. Though revised data on unemployment rate were not quarterly all through, the yearly data were transformed to quarterly using appropriate econometric tools to allow for empirical estimations.

4.0 EMPIRICAL ANALYSIS AND RESULTS

We begin the empirical estimation by testing for the presence of unit root using the Augmented Dickey-Fuller (ADF) and the Phillip- Perron (PP) tests first, and the Zivot - Andrews's unit root tests for further interrogation.

Table 1: Unit Root Tests- 1983Q1 to 2013Q4 Series

Test Type	ADF				PP				Zivot-Andrews		
Variable	Level	First	Second	Decision	Level	First	Second	Decision	Level	Break Date	Decision
Unem	-1.579161	-0.5462	-4.300309*	I(2)	-1.94886	-4.314514*	-1.8618	I(1)	-2.328781*	1999Q1	I(0)
GFCg	-4.156063*	-7.38709	-9.015498	I(0)	-4.468153*	-18.36596	-76.0816	I(0)	-5.169101*	2008Q1	I(0)
M2g	-3.652297*	-4.25772	-14.06275	I(0)	-4.395593*	-19.50998	-65.2224	I(0)	-5.442946*	2009Q1	I(0)
MPR	-2.911120*	-9.02827	-9.663407	I(0)	-2.313205	-9.132824*	-43.2259	I(1)	-3.999593*	2005Q1	I(0)

"" Null Hypothesis of Unit Root Not Accepted at 5% level of significance*

The unit root tests results from the ADF and PP with no trend shows that at 5% levels of statistical significance, all the variables are stationary at level under ADF except *Unem* which is stationary only at the second difference. On the other hand, two variables (GFCg and M2g) are found stationary at level except *Unem* and MPR under the PP. Further examination with the Zivot-Andrews' test that hypothesizes existence of unit root in each series with a structural break in the intercept as null shows that at 5% level of statistical significance, all the series are stationary at level (Table1). Hence, there was no need for further cointegration assessment. The Zivot-Andrews' test indicated structural change occurring at different dates for individual variable.

Table 2: Bai-Perron Least Squares Estimation with Breaks: 1983Q1 – 2014Q1

Dpendent Variable: UNEM					Breaks: 1994Q1, 2000Q2, 2009Q3				
Variable	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficier	Std. Error	t-Statistic	Prob.
1983Q1 - 1993Q4 -- 44 obs					1994Q1 - 2000Q1 -- 25 obs				
C	7.507243	0.876414	8.565866	0.0000	C	-10.68574	3.477328	-3.072974	0.0027
GFCG	-0.003408	0.012752	-0.267292	0.7897	GFCG	0.044843	0.037527	1.194963	0.2347
M2G	0.006580	0.003905	1.685040	0.0948	M2G	0.019761	0.041321	0.478218	0.6335
MPR	-0.201408	0.067114	-3.000988	0.0033	MPR	0.916213	0.210447	4.353650	0.0000
2000Q2 - 2009Q2 -- 37 obs					2009Q3 - 2014Q1 -- 19 obs				
C	16.29260	1.251414	13.01935	0.0000	C	31.07819	2.011999	15.44642	0.0000
GFCG	-0.002155	0.004803	-0.448737	0.6545	GFCG	-0.427279	0.039390	-10.84735	0.0000
M2G	-0.050892	0.018101	-2.811593	0.0058	M2G	0.023297	0.056958	0.409021	0.6833
MPR	-0.116959	0.076699	-1.524908	0.1302	MPR	-1.925198	0.182749	-10.53464	0.0000
R-squared	0.908729		F-statistic	72.34996	Akaike info criteric	3.787328			
Adjusted I	0.896169		Prob(F-statisti	0.000000	Schwarz criterion	4.149352			
S.E. of reg	1.514686		Mean dependent var	7.872251	Hannan-Quinn crit	3.934399			
Sum squa	250.0759		S.D. dependent var	4.700666	Durbin-Watson sta	1.343213			
Log likelih	-220.7080								

Putting all the variables in the unemployment equation with reference to the structural changes in each variable, we employ Bai-Perron least squares technique to validate the estimates of the break dates and estimate the properties of the estimators to allow inference to be made about the presence of the breaks and the number of breaks The results is as summarized in Table 2.

Table 3: Vector Autoregressive Estimates: Sample (adjusted): 1983Q2 2014Q1

	UNEM	GFCG	M2G	MPR
UNEM(-1)	0.921857	0.339771	0.681670	-0.113319
	(0.03434)	(1.01619)	(1.11798)	(0.05889)
	[26.8477]	[0.33436]	[0.60973]	[-1.92440]
GFCG(-1)	-0.006793	0.668647	-0.085165	-5.71E-05
	(0.00238)	(0.07034)	(0.07739)	(0.00408)
	[-2.85809]	**[9.50549]**	[-1.10047]	[-0.01400]
M2G(-1)	-0.001780	0.011589	0.645424	-0.004503
	(0.00213)	(0.06311)	(0.06943)	(0.00366)
	[-0.83486]	[0.18363]	**[9.29575]**	[-1.23140]
MPR(-1)	0.042711	1.245731	-0.070409	0.897054
	(0.02381)	(0.70472)	(0.77531)	(0.04084)
	[1.79365]	[1.76771]	[-0.09081]	**[21.9670]**
C	-0.165975	-14.84877	11.73264	2.531840
	(0.41401)	(12.2525)	(13.4798)	(0.71000)
	[-0.40090]	[-1.21190]	[0.87038]	[3.56597]
DUMMY1	0.190399	-1.013224	-7.319725	-0.880110
	(0.23182)	(6.86072)	(7.54797)	(0.39756)
	[0.82132]	[-0.14768]	[-0.96976]	**[-2.21377]**
DUMMY2	0.689730	-6.145563	-3.189387	1.155162
	(0.40397)	(11.9556)	(13.1532)	(0.69279)
	[1.70736]	[-0.51403]	[-0.24248]	[1.66740]
DUMMY3	-0.807994	8.838009	-5.398808	-0.436658
	(0.30211)	(8.94106)	(9.83670)	(0.51811)
	[-2.67446]	[0.98847]	[-0.54884]	[-0.84279]
R-squared	0.966793	0.519108	0.501884	0.866392
Adj. R-squared	0.964790	0.490089	0.471825	0.858330
Sum sq. resids	90.94744	79657.36	96415.49	267.4815
S.E. equation	0.885454	26.20499	28.82998	1.518511
F-statistic	482.4683	17.88835	16.69678	107.4591
Log likelihood	-156.7284	-576.7913	-588.6291	-223.6121
Akaike AIC	2.656909	9.432117	9.623050	3.735678
Schwarz SC	2.838863	9.614071	9.805004	3.917632
Mean dependent	7.880684	8.060130	23.58971	13.44758
S.D. dependent	4.718786	36.69751	39.66939	4.034397
Determinant resid covariance (dof adj.)		1007580.		
Determinant resid covariance		771657.8		
Log likelihood		-1544.284		
Akaike information criterion		25.42393		
Schwarz criterion		26.15175		

***** *Standard errors in ( ) & t-statistics in [ ]*

The Bai-Perron test estimates validated three breakpoints dated at 1994q1, 2000q2 and 2009q3. These breakpoints are then modeled as dummies such that each dummy series consists of two values (0 and 1) where the zeros are for the periods before the break. Thus, three dummies are generated for the identified breaks as dummy 1 = 1994q1, dummy 2 = 2000q2 and dummy 3 = 2009q3, and are accommodated in the VAR model with optimal lag length of

1 selected based on Schwarz information criterion to obtain the VAR estimates presented in Table 3. A cursory observation shows that two dummies (dummies 1 & 3) are statistically significant with dummy 1 relating to *MPR*[7] and dummy 3 relating to *Unem*[8].

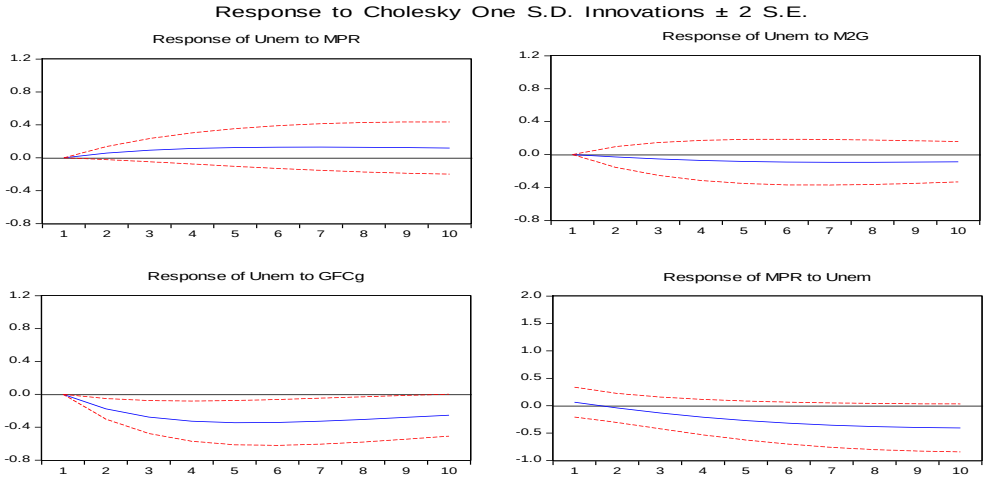

Figure 2: ***Impact of Changes in Investment, Money Supply and Interest Rate on Unemployment Rate in Nigeria***

Evaluating the response of unemployment dynamics to monetary policy impulse, we find that a positive shock monetary policy rate elicits a mild and steady positive response from unemployment, while a positive shock to money supply exerts a mild inverse and steady pressure on unemployment up to 10 quarters period. The results also show that unemployment responds positively and significantly to a positive shock to investment over the 10 quarters period.

Decomposing the variance of the unemployment rate we see that the contributions of monetary policy rate, change in money supply and change in investment to the total variation in unemployment rate increase with time as summarized in Table 4.

Table 4: Variance Decomposition of Unemployment Dynamics: 1983q1-2014q1

[7] The removal of maximum lending rate in 1993 upshot interest rates to an unprecedented levels with rising inflation following the liberalization of interest rate regime by CBN, and in 1994 direct interest rate controls were restored (http://www.cenbank.org/MonetaryPolicy/Reforms.asp)

[8] The global financial crisis of 2007/2008 effect in Nigeria triggered credit friction and a huge budget cut in both Federal and State governments' spending with its attendance effect on unemployment ratio (see also Oke and Ajayi, 2012)

Period	S.E.	UNEM	GFCG	M2G	MPR
1	0.885454	100.0000	0.000000	0.000000	0.000000
2	1.224361	97.64501	1.937072	0.139744	0.278171
3	1.470377	94.28876	4.622849	0.387022	0.701372
4	1.662507	91.00749	7.169057	0.675998	1.147456
5	1.815264	88.16245	9.301543	0.967322	1.568681
6	1.937005	85.81630	10.99308	1.240334	1.950285
7	2.033795	83.92496	12.29892	1.485619	2.290508
8	2.110458	82.41576	13.29203	1.700120	2.592093
9	2.170938	81.21646	14.04040	1.884230	2.858917
10	2.218466	80.26445	14.60066	2.040105	3.094788
Cholesky Ordering: UNEM GFCG M2G MPR					

This trend is consistent even when the ordering is varied. The impulse analysis and variance decomposition results found support for dynamic relation between variables under evaluation. The results also seem to align with both the monetarist and the Keynesian views. However, since correlation does not imply causality, we further examine the causality relation between unemployment and monetary policy using Granger causality test and the result is as summarized in Table 5. The result shows bidirectional causality relation between unemployment and monetary policy rate (interest rate) which is the price-based nominal anchor of monetary policy and also anchors policy stance in Nigeria, at 10% level of statistical significance in the causality from interest rate to unemployment and at 5% level of statistical significance in the causality from unemployment to interest rate. On the other hand, money supply which is a quantity-based nominal anchor of monetary policy does not Granger cause unemployment independently, but does so jointly with interest rate and investment, while investment Granger causes unemployment at 5% level of statistical significance. These results find support for Choudhry (2013) report about the Bank of England and the U.S. Federal Reserve linking changes in its base interest rate to the rate of unemployment. This suggests that the transmission mechanism of monetary policy with relation to unemployment rate in Nigeria is based on the traditional Keynesian interest rate channel.

Table 5: VAR Granger Causality/Block Exogeneity Wald Tests: Sample: 1983Q1 2014Q1

Dependent variable	Excluded	Chi-sq	df	Prob.	Remarks
	GFCg	8.168664	1	**0.0043**	GFCg Granger causes Unem
Unem	M2g	0.696988	1	0.4038	
	MPR	3.217191	1	**0.0729**	MPR Granger causes Unem
	All	9.242682	3	**0.0262**	GFCg, M2g and MPR jointly Granger cause Unem
	Unem	0.111795	1	0.7381	
GFCg	M2g	0.033719	1	0.8543	
	MPR	3.124782	1	**0.0771**	MPR Granger causes GFCg
	All	3.149945	3	0.3691	
	Unem	0.371773	1	0.542	
M2g	GFCg	1.211035	1	0.2711	
	MPR	0.008247	1	0.9276	
	All	2.058626	3	0.5603	
	Unem	3.703302	1	**0.0543**	Unem Granger causes MPR
MPR	GFCg	0.000196	1	0.9888	
	M2g	1.516346	1	0.2182	
	All	5.89853	3	0.1167	

5. Conclusion and Policy Implications

This paper has empirically investigates monetary policy – unemployment nexus in Nigeria using quarterly data from 1983Q1 to 2014Q1. The investigation identified significant incidences of structural breakpoints in the unemployment equation at 1994Q1, 2000Q2 and 2009Q3 with 1994Q1 and 2009Q3 breaks linked to the removal of maximum lending rate in 1993 by CBN, the restoration of direct interest rate controls in 1994, and the global financial crisis of 2007/2008, while the breakpoint of 2000Q2 is not significant. The analysis also shows existents of correlation relation between unemployment and monetary policy with bidirectional causality between them. The results found support for monetary policy – unemployment relation in Nigeria. It therefore follows that the conventional channel for monetary policy to affect unemployment in Nigeria is through the traditional Keynesian interest rate channel. This implies that adjustment in official interest rates by the Central Bank of Nigeria will affects directly money-market interest rates and, indirectly, lending and deposit rates, which are set for customers by banks. The changes in interest rates will also affect saving and investment decisions of households and firms as changes in consumption and investment will change the level of domestic demand for goods and services relative to domestic supply. In other words, when demand exceeds supply, upward price pressure is likely to occur, and changes in aggregate demand may translate into tighter or looser conditions in labour and intermediate product markets. This, in turn, can affect price and wage-setting in the respective market.

Hence, in line with Brash[9] (1994: pp.23), the best contribution monetary policy can make would be to maintain stability in the general level of prices. Hence, it is recommended that policy makers in Nigeria should focus invariably on the adjustment of interest rate when considering unemployment in its monetary policy decisions.

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