“The credit channels of monetary policy transmission: implications on output and employment in Nigeria”

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THE CREDIT CHANNELS OF MONETARY POLICY TRANSMISSION: IMPLICATIONS ON OUTPUT AND EMPLOYMENT IN NIGERIA

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Abstract

There has been an increasing trend in the unemployment rate despite the growth rate witnessed. Monetary policy is presumed as one of the ways to improve the situation. Likewise, the relationship between monetary policy and employment has generated controversial debates in the literature. Though its connection has been extensively studied, however, the implications of monetary policy in respect to time frame perspectives on employment and output have not been widely addressed in the literature. This study provides evidence on shock effects, long and short-run impacts of monetary policy transmission through the credit channels on output and employment in Nigeria within the period of 1981 to 2016 using the Structural Vector Autoregression and Autoregressive distributed lags (ARDL). Evidence from the forecast error shock showed that variations in monetary policy indicators affect output more than employment in the first two periods; however, it affects employment more afterwards. The ARDL results show no evidence of cointegration when output is used as the dependent variable; conversely, cointegration exists when employment is used as the dependent variable. The monetary policy indicators: money supply, bank deposit liability and interest rate are statistically and economically significant with employment in the long run. In the short run, money supply and interest rate are economically and statistically significant. The findings revealed that the Nigerian government can maximize the long-run benefits of monetary policy through the credit channels on employment. Hence, there is a need for policymakers to look beyond short-run gain and promote long-run employment via monetary policy among others.

Keywords credit channels, monetary policy, output, employment

JEL Classification E24, E52, E60, J64

INTRODUCTION

For some decades, Nigeria had been witnessing an increase in economic growth, even though there was a reduction in the second quarter of 2016 due to the recession experienced at the period. But the growth witnessed for a long period of time has not positively impacted employment as suggested theoretically and empirically (Okun, 1969; Yang & Shao, 2018). The official statistics had shown that over the years there has been an increasing trend in the unemployment rate. For example, the unemployment rate was 8.2 per cent, 13.9 per cent and 18.8 per cent in 2015, 2016 and 2017, respectively (Nigerian National Bureau of Statistics NBS, 2017). While the annual growth rate was 2.84 per cent and 0.72 per cent in 2015 and 2017, respectively, and it stands at 1.5 per cent in the second quarter of 2018 (Central Bank of Nigeria, 2018). The Nigerian government had adopted different macroeconomic policies and programs

to promote employment generation, growth and development. This programs and policies are done through solicitation of fiscal and monetary policy. But, despite all these attempts by Nigerian's government, high unemployment rate, high rate of poverty and a lower rate of investment still remain major challenges in Nigeria (Oloni, Asaleye, Abiodun, & Adeyemi, 2017). The conduct of monetary policy by the Nigerian Government has been to ensure stability in the economy, correct internal and external balance of payments. Over the years, the Nigerian Government has adopted different measures of monetary policy. However, the major two measures adopted are direct monetary control and market mechanism (Central Bank of Nigeria, 2007). In recent times, the Nigerian banking system has undergone various restructured stages that cause instability within the system. Due to these effects, the role of credit channels to promote growth in output and employment are questioned (Matousek & Solomon, 2018).

Consequently, Nigeria depends on the oil sector as the main source of revenue and the country is characterized by a high importation of foreign goods, unstable business cycles and economic fluctuations. This makes the economy to be exposed to external shocks. However, there is a need for developing economy like Nigeria to design a monetary policy framework to accommodate the imbalances and improve macroeconomic performance. Theoretically, the classical economists believed that monetary policy intervention does not matter, while the Keynesian economists stressed the effects in the short and long run affecting interest rate and inflation rate respectively. The monetarist economists showed that the economy depends on the monetary policy to promote output and employment. There are inconclusive implications of monetary policy on the economy from the theoretical perspectives. The roles of monetary policy to promote welfare through the availability of credit, the willingness of banks to take specific risks among others, have generated fervent controversies and debates in the empirical literature as well. A monetary authority decision to reduce the interest rate will lower the cost of borrowing, which on the other hand will promote higher investment activity and also increase the purchasing power of the consumer. The combinations of these factors will increase output and employment (Friedman & Schwartz, 1963).

Similarly, Mishkin (1995) emphasized that additional supply of money promotes growth in the short run, while the decrease in the money supply responses to increase in the rate of interest, which on the other hand will encourage bank deposit that can be channelled to promote long-run investment in real GDP. There is a vast literature documenting the implications of monetary policy on employment and output, some scholars believed it has adverse effects on the economy, while other believed it does not matter (Lennard, 2018, among others). In the literature, some studies show the impact of monetary policy has transmitted through the shock effects (Furcer, Loungani, & Zdzienicka, 2018; Voinea, Lovin, & Cojocaru, 2018). Aguanno (2018) documented that monetary policy shock causes welfare effects and destabilizes the economy. Conversely, Albulescu and Lonescu (2018), Colletaz, Levieuge, and Popescu (2018), Silva and Vieira (2017), Teimouri and Zietz (2017) showed that monetary policy shock was transmitted through the short- and long-run impacts. However, the scholars focused on foreign direct investment, systemic risk-taking, income and consumption inequality. This study is distinguished from the previous research by examining the impact of monetary policy on employment and output through the shock effects, short- and long-run impacts. It is believed that investigating this channels documented in the literature in which monetary policy affects the economy will help to maximize the benefit of the policy through the credit channels with the aim to curb the unemployment problem in Nigeria and also will serve as a blueprint for future studies.

The remainder of this work is organized as follows. Section 1 reviews the literature. Section 2 describes the methodology. Section 3 discusses the result. The last Section concludes.

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1. LITERATURE REVIEW

The belief of the classical economists is that the economy attains full employment in the long run with much attention shifted to the role of prices and its implication on inflation. It was stressed further by the classical school of thoughts that the credit channels of monetary policy will only affect prices without any significant effects on output and employment (Say, 1988). The Keynesian theory shared different perspective by putting emphasis on the inflexibility of prices, the tendency of an economy to operate at output and income less than the full employment level. In the mechanism of the Keynesian theory, monetary policy influences interest rate, which in turn influences investment decisions and as a result, output and income are impacted through the multiples process (Romer & Romer, 1989). It was further stressed by the Keynesian economists that the interest rate is the major determinant of investment to influence output and employment. According to this school of thought, it is believed that the impact of monetary policy on the economy has short-run effects (de Long & Summers, 1998; Romer & Romer, 1989). While some Keynesian economists shared different perspectives that economic development taking different processes and implications of demand shock through credit channels can have long-run effects on employment and output (Akerlof, 2007; Ball, 2008).

On a contrary view, the monetarist school of thought hold the view that money matters in all economic activities and as such monetary policy is a more possible economic stabilization measure than fiscal policy (Barro, 2007). From the theoretical perspectives, there are no agreements on the implications of monetary policy through credit channels on the economy. The general opinion is that monetary policies affect the economy but there is no consensus on how or through what channels; though Miskin (1995) emphasizes the implications on the economy through the interest rate, exchange rate and credit channels. The New classical economists shared the view that unanticipated monetary policy will affect employment and output; however, an anticipated policy will not affect employment and output due to systematic actions by economic agents towards the policy (Sargent, 1976). Sims (1980) examined the effect of monetary policy on the United States of America's economy. The author showed that interest rate explains more variation in output in the post-war period. In a similar study by Eichenbaum and Singleton (1986), it was documented that it does not have a significant impact on output.

Likewise, other empirical studies reported different implications of monetary policies on the economy. Berument and Dincer (2008) investigated the implications of monetary policy on Turkish's economy. The scholars reported that contractionary monetary policy provisionally affects output in the short run by causing reduction. These findings confirmed the work of previous studies (Sousa & Zaghini, 2008; Eichenbaum & Evans, 1995). These findings contradicted the study by Anwar and Nguyen (2018) that tested the channels of monetary policy transmission in the Vietnamese economy using SVAR. It was reported by the authors that monetary policy shocks tend to have a strong influence on output in Vietnam. The scholars used the broad money supply (*M2*) and interest rate as proxies for monetary policy. Despite the inconclusiveness in the literature on the implication of monetary policy on the economy, it was observed from both the theoretical and empirical studies that its implications on the economy are subject to time frame perspectives, that is short- and long-run effects.

More so, Lennard (2018) analyzed the effect of monetary policy on the British economy. It was reported that a positive relationship exists between monetary tightening and unemployment, though an increase in the inflation rate was noted. Rhee and Song (2017) investigated the nexus between labor market friction, nominal wage rigidities and monetary policy in a small open economy. The scholars concluded that stabilizing unemployment rate rather than output is better if the shock is uncertain. Barakchian and Crowe (2013) examined the impact of a monetary shock in the US economy using Vector Autoregression (VAR). The authors showed that variability in output was driven by monetary policy shocks. Jeanne (1995) used SVAR to analyze the impact of monetary policy on the British economy. It was shown by the scholars that contractionary monetary policy shock lowered output but increased the price.

The different results of the implications of monetary policy through credit channels in the literature are attributed to different factors, which include: implications within the time frame perspectives, measurement of the monetary policy indicators, nature of the monetary policy (contradict or expansion), among others. For example, Bhuiyan (2008) examined the effects of monetary policy shock in Canada. The findings of the author indicate that the transmission of the monetary policy shock to real output operates through both the interest rate and the exchange rate. Likewise, Colletaz, Levieuge, and Popescu (2018) investigated the impact of monetary policy on the long-run systemic risk-taking. Their findings showed causality from monetary policy to systemic risk in the short run was not statistically significant but was positively significant in the long run. Consequently, Aastveit, Natvik, and Sola (2017) analyzed the effects of monetary policy shock on the United States of America's economy using SVAR. Their findings show that monetary policy shock affects the economy less when uncertainty is high. Silva and Vieira (2017) investigated the impact of monetary and fiscal policies in advanced and emerging/developing economies before the financial crisis (2001–2008) and after the financial crisis (2009–2012) using Generalized Method of Moments (GMM) dynamic panel models. It was documented by the scholars that monetary policy was countercyclical only for advanced economies within the period of 2001 to 2008. Mumtax and Theophilopoulou (2017) showed that contractionary monetary policy shock in the United Kingdom causes an increase in earnings, income and consumption inequality. From the empirical perspectives, it was shown that the monetary policy affects the economy through the shock effects.

While the impact of monetary policy on the economy has been extensively studied, most of the recent study focused on monetary policy shock and inequality (Furcer, Loungani, & Zdzienicka, 2018; Voinea, Lovin, & Cojocaru, 2018). The implications of monetary policy with respect to time frame perspectives on employment and output have not been widely addressed in the literature. In the literature, monetary policy through the credit channels has shock effects, short- and long-run effects. According to Anwar and Nguyen (2018), Aastveit, Natvik, and Sola (2017), Mumtax and Theophilopoulou (2017), Rhee and Song (2017), among others, the impacts are transmitted through the shock effects. Similarly, scholars documented that it affects through the short and long-run impacts (Colletaz, Levieuge, & Popescu, 2018; Lennard, 2018; Teimouri & Zietz, 2017; Silva & Vieira, 2017).

On the methodological approaches, different methods have been used in the literature to examine the monetary policy implications on the economy. Examination of the shock effects in the 'black box' was analyzed using the Vector Autoregression (VAR) and Structural Vector Autoregression models. Studies have shown that the SVAR has an advantage over the VAR by imposing restrictions to replicate the economy under study. Though, the dynamic stochastic general equilibrium is mostly used nowadays. Fujiwara and Wang (2017) investigate how optimal monetary policy in an open economy using a two-country Dynamic Stochastic General Equilibrium model (DSGE). It was reported by the scholars that optimal monetary policy stabilized inflation rate more under cooperation in relative to non-cooperation policy. Castelnuovo and Pellegrino (2018) stressed that SVAR/VAR and DSGE give similar results when used to investigate the implications of monetary policy shock on macroeconomic performance.

In the literature, different approaches are used to examine the long-run implications. Albulescu and Lonescu (2018) investigate the long-run impact of monetary policy uncertainty and banking stability on inward foreign direct investment in European countries using Fully Modified Least Square (FMOLS) and Dynamic Least Square (DOLS) estimators. The scholars reported that a positive relationship exists between the business cycle and foreign direct investment. Different approaches to estimating the long-run relationship have been introduced in the literature. Few among others include: the Error Correction Model (ECM) by Engle and Granger (1987), Maximum Likelihood by Johansen and Juleius (1990), Dynamic Least Square approach to cointegration (DOLS) by Stock and Watson (1983), the Canonical Cointegrating Regression (CCR) by Park (1992), and Modified Least Square approach to cointegration by Phillips and Hansen (1990). However, the aforementioned approaches to cointegration required that the

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properties of the stationarity to be tested and integrated of the same order (order one) are as well not suitable for small samples. The Auto Regressive Distributed Lag (ARDL) by Pesaran and Shin (1995) overcome the limitations and can be used irrespective of the series are integrated of order zero or one. The ARDL as well can be used to investigate the short-run and long-run component of the model (Popoola, Asaleye, & Eluyela, 2018).

Bernanke and Gertler (1995) identified two credit channels, in which monetary policy affects the economy, namely as follows: bank lending rate and balance sheet channels. The bank lending channel focused on the supply of loans, there is a trade-off between interest rate and inducement of obtaining the loan. Similarly, an increase in the amount of deposit in the bank will promote capital available for loan. While the balance sheet channel, according to the authors, focused on how the equity price of borrowers can affect the money supply. Based on this, the study uses a broad money supply (*M2*), interest rate and bank deposit liability as indicators of credit channels in which monetary policy affects the economy. Other variables considered are gross fixed capital formation, exchange rate, gross domestic product (GDP) and employment. The credit channels of monetary policy indicators have a direct impact on aggregate output and employment. The impact can result in contractionary monetary policy measures, which reduces investment, employment and output or through expansionary monetary policy measure which increases investment, employment and output.

In Nigeria, most of the recent studies focused on the impact of monetary policy on the interest rate, bank lending channel and inclusive growth. Few among others include the studies by Matousek and Solomon (2018) who investigated the relationship between bank lending channel and monetary policy using the GMM in 23 banks. In a similar study, Bassey, Akpan, and Umoh (2018) explored the impact of an open market instrument on monetary management. Goshit (2015) analyzed the relationship between monetary policy and inclusive growth. Albeit, so studies are focused on employment and output. For example, Essien et al. (2016) investigated the relationship between monetary policy and unemployment using VAR. The authors documented that a positive shock increases the unemployment rate. Also, the study by Osadume (2018) examined the effect of interest rate mechanisms on economic growth using the Error Correction Model (ECM) and Granger Causality. On the methodological approaches, the ECM is inadequate where there are more than one cointegrating vectors and as well not suitable for small samples, while the SVAR has an advantage over the VAR by imposing restrictions to identify the structural shocks (Asaleye, Okudua, Oloni, & Ogunjobi, 2017; Amisano & Giannini, 1997). However, Chukwu (2009) investigated the impact of monetary policy on output in Nigeria using SVAR. The scholar reported that that monetary policy using money supply as the indicator has trivial effects on output and prices. The study ignored the channels documented in the literature in which monetary policy affects the economy, that is the shock effect, long-run and short-run effects.

In conclusion, the investigations of monetary policy through the credit channels in respect to time frame perspectives (short and long-run) and the shock effects in Nigeria remain underresearched. In the light of the gap identified in the literature and the importance of credit channel through monetary policy to promote output and employment, this study investigates the relationship between credit channels with the focus on monetary policy and its implications on output and employment in Nigeria. Two models were estimated in this study. The first model was used to examine the shock effect, while the second model was used to analyze the short- and long-run impact. The shock effects were examined using the SVAR and the short and long impacts were investigated using the ARDL.

2. METHODOLOGY

2.1. Theoretical framework

This study examines the implication of monetary policy through the credit channels on output and employment in Nigeria. The quantity classical theory of money expresses the relationship between output and money supply. Fisher (1911) states the velocity of money as follows:

$$V = \frac{PY}{M}. \quad (1)$$

In equation (1), V is the velocity of money, P is the price level, Y is the quantity of output and M is the quantity of money. Rewriting equation (1) gives:

$$MV = PY. \quad (2)$$

Equation (2) indicates that the quantity of money supply is directly related to the nominal value of output, where MV represents the money velocity and PY is the total output. In production function specifications, the natural level of output is derived by the rate of technology, labor and capital. A simple specification of production is given as:

$$Y_t = A_t \cdot K_t^{\beta} \cdot L_t^{\alpha}. \quad (3)$$

In equation (3), A, K and L represent technology, capital and labor respectively. To achieve the objectives of this study, equation (1) is incorporated into equation (3), modified as follows:

$$Y_t = A_t \cdot K_t^{\beta} \cdot L_t^{\alpha} \cdot MV^{\gamma}. \quad (4)$$

Equation (4) shows that output is positively related to capital, labor and money supply. Evidence from the empirical literature shows that money supply affects the economy through the following credit channels: the interest rate, broad money supply and total bank deposit (Aastveit, Natvik, & Sola, 2017; Anwar & Nguyen, 2018; Barro, 2007). More importantly, Bhuiyan (2008) and Miskin (1995) stressed the importance of the exchange rate on the economy. Based on this, the implicit form of the model used in this study is given as:

$$GDP = f(M_2, INT, BDL, EXC, GFC, EMP). \quad (5)$$

In equation (5), gross domestic product (*GDP*) was used as a proxy for aggregate output (*Y*), gross fixed capital formation (*GFC*) was used to proxy for capital (*K*), total employment (*EMP*) used for labour (*L*) and other variables include monetary policy indicators: broad money supply (M_2), interest rate (*INT*) and bank deposit liability (*BDL*). *EXC* represents the exchange rate. The study used output (*GDP*) and employment (*EMP*) as the dependent variables separately to establish output and employment equations respectively for the long-run and short-run dynamics.

2.2. Empirical models

The empirical models of the study are derived from the theoretical framework. Two models are estimated in this study. The first model investigates the shock effects of credit channels through monetary policy on employment and output. The second model analyzes the long-run and short-run dynamics.

2.2.1. Shock effects (model 1)

The study investigated monetary policy shocks on the Nigerian economy with emphasis on output and employment using structural vector autoregression (SVAR). The SVAR approach allows for a short-run contemporaneous relationship. In the traditional Vector Autoregression Model (VAR), contemporaneous restrictions are absent. Restrictions in SVAR can be divided into, namely, short-run and long-run restrictions. This study imposes only the short-run restrictions because of the nature of the study[1]. The restrictions on the SVAR are theoretical and are used to identify the contemporaneous relationship between the variables. Based on this, the restrictions enable to decompose the covariance matrix and help to determine the value for the parameters. The SVAR for this study is given as:

$$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ z_{21} & 1 & 0 & 0 & 0 & 0 & 0 \\ z_{31} & z_{32} & 1 & 0 & 0 & 0 & 0 \\ z_{41} & z_{42} & z_{43} & 1 & 0 & 0 & 0 \\ z_{51} & z_{52} & z_{53} & z_{54} & 1 & 0 & 0 \\ z_{61} & z_{62} & z_{63} & z_{64} & z_{65} & 1 & 0 \\ z_{71} & z_{72} & z_{74} & z_{75} & z_{76} & z_{77} & 1 \end{pmatrix} \begin{pmatrix} gdp_t \\ gfc_t \\ INT_t \\ EXC_t \\ m2_t \\ bdl_t \\ emp_t \end{pmatrix} = q_{ij} \begin{pmatrix} gdp_t \\ gfc_t \\ INT_t \\ EXC_t \\ m2_t \\ bdl_t \\ emp_t \end{pmatrix}. \quad (6)$$

In equation (6), z_{ij} are the elements of the matrix, while q_{ij} are the elements of the variables and $i, j = 1, 2, \ldots, 7$. This study imposes restrictions on appropriate elements of the matrices in equation (6). This allows identifying the structural shocks called contemporaneous restrictions (Amisano & Giannini, 1997). Just identified restric-

1 Monetary policy shock has a short-run direct impact on the economy; however, the indirect impacts may be transmitted to the economy in the long run (Ball, 2009).

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tions are imposed, since the objective of the study is to use impulse response and variance decomposition to investigate the effect of monetary policy indicators shocks on employment and output.

2.2.2. Long-run and short-run effects (model 2)

The Auto Regressive Distributed Lag (ARDL) Model using bounds test approach with unrestricted error correction model (UECM) was employed to analyze the impacts of monetary policy through credit channels on output and employment in Nigeria. To achieve the objective of this study, model 2 comprises two sets of structural equations as follows: using the output as a dependent variable, and using employment as a dependent variable.

Using output as a dependent variable

$$\begin{aligned}\Delta gdp_{1t} &= \alpha_0 + \delta_{11} gdp_{t-i} + \delta_{12} gfc_{t-i} + \\ &+\delta_{13} INT_{t-i} + \delta_{14} EXC_{t-i} + \delta_{15} m2_{t-i} + \\ &+\delta_{16} bdl_{t-i} + \delta_{17} emp_{t-i} + \sum_{i=0}^{q} k_{1j} \Delta gdp_{t-j} \\ &\sum_{i=0}^{q} \beta_{1j} \Delta gfc_{t-j} + \sum_{i=0}^{q} \gamma_{1l} \Delta INT_{t-l} + \\ &+\sum_{i=0}^{q} M_{1j} \Delta EXC_{t-j} + \sum_{i=0}^{q} \psi_{1k} \Delta m2_{t-k} + \\ &+\sum_{i=0}^{q} \rho_{1n} \Delta bdl_{t-n} + \sum_{i=0}^{q} \vartheta_{1n} \Delta emp_{t-n} + \varepsilon.\end{aligned} \quad (7)$$

Using employment as a dependent variable

$$\begin{aligned}\Delta emp_{2t} &= \beta_0 + \delta_{21} emp_{t-i} + \delta_{22} gfc_{t-i} + \\ &+\delta_{23} INT_{t-i} + \delta_{24} EXC_{t-i} + \delta_{25} m2_{t-i} + \\ &+\delta_{26} bdl_{t-i} + \delta_{27} gdp_{t-i} + \sum_{i=0}^{q} k_{2j} \Delta emp_{t-j} \\ &\sum_{i=0}^{q} \beta_{2j} \Delta gfc_{t-j} + \sum_{i=0}^{q} \gamma_{2l} \Delta INT_{t-l} + \\ &+\sum_{i=0}^{q} M_{2j} \Delta EXC_{t-j} + \sum_{i=0}^{q} \psi_{2k} \Delta m2_{t-k} + \\ &+\sum_{i=0}^{q} \rho_{2n} \Delta bdl_{t-n} + \sum_{i=0}^{q} \vartheta_{2n} \Delta gdp_{t-n} + v.\end{aligned} \quad (8)$$

In equations (7) and (8), the summation terms signs denoted the Error Correction Model (ECM) dynamics, where α_0 and β_0 are the constant terms for equations (7) and (8), respectively. Coefficients without the summation signs (that is δ's) represent the long-run multipliers that explain the long-run relationship (Asaleye, Olurinola, Oloni, & Ogunjobi, 2017). The symbol Δ denotes the first difference operator; p and q are the numbers of lags used where ε and v are the error terms for equations (7) and (8), respectively. The number of lags used was determined by the Hannan-Quinn Criterion (HQ). Also, the study carried out a preliminary test to investigate the stationarity properties using Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests. The estimated results were subject to diagnostic checks to know if the models are specified correctly. For a model to be correctly specified, the residual's series must not be serially correlated, must be normally distributed and homoscedastic (Fashina, Asaleye, Ogunjobi, & Lawal, 2018). The results of the diagnostic checks are presented after the model's estimation in the next section (section 3).

Table 1. Summary of apriori expectation for model 2

Source: Authors' computation.

Using output (GDP) as a dependent variable					
GFC	*INT*	*BDL*	*EXC*	*M2*	*EMP*
+	–	+	+ / –	+	+
Using employment (EMP) as a dependent variable					
GFC	*INTR*	*BDL*	*EXCR*	*M2*	*GDP*
–	–	+	+ / –	+	+

The theory suggested a positive relationship between output and capital (GFC). This follows directly from the output models. Likewise, a positive relationship between employment and output is expected. Okun's laws stressed that an inverse relationship exists between unemployment and output. A positive relationship between monetary policy indicators (money supply (M_2) and bank deposit (*BDL*)) and output/employment is expected, while negative with interest rate. This is because expansionary monetary policy will boost output and employment in the long run. According to the Marshall-Lerner condition, the sign expected between output/employment and exchange rate could either be positive or negative. This determines the sum of export and import demand elasticities if it is greater than one will lead to an im-

provement in the trade balance, otherwise it will not. Given this situation, the sign of the exchange rate depends on the sum of the elasticities of export and import. A negative relationship between capital (*GFC*) and labor (*EMP*) is expected due to the technical rate of substitution of factor inputs in production.

2.3. Data sources and measurement

The data for this study were obtained from the Central Bank of Nigeria's (CBN) Statistical Bulletin (various years) and National Bureau of Statistics (NBS). The data include the Gross Domestic Product (GDP), interest rate (INT), exchange rate (EXC), broad money supply (M2), bank deposit (BDL) and gross fixed capital formation (GFC) that are obtained from CBN, while total employment was obtained from NBS[2]. The study covers the period from 1981 to 2016.

3. RESULTS

The results of the preliminary test are presented. There are different approaches to test the unit properties of the series. This study used the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests.

Table 2 presents the summary of ADF and PP unit root tests of the series. The hypothesis of the presence of unit is tested at a 5 per cent significance level[3]. It can be depicted that most of the series were not-stationary at levels, since the absolute value of the ADF and PP statistics did not exceed the test value at 5 per cent level of significance except interest rate, which is stationary at level. Similarly, variable BDL is stationary at the level of 10 per cent significance level. The non-stationary series are integrated or differenced (that is, integrated of order one). Based on the outcome of these results, the most appropriate technique to use to examine the short- and long-run relationship is the Autoregressive distributed lags (ARDL). The results of models 1 and 2 are presented afterwards.

3.1. Summary model 1 result (shock effects)

Table 3 shows how the forecast error shocks of monetary policy indicators affect the variables used in the study. The emphasis of the forecast

Table 2. Summary of the ADF and PP unit root tests of the series

Source: Authors' computation.

Series	*ADF*		*PP*		Order of integration
	Level	First diff.	Level	First diff.	
GDP	0.097324	–3.229346**	1.212148	–3.044705**	I(1)
GFC	–1.955018	–5.365960*	–1.955018	–5.347953*	I(1)
EXC	0.407646	–5.565786*	0.408064	–5.565144*	I(1)
INT	–3.088163**	–	–3.047442	–	I(0)
M2	–1.121719	–3.297546**	–0.289558	–3.315655**	I(1)
EMP	0.300814	–5.879123*	0.300814	–5.879128*	I(1)
BDL	–2.791202***	–5.212541*	–2.641436***	–9.715585*	I(1)

Test critical values		
	Level	First diff.
1 per cent	–3.632900	–3.639407
5 per cent	–2.948404	–2.951125
10 per cent	–2.612874	–2.614300

Note: The null hypothesis involves testing the presence of unit root. *, ** and *** show significance at 1%, 5% and 10% levels, respectively.

2 The lower case variables are in logs, while the upper case variables are not logged.

3 The lag length for the ADF was selected automatically by Akaike Information Criteria (AIC).

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Table 3. Variance decomposition of monetary policy indicators

Source: Authors' computation using Eviews 9.5.

Variance decomposition of INT								
Pd.	***S.E.***	***GDP***	***GFC***	***INT***	***EXC***	***M2***	***BDL***	***EMP***
2	4.375750	2.760270	49.30525	43.68187	0.141000	0.424641	3.392121	0.294844
4	4.776096	2.651741	50.84604	38.95919	0.912965	0.648446	2.894987	3.086632
6	4.833170	2.707340	50.70485	38.71608	1.019641	0.637750	2.885781	3.328557
8	4.863810	2.755688	50.33357	38.29365	1.104397	0.663043	3.197192	3.652461
10	4.877737	2.757241	50.12451	38.11464	1.174581	0.748681	3.204387	3.875959
Variance decomposition of M2								
Pd.	***S.E.***	***GDP***	***GFC***	***INT***	***EXC***	***M2***	***BDL***	***EMP***
2	0.056538	5.263309	1.530798	39.76234	21.89023	26.72275	4.824950	0.005631
4	0.119667	3.716733	0.847433	46.79321	13.62024	10.68787	10.82848	13.50604
6	0.172063	2.646551	6.182770	39.06259	7.576215	5.441022	12.01294	27.07791
8	0.202589	2.165786	10.51771	38.37048	6.067939	4.115575	12.01534	26.74716
10	0.226895	2.766285	12.86215	39.01593	4.972898	3.635960	10.97815	25.76863
Variance decomposition of BDL								
Pd.	***S.E.***	***GDP***	***GFC***	***INT***	***EXC***	***M2***	***BDL***	***EMP***
2	0.050403	6.438393	8.511670	39.26662	15.64716	1.775247	27.22413	1.136790
4	0.068988	4.925264	11.61784	23.06060	11.53253	2.168278	15.85770	30.83778
6	0.072133	5.520406	12.81598	21.79060	11.16909	2.433366	14.88808	31.38248
8	0.078970	5.128977	11.10446	19.31378	9.976786	3.460120	14.49311	36.52277
10	0.081380	5.818570	10.52102	18.27565	9.560960	3.461869	14.14483	38.21710

Note: Pd. indicates period and S.E. shows the standard errors.

error shocks is on output and employment. In the variance decomposition of interest rate, the forecast error shock of interest rate affects output more than employment in period 2. This is in line with the study by Barakchian and Crowe (2013), who reported that variability in output was driven by monetary policy shocks. Likewise, Anwar and Nguyen (2018) documented that monetary policy shocks tend to have a strong influence on output in Vietnam. Consequently, study by Bhuiyan (2008) repoted that transmission of monetary policy shock on output is through the interest rate in Canada. However, the findings contradict the studies by Eichenbaum and Sigleton (1986), Berument and Dincer (2008), Sousa and Zaghini (2008), and Eichenbaum and Evans (1998) who stressed that monetary policy indicator does not have a significant impact on output. Though, from period 4 to 10, it affects employment more than output. In the variance decomposition of M2, it affects output more than employment in period 2. From period 4 to 10, it affects employment more than output. When it comes to the effect on employment, the forecast error shock of M2 on output is trivial. Likewise in the variance decomposition of BDL, the shock of BDL has more variation in output more than employment in period 2 and afterwards affects employment more. The effects on employment are prolonged in relation to effects on output. The argument supports the findings of Chukwu (2009) that documented trivial effects on output due to monetary policy shock. Rhee and Song (2017) stressed that stability of unemployment rate rather than output is better if the shock is uncertain.

Source: Authors' computation using Eviews 9.5.

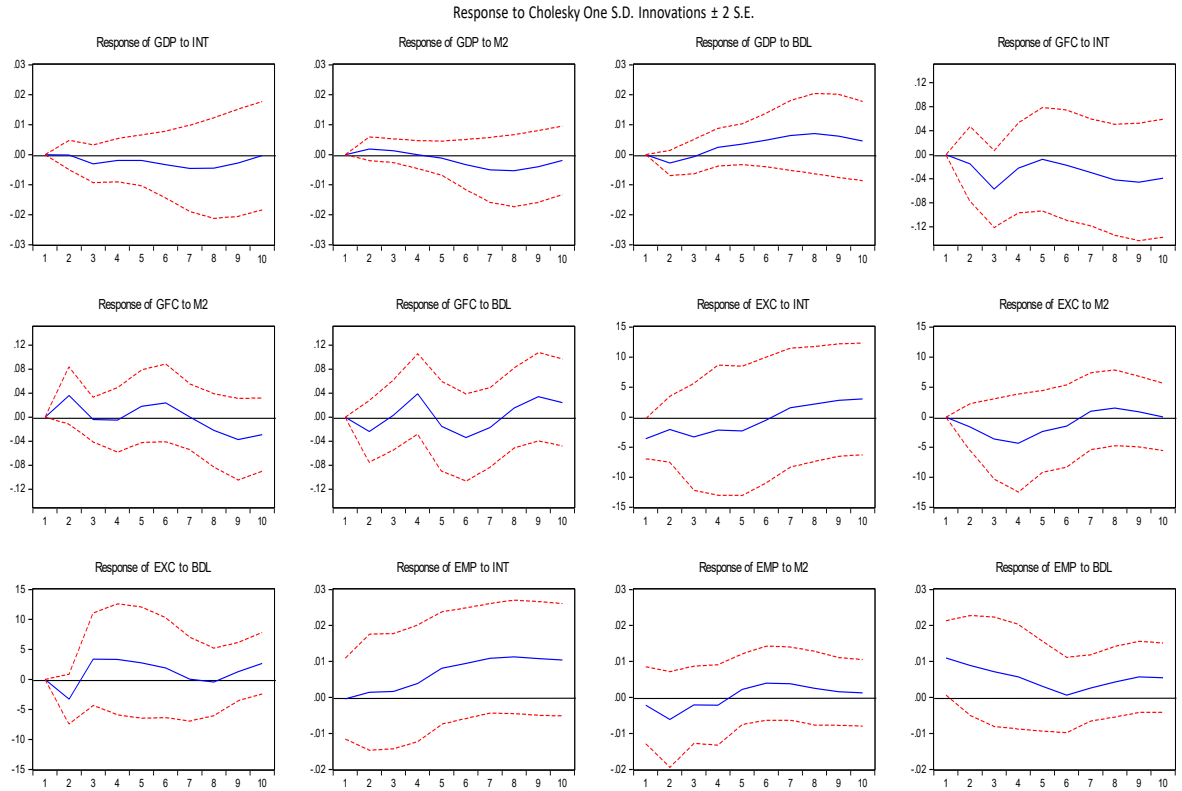

Figure 1. Impulse response function of monetary policy indicators

Impulse response function

Figure 1 shows the response of the variables to a one standard deviation increase in monetary indicators variables. The focuses of the shock monetary policy indicators are on employment and output. There is a positive response of *EMP* over a period of ten years due to shocks of *INT* and *BDL*. The responses of *EMP* and *GDP* to M_2 have smooth fluctuations, both negative and positive towards the time horizons. Likewise, the response of *GDP* to *BDL* shows both negative and positive trends towards the time horizons. The response of *GDP* due to *INT* is negative over the ten-year period.

3.2. Summary of model 2 result (short- and long-run relationship)

Table 4 presents the ARDL bound test using output (GDP) and employment (EMP) as dependent variables[4]. Evidence from the results showed no evidence of cointegration when output is used as a dependent variable across all significance levels, because the F-statistics falls below the lower bound critical values at 1 per cent, 2.5 per cent 5 per cent and 10 per cent. Hence the null hypothesis of the presence of a long-run relationship among the series cannot be rejected. Using employment as a dependent variable, there is a presence of cointegration among the series, since the F-statistics value is greater than the lower and upper bound critical values level at 10 per cent, 5 per cent and 2.5 per cent. However, evidence of cointegration cannot be established at 1 per cent significance level, since the F-statistics is in between the lower and upper critical bounds. Due to the outcome of the results[5], the study estimated the short-run and long-run model using employment as a dependent variable which is presented in Table 5.

Money supply (M_2) and bank deposit liability (*BDL*) are observed to positively affect employ-

4 The model selections criteria result is not presented in this study, however, can be provided if requested.

5 The presence of cointegration among the series when employment is used as the dependent variable, but no cointegration when output is used.

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Table 4. ARDL bounds test

Source: Authors' computation using Eviews 9.5.

Significance	Critical value bounds		K	F-statistics	Hypothesis evaluation
	IO Bound	I1 Bound			
Dependent variable: GDP (ARDL 2, 3, 3, 3, 2, 2, 3)					
Independent variables: GFC, INT, EXC, M2, BDL, EMP					
10 percent	2.12	3.23	6	1.900285	No cointegration
5 percent	2.45	3.61	6	1.900285	No cointegration
2.5 percent	2.75	3.99	6	1.900285	No cointegration
1 percent	3.15	4.43	6	1.900285	No cointegration
Dependent variable: EMP (ARDL 2, 3, 3, 3, 0, 2, 3)					
Independent variables: GFC, INT, EXC, M2, BDL, GDP					
10 percent	2.12	3.23	6	4.135726	Cointegration exists
5 percent	2.45	3.61	6	4.135726	Cointegration exists
2.5 percent	2.75	3.99	6	4.135726	Cointegration exists
1 percent	3.15	4.43	6	4.135726	Indecisive
Null hypothesis: No long-run relationship exists					

Table 5. Short- and long-run results

Source: Authors' computation.

Dependent variable: EMP				
Long-run relationship				
Variable	**Coefficient**	**Std. error**	**t-statistic**	**Prob.**
GFC	–0.141469***	0.077160	–1.833437	0.0966
INT	–0.005833**	0.002454	–2.376709	0.0388
EXC	0.000378	0.000417	0.908146	0.3852
M2	0.100756*	0.026931	3.741284	0.0038
BDL	0.673644**	0.218221	–3.086984	0.0044
GDP	0.187114	0.286368	0.653404	0.5282
C	0.260475	1.578847	0.164978	0.8722
Short-run relationship				
Variable	Coefficient	Std. error	t-statistic	Prob.
D(EMP(–1))	1.926652	1.252723	1.537971	0.1551
D(GFC)	–0.207072**	0.095477	–2.168812	0.0543
D(GFC(–1))	0.076979	0.062909	1.223658	0.2491
D(GFC(–2))	0.120763***	0.062163	1.942684	0.0807
D(INT)	–0.004909**	0.002378	–2.064008	0.0481
D(INT(–1))	0.003705	0.002790	1.327792	0.2138
D(INT(–2))	0.002059	0.002579	0.798324	0.4432
D(EXC)	0.001011**	0.000332	3.047240	0.0050
D(EXC(–1))	0.002733***	0.001303	2.096810	0.0624
D(EXC(–2))	–0.001498	0.001376	–1.088808	0.3018
D(M2)	0.136048*	0.034552	3.937466	0.0005
D(BDL)	–0.430488**	0.203990	–2.110280	0.0433
D(BDL(–1))	–0.287047**	0.148594	–1.931758	0.0636
D(GDP)	0.804079	1.135590	0.708071	0.4951
D(GDP(–1))	1.141355	0.901060	1.266680	0.2340
D(GDP(–2))	–1.134579	0.701969	–1.616281	0.1371
ECM	–0.082239**	0.038903	–2.113951	0.0427

Note: *, ** and *** show significance at 1%, 5% and 10% levels, respectively.

Table 6. Diagnostic checks

Source: Authors' computation using Eviews 9.5.

Dependent variable: GDP (ARDL 2, 3, 3, 3, 2, 2, 3)		
Breusch-Godfrey Serial Correlation LM Test	Obs.*R-Squared value	4.414129
	Chi-Square (2) Prob. value	0.1100
Heteroskedasticity Test: ARCH	Obs.*R-Squared value	0.315991
	Chi-Square (2) Prob. value	0.8539
Histogram Normality Test	Jarque-Bera value	0.854109
	Prob. value	0.652428
Dependent variable: EMP (ARDL 2, 3, 3, 3, 0, 2, 3)		
Breusch-Godfrey Serial Correlation LM Test	Obs.*R-Squared value	4.464026
	Chi-Square (2) Prob. value	0.1073
Heteroskedasticity Test: ARCH	Obs.*R-Squared value	0.122370
	Chi-Square (2) Prob. value	0.9406
Histogram Normality Test	Jarque Bera value	4.882599
	Prob. value	0.087048

ment in the long run at significance levels of 1 per cent and 5 per cent, respectively. The outcome of the result is in line with the theoretical prediction of the study. Mishkin (1995) pointed out that the implications of monetary policy for the economy is through the interest rate and credit channels. Capital (*GFC*) and interest rate (*INT*) have a negative relationship with employment at a 10 per cent significance level. This is also in line with the theory. Lennard (2018) also reported inverse relationship between interest rate and employment in British economy. Exchange rate and output are not statistically significant. In the short run, capital (*GFC*) and interest rate have a negative relationship with employment at 5 per cent significance level; however, two periods lagged coefficient of *GFC* is positively related to employment at 10 per cent significance level. The exchange rate has a short-run positive relationship with employment at 5 per cent and 10 per cent significance levels. Moreover, bank deposit liability (*BDL*) and money supply (M_2) have a negative and positive relationship with employment, respectively, at a 5 per cent significance level. The error correction coefficient is the *ECM*, which measures the speed of adjustment. The coefficient is less than one with a negative sign and is statistically significant at the level of 5 per cent. This validates that long-run equilibrium can be achieved using employment as the dependent variable.

Table 6 present the diagnostics checks result, this was done to determine the appropriateness and stability of the model as well as the results robustness. The specification of the model(s) should be tested for normality, serial correlation, autoregressive conditional heteroskedasticity and stability (Asaleye, Olurinola, Oloni, & Ogunjobi, 2017). These diagnostic checks are based on the null hypothesis that there is no serial correlation, residuals are normally distributed and there is no heteroskedasticity. The result revealed no indications of serial correlation and heteroskedasticity in the models used in this study. Similarly, the residuals are normally distributed.

CONCLUSION

Nigeria had been witnessing an increase in economic growth for decades; the growth witnessed for a long period of time has not positively impacted employment as suggested theoretically and empirically. Consequently, the Nigerian government had adopted different macroeconomic policies and programs to promote employment generation, growth and development through fiscal and monetary policy. But despite all these attempts by Nigerian's government, the unemployment rate still one of the major challenges in Nigeria. Nowadays, Nigeria government has attached more priority to price stability over other policy goals. The Nigerian banking system has undergone various restructured stages to integrate

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the roles of the banking sector into the economy. However, some scholars believed this has caused instability within the system. Due to these effects, the role of credit channels to promote growth in output and employment in recent times are questioned. This study examines the channels documented in previous studies, in which monetary policy affects the economy. The shock effect was investigated using the Structural Vector Autoregression and, the long- and short-run effects were analyzed using Autoregressive distributed lags (ARDL).

Evidence from the forecast error shock showed that variations in monetary policy indicators affect output more than employment in period 2. However, from period 4 to 10, it affects employment more than output. The ARDL results revealed no evidence of cointegration when output is used as a dependent variable, while using employment as the dependent variable, there is a presence of cointegration among the series. Due to the outcome of the results, the study investigated the short- and long-run model using employment as the dependent variable. The monetary policy indicators: money supply, bank deposit liability and interest rate are statistically and economically significant with employment in the long run. Exchange rate and output are not statistically significant in the long run. In the short run, money supply and interest rate are economically and statistically significant. However, bank deposit liability is statistically but not economically significant in the short run. Similarly, the exchange rate and capital (measured by gross capital formation) have a short-run positive relationship with employment.

The implications of the result showed that the Nigerian government can maximize the long-run benefits of monetary policy through the credit channels on employment. There is a need for policymakers to look beyond short-run gain and develop a framework to promote long-run employment via monetary policy and ensure balanced monetary measures. Changes in monetary policy affect the employment in two ways: Contractionary Measures, which involves the decrease in the growth rate of the money supply through an increase in interest rate. This, on the other hand, encourages foreign financial investment and helps to strengthen the international value of the local currency. This approach promotes imports and discourages exports, trade balance moves toward a deficit. It has a negative effect on employment, though it might reduce the inflation rate. Expansionary Measures involve the increase in the growth rate of the money supply through a decrease in interest rate. This discourages financial investment, weakens the international value of local currency, decreases import, increases export, and trade balance moves towards surplus. With this approach, there is a positive impact on the employment, however, it may increase with the inflation rate increase. This study is limited by the unavailability of employment data to widen the scope of the study. However, the study sampled over 30 observations, which is appropriate in the literature to replicate the population. Studies have shown that anticipated and unanticipated monetary shocks have different implications on employment and wages. Further study can investigate the effects of anticipated and unanticipated monetary shocks on employment and wages. Invariably, this will help to maximize benefit from monetary policy on the economy.

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APPENDIX

Table A1. Residual serial correlation LM tests

Source: Authors' computation using Eviews 9.5

Number of lags	LM-stat. value	Probability value
1	54.79207	0.2643
2*	58.14243	0.1741
3	62.28516	0.0963

Null hypothesis: no serial correlation
Probs from chi-square with 49 df.
Included observations: 33

Note: * indicates the number of lags used.

Table A2. Structural VAR estimates

Source: Authors' computation using Eviews 9.5.

Matrix A outcome						
1	0	0	0	0	0	0
–2.703724	1	0	0	0	0	0
8.795149	18.33516	1	0	0	0	0
405.6131	50.34943	1.311229	1	0	0	0
1.363185	–0.004430	–0.002940	0.001856	1	0	0
1.499741	–0.167573	–0.006011	0.001057	–0.278926	1	0
–0.212321	0.057572	0.001130	–0.001314	0.217014	–0.436591	1
Matrix B outcome						
0.011733	0	0	0	0	0	0
0	0.145846	0	0	0	0	0
0	0	2.757069	0	0	0	0
0	0	0	9.275774	0	0	0
0	0	0	0	0.022956	0	0
0	0	0	0	0	0.025098	0
0	0	0	0	0	0	0.028694

Note: * Structural VAR is just identified.

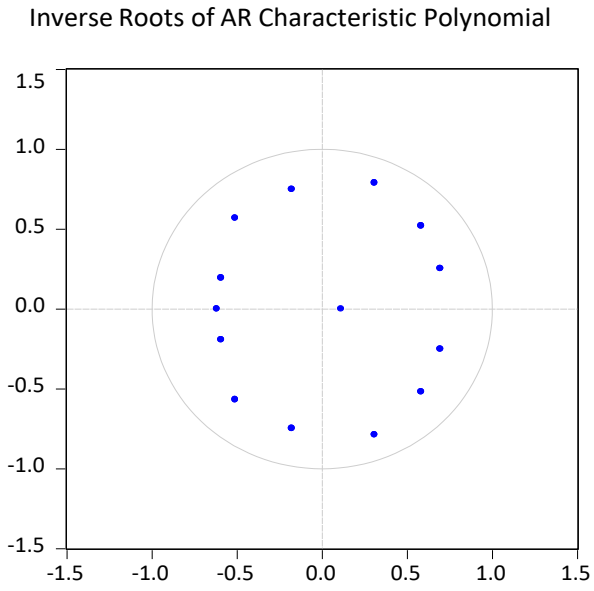

Figure A1. Stability test for the structural VAR

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