# Does CBN Intervention Funds Contribute to Inflationary Pressure in Nigeria? An Empirical Investigation

**Akinboyo Olorunyomi Lawrence**

*Abstract: The objective of this paper is to empirically evaluate the effects of the Central Bank of Nigeria's (CBN) intervention on inflation in Nigeria from 2007M12 to 2020M8. The paper employed a three-variable Vector Error Correction Model (VECM), with headline inflation examined as an endogenous function of the CBN's intervention funds and exchange rate movements. The study finds that the CBN's interventions through credit-easing to specific industries reduce inflation in the long term, particularly food inflation. The outcome suggests a divergence in the effects of unconventional monetary policy between developed and developing countries. It also established that there is a three-month policy lag window in CBN's response to inflation using intervention funds. This is consistent with the claim that central banks of developing countries are more flexible in their approach and rely more frequently on 'unconventional' monetary policy tools, with evidence that these tools have been successful in a stagflation economy. Nonetheless, the country still faces high supply-side inflation rates, which suggests that these tools should be improved to increase efficiency and impact.*

*Keywords: Nigeria, Central Bank, Intervention Funds, Inflation & VECM JEL Codes:*

## I. INTRODUCTION

In Nigeria, a significant gap exists between the demand and supply of credit, especially for Micro, Small, and Medium Enterprises, as evidenced by the substantially high lending rates. This gap is sustained by the perceived risk of lending to the private sector, as well as double-digit domestic inflation and high transaction costs. Paradoxically, Nigeria's spiralling inflation is mainly supply-side driven; thus, it cannot be resolved without increased lending to the private sector for sustained investment. Consequently, to forestall inflation, the Central Bank of Nigeria (CBN) intervened using unconventional monetary tools to ease the supply of credit and bolster economic growth. The CBN interventions began in the 1980s; however, following the 2007/2008 global financial crisis, they were ratcheted up to stimulate the declining economy further. By 2010, the CBN's real sector intervention policy focus was formalised with the creation of the Development Finance Department.

Over the next decade, the CBN instituted various interventions to galvanise domestic production and economic growth. These unconventional measures were primarily targeted at addressing the rigidities that hinder appropriate risk-taking by the banking industry and constrain the flow of necessary funding to critical sectors of the economy. The weak transmission channels of the traditional monetary policy tool further necessitated this approach. There have been numerous interventions, some of which include: NEMSF, NIRSAL, CACS, ACGSF, ACSS, RSSF, ABP, PAIF, Textile Sector Intervention Fund, RRF. In addition, the Bank initiated a N620 billion bailout for deposit money banks (DMBs) in 2009 to shore up the balance sheets of banks that had been severely affected by exposures to the oil and gas sector following a significant decline in the international price of crude oil. The N220 billion Micro, Small and Medium Enterprises Development Fund (MSMEDF), Nigeria Incentive Based Risk Sharing for Agricultural Lending (NIRSAL), Power and Aviation Intervention Fund (PAIF), Real Sector Support Fund (RSF), Anchor Borrowers Programme (ABP), Youth Enterprise and Innovation Development Fund (YEIDF), Agriculture and Small and Medium Enterprises Investment Scheme (AgSMEIS), among others. In recent times, in response to the current health pandemic, a N50 billion Household and SMEs Support Facility and a N100 billion Health Intervention Fund were rolled out. Hope Moses-Ashike (2021). However, as a result of these outlays, the central bank's balance sheet has expanded significantly.

Moreover, inflation rates have begun to rise once more, which calls into question the efficacy of the interventions. Ideally, interventions which target the real sector should not lead to increased inflation. However, if these interventions are not firmly channelled, they could improve liquidity and merely worsen the inflationary pressure in the economy. Subsequently, the excess liquidity could lead to increased lending to the government, which drives up interest rates in the domestic economy through crowding out, further exacerbating the inflation conundrum. While funding from the central bank has become a cornerstone of Nigeria's recent economic successes, it also raises questions about policy conflicts and the central bank's sphere of influence. No doubt, the country may have been worse off without CBN interventions, but issues of sustainability, in terms of implementation, impact on the balance sheet, and inflation, arise. How have CBN intervention funds altered its historical operational functions? The possible threats of excess liquidity in the Bank's balance sheet and its implications on monetary policy management are discernible.

*Retrieval Number:100.1/ijef.B2547113223*
*DOI:10.54105/ijef.B2547.113223*
*Journal Website: www.ijef.latticescipub.com*

21

*Published By:*
*Lattice Science Publication (LSP)*
*© Copyright: All rights reserved.*

First, the intervention and its liquidity undertones could exacerbate inflationary pressures in the economy. In other words, an increased money supply following intervention could lead to excessive money in circulation, weakening the purchasing power of the naira. Second, excess liquidity can lead to an increase in lending to the government, as well as the extension of credits to the private and core private sectors. It can also result in capital flight from the domestic economy to other economies through the rent-seeking behaviours of economic agents. Such an increased liquidity surge, consequent upon increased intervention, can exert significant pressure on the exchange rate (dollarisation). Such a scenario can underpin financial contagion and lead to breaches of corporate governance codes. Hence, the primary objective of this paper is to empirically examine the impact of the Central Bank of Nigeria's (CBN) intervention on inflation in Nigeria. This is imperative, as substantial funding for these interventions has been based on theoretical assumptions and micro-level evaluations. A failure of the supposed linkages would pose inherent risks to the efficacy of monetary policy, macroeconomic stability, and the operational processes of the Bank (through its balance sheet). An exegesis of intervention funding from the Central Bank of Nigeria would provide a valuable body of work for policy consideration within the bank and among its fiscal (and development) partners. It would also promote the availability of information on the inclusion of development mandates in central banking of developing countries, for further research and analysis.

## II. STYLIZED FACTS

### 2.1. CBN Intervention and Nigerian Economy

The CBN has intervened in the economy through equity investments in many Development Finance Institutions (DFIs) and subsidised lending to these Institutions. In addition, the Bank has undertaken direct interventions (not in collaboration with the Federal Government of Nigeria) in the real sector of the economy through commercial and microfinance banks. The Bank's involvement in real sector interventions was part of the effort to address the country's unique development challenges. The Bank's interventions in the real economy aim to achieve a variety of economic objectives, including reducing poverty and providing easy access to credit to provide the necessary impetus for the development of priority sectors. This is particularly relevant considering the current economic trend in Nigeria and the gap that exists between the demand and supply for domestic resources. Indeed, the philosophy behind CBN's interventions is to influence the cost of production of firms, ensuring lower prices. A concessionary interest rate implies that firms can borrow money to invest in their capital stock and pay a lower interest rate for it. It can also help transition the real economy from being primarily focused on producers to manufacturers by providing low-cost and long-term funding for companies involved in large-scale production activities. Moreover, in Nigeria, where food accounts for over 50 per cent of the consumer basket (as computed in the Consumer Price Index (CPI)), the Bank's intervention to boost agricultural output will certainly help dampen food prices, and this in turn will reduce inflation. Indeed, the CBN is highly committed to intervening in the economy, as evidenced by its various initiatives since 1978.

### 2.2. Sectoral Review

The Bank's interventions are focused on stimulating credit to the real sector for job creation and wealth generation, as well as promoting economic diversification. The interventions are therefore targeted at critical sectors of the economy with a high multiplier effect. These sectors include agriculture, manufacturing, aviation, infrastructure, and health. The choice of these sectors is premised on their relative importance and contribution to the Nigerian economy.

*2.2.1. The Agriculture Sector*

Nigeria's agricultural endowment is enormous, ranging from diverse climates in the south to the arid zone in the north. The country's vegetation is rich and viable for crop and livestock production. Nigeria has a land area of 98.3 million hectares, out of which 71.2 million hectares are considered cultivable (72.4 per cent of the total land area) (S. Famoriyo, 2021). These potentials undoubtedly present agriculture as a strategic means of addressing Nigeria's challenges of economic growth, wealth creation, employment generation, and food security. Despite the dominant role of the petroleum sector as the primary foreign exchange earner, agriculture remains the largest non-oil export earner, the largest employer of labour, and a key contributor to wealth creation and poverty alleviation. However, the transfer of these investible surpluses does not take place without a significant capital investment in the agricultural sector. Consequently, there was a need to intervene in the industry, particularly in addressing the market's inability to achieve equilibrium in the demand and supply of financial and capital funds to the agricultural sector.

*2.2.2. The Manufacturing Sector*

Although the manufacturing sector has the potential to create wealth and employment, its contributions to GDP and jobs have stagnated over the years, remaining dismal. The activity mix in the sector is also limited and dominated by import-dependent processes. The manufacturing sector faces several constraints; however, access to investible resources, including long-term finance and funds, has posed a grave challenge that has impeded the effective use of other factors of production. Therefore, there is a need to provide strategic interventions that stimulate the flow of finance to the manufacturing sector.

*2.2.3. The Infrastructure Sector*

Nigeria's infrastructure does not meet the needs of the average investor, which inhibits investment and increases the cost of doing business. Power is strategic and represents the most critical infrastructure requirement for advancing the private sector. It is estimated that poor infrastructure indirectly accounts for an additional 16 per cent of the cost of sales. Consequently, it is essential to intervene in the power sector to create a favourable investment climate that reduces generation deficits, enables the rehabilitation of installations, expands transmission and distribution networks, and increases rural access to electricity. World Bank(2022)

**Table 1: Sectoral Intervention**

| Sectors | Agriculture Sector | Manufacturing Sector | Infrastructure – Power | Entrepreneurship Development |
|---|---|---|---|---|
| Interventions | CACS | SME – RFF | PAIF | MSMEDF |
| | Anchor Borrowers' Programme | RSSF | NEMSF | YEDP |
| | National Food Security Programme | Textiles Interventions | | |
| | | Export Stimulation Facility | | |

**Table 2: Interventions and the Targets**

| Intent | Objectives | Deliverables | Overall Targets |
|---|---|---|---|
| Diversified economy with increasing inclusive economic growth and improved employment generation capacities | • Stimulate finance to the real sector of the economy<br>• Improve access to Finance | De-risk lending to targeted sectors | 20% Increase in access to finance by MSMEs annually |
| | | | 5% Increase in access to finance for women's Businesses annually |
| | | Ease the challenge of collateral requirements | 20% Increase in the use of movable assets as collateral annually |
| | | Reduce the Cost of borrowing | 5% Decrease in the rate of lending to MSMEs annually |
| | • Accelerate financial inclusion | Increase in % Nigerian adults that formal financial institutions serve from 43% in 2012 to 48.6% in 2019 | 66% of the Adult population will be using Payments by 2019 |
| | | | 56% of the Adult population will be using Savings by 2019 |
| | | | 73% of the Adult population will be using credit by 2019 |
| | • Improve productivity and economic growth | Ramp production of key agricultural produce | 5% Increase in the output of focal commodities annually |
| | | Stimulate .exports of agricultural produce | |
| | • Improve Infrastructure Efficiency | Improve electricity market efficiency | 500MW Increase in on-grid power generation annually |
| | | Increase captive power generation and utilization. | |
| | Create jobs | | 5% Increase in jobs created through interventions annually |

**Table 3: Intervention During COVID-19**

| S/N | Intervention Type | Sector |
|---|---|---|
| 1 | N50 Billion Targeted Credit Facility | SMEs/Household |
| 2 | N100 Billion Health Sector Intervention Facility | Health Sector |
| 3 | N1 Trillion COVID-19 Intervention for the Manufacturing Sector | Manufacturing |
| 4 | Health Research and Development Intervention Facility | Health and Education |
| 5 | Interest rate reduction from 9% to 5% for one (1) year, effective 01 March 2020. | Interest rate on all applicable CBN's intervention facilities |
| 5 | Extension of moratorium of one (1) year granted on all principal repayments, effective 01 March 2020. | All CBN's interventions |

Central Bank Balance Sheet: Between 2007 and 2020, the central bank's asset-side balance sheet expanded by 1801.84%. Year on year, in August 2020, it grew by 32.98%. This growth has been driven by both an increase in claims on the central government and claims on the private

sector. The expansion in the private sector is dominated by claims on other financial institutions, which account for over 90%.
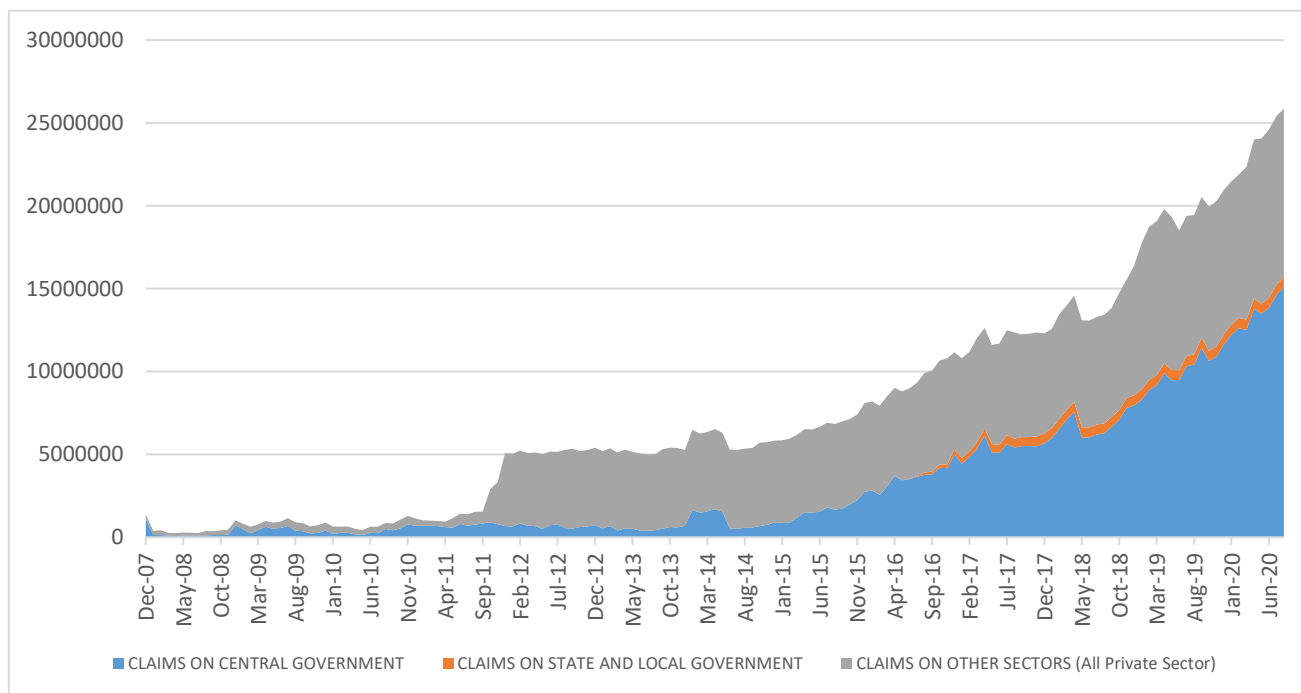


*Source: Central Bank of Nigeria (2021)*

**Figure 1: Central Bank Balance Sheet (Assets)**
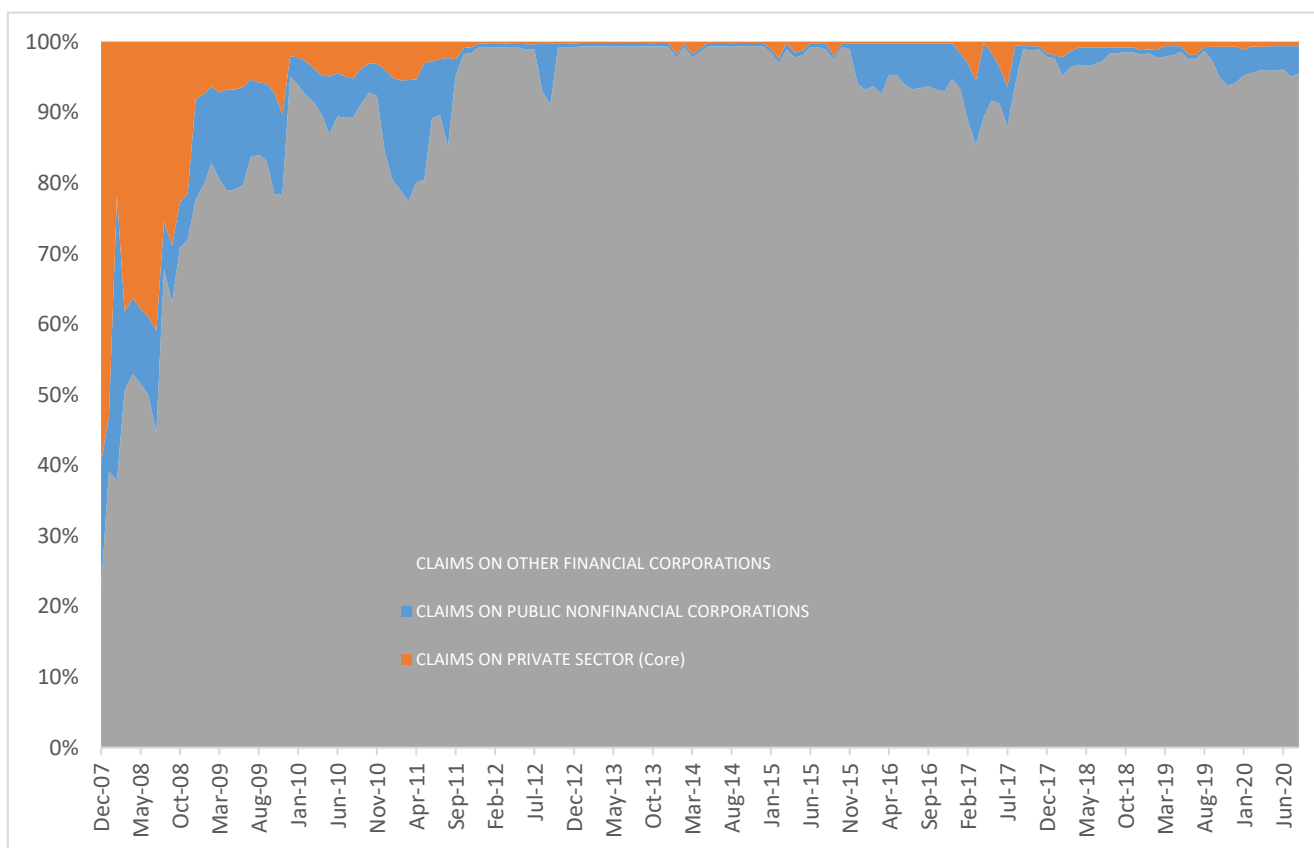


Source: Central Bank of Nigeria (2021)

**Figure 2: Claims on the Private Sector**

Broad money (M2) shows a general increase in trend over a long period. For the first six months of fiscal 2020, it rose to N32,451.40 billion at end–June 2020, representing an increase of 12.74%, compared to the level at end-December 2019. The prime lending rate has been relatively stable, ranging from 16 to 17%. In April 2019, the rate increased to 18.23%, before declining to 11.76% by August 2020. Contrarily, however, the maximum lending rate has risen from 17.58% in April 2008 to 29.51% in August 2020, representing a 40.42% increase within the period.
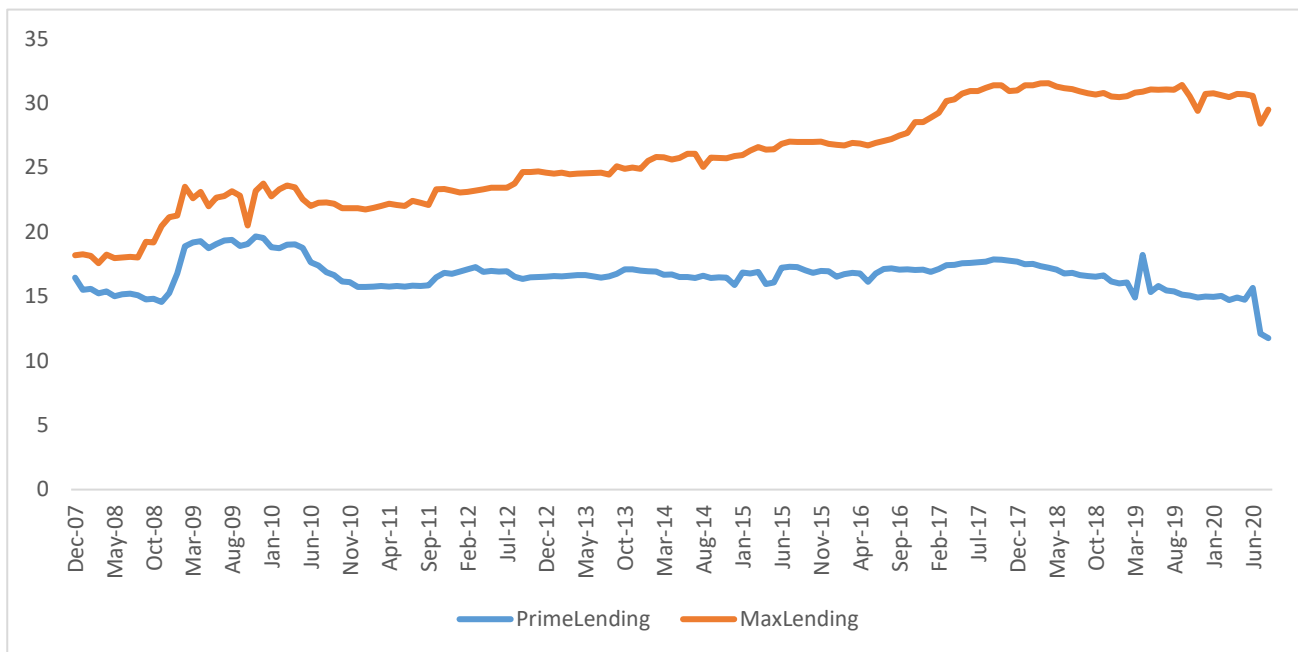
**Figure 3: Prime and Maximum Lending Rates**
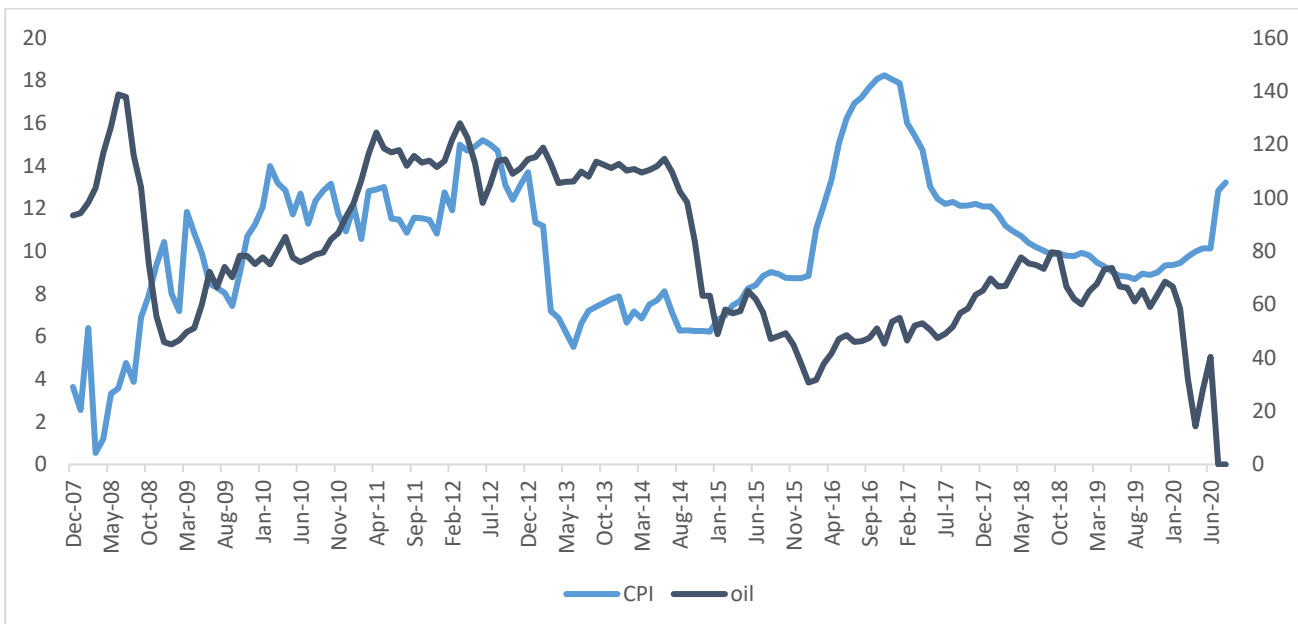


**Figure 4: Inflation and Bonny Oil Price**

In March 2014, the inflation rate fell to 7.78%, the lowest in a decade, driven by lower food prices. However, by September 2020, inflation had reached 13.71%, following a 13th consecutive month of expansion. At the same time, the oil price fell to $44 per barrel in January 2009, following the global financial meltdown. In April 2012, the oil price peaked at $122.62 per barrel, driven by stronger oil demand and concerns about potential supply disruptions linked to Iran's nuclear program.

U.S Energy Information Administration (2013). The oil price plunged to $ 31.7 in February 2016, owing to the escalation of tensions between Russia and Saudi Arabia, sparking fears of an imminent all-out price war. As of April 14, 2020, the oil price had fallen sharply to as low as $ 14.28 per barrel, with the ramifications of the COVID-19 pandemic as the main driving force, resulting in an unprecedented worldwide oil demand shock and massive sell-offs in the global oil markets, with a significant crude surplus— Organization of Petroleum Exporting Countries (2021). The exchange rate began to rise from November 2015 and peaked at N494 per dollar in February 2017, due to a decline in oil prices and forex scarcity caused by high demand. Thereafter, it maintained stability from September 2017 until the outbreak of the COVID-19 pandemic in early March 2020. The market volatility resulted from demand pressure coupled with liquidity scarcity following oil price shocks in the global oil market. From March to June 2020, at the BDC segment, the naira depreciated by 26.74% to an end-period rate of N455.00/US$ at the end of June 2020, from N359.00/US$ at the end of February 2020.
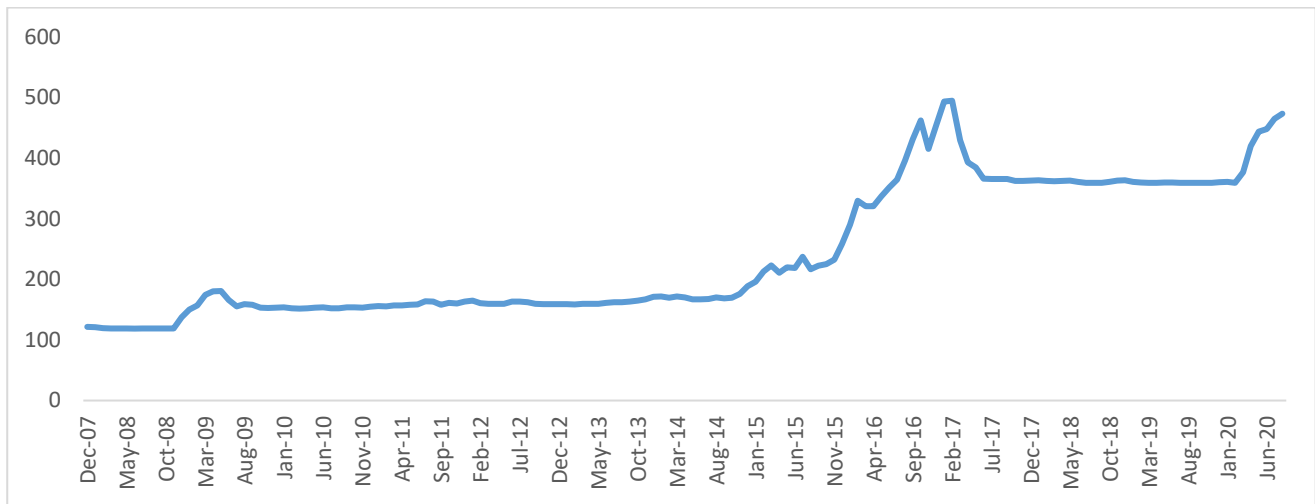
**Figure 5: Bureau De Change (BDC) Exchange Rate**

## III. EMPIRICAL AND THEORETICAL LITERATURE REVIEW

The unconventional monetary policy involved the purchase of assets from private institutions, such as Credit institutions, non-financial and financial organisations. At the same time, corresponding claims were held by their banks against the Bank of England, also known as reserves. This automatically increased the money supply in the economy. Michaelis & Watzka (2017) affirm that the monetary authority in England has enabling laws that allow it to respond by holding primary market instruments in real-time. Studies abound on the critical assessment of quantitative easing in both developed and emerging market economies, and robust frameworks have also been developed for the practical evaluation of these policies. Michaelis & Watzka (2017)[21] for instance examined the efficacy of unconventional monetary policy in Japan with a time-varying parameters vector autoregression model. The outcome suggests that both the core CPI and real GDP indicate significant time variation in their responses. Miyakoshia et al (2017)[22] in their study evaluated the impact of quantitative easing on the stock prices of eight Asian Emerging Markets and Federal Reserve, European Central Bank and Bank of Japan between 2001–2016. The results indicated that the stock prices of the selected countries increased as a result of the quantitative easing policy. Researchers have also investigated quantitative easing with special attention on the following special areas, including:(Kryzanowski, Zhanga, & Zhong, 2017)[16] evaluate correlation of quantitative easing and cross financial market; Lim & Mohapatra, 2016)[19] also investigated the promotion of financial flows to developing countries during the post-crisis era with the help of quantitative easing; the impact of policies of quantitative and qualitative easing in the Bank of Japan as promoted by Matsuki, Sugimoto, & Satomac, 2015)[20]; (Belke, Gros, & Thomas, 2017)[2] also evaluted the efficacy of quantitative easing policy of the Federal Reserve. Other studies also include Japan's existing quantitative easing of fiscal cost (Fujiki & Tomura, 2017)[11], quantitative easing's effect in the European area, the United Kingdom, Japan and the United States (Hausken and Ncube, 2013)[12]; bank lending implications of quantitative easing (Bowman, Cai, Davies, & Kamin, 2015)[4], assessments of counterfactional (Pesaran & Smith,

2016; Barroso, Pereira da Silva & Sales, 2016)[1][28], and the bond market side-effects of quantity easing (Steeley, 2015)[31]. Some studies have recognized anecdotal evidence to show the side-effects of quantitative easing on exchange rates, inflation and interest rates (Moosa, 2014 and Brown, 2015)[5][23].

The CBN interventions can be contextualised within the monetary policy framework through their effect on the central bank's balance sheet. By design, any transaction undertaken by the central bank, from foreign exchange operations to emergency bailouts, is reflected in the central bank's balance sheet. However, a significant expansion and/or rebalancing of the central bank's balance sheet is a key component of non-interest rate monetary policies. Such that, these unconventional policies are now referred to as balance sheet polices (Rule et al., 2015)[29]. The discussion on balance sheet policies is further couched in terms of quantitative easing (QE) and credit easing (CE), although the two terms are often conflated. Hence, we follow Klyuev, de Imus, and Srinivasan (2009)[15]; van den End and Pattipeilohy (2015)[32] to distinguish quantitative easing as the targeted increase of commercial bank reserves through the purchase of government securities, which expand the central bank balance sheet on the liabilities side. Credit easing is the intervention in specific markets to increase liquidity and the availability of credit, or reduce the cost of credit, through the purchase of private assets. Therefore, the CBN interventions, characterised by lowered interest rates and increased loan outlays for specific industries, disbursed through commercial banks, can be evaluated as a balance sheet policy and credit easing policy. A central bank's balance sheet affects the real sector through the restructuring of the private sector balance sheets. By adjusting its assets and liabilities, central banks can increase commercial banks' reserves and thereby liquidity in the money market. This should stimulate credit creation, economic growth and inflation. In addition, credit easing policies directly affect bond yield and private sector borrowing costs, which should further bolster economic growth and inflation (Borio & Disyatat, 2010)[3].

However, these theoretical underpinnings have not been strongly supported. Fawley, Neely, et al. (2013)[10] assessed balance sheet expansion in major central banks – the FED, ECB, BOJ and BOE – and found that despite the different policy modifications, they all led to an immediate increase in the monetary base, which, remarkably, did not transmit to higher inflation. They suggest that this was due to banks reportedly withholding funds made available, citing increased risk from economic uncertainty.

Klyuev et al. (2009) specified an unrestricted VAR model to estimate the effect of quantitative and credit easing in various countries. While, Fasano-Filho, Wang, and Berkmen (2002)[9] estimated a structural vector autoregressive model (SVAR) for the Bank on Japan's to assess the impact of its expansionary balance sheet policy. They both found that while output was weakly but positively impacted, inflation rates remained unyielding. Others, such as Yue and Leung (2011)[33] study the impact of QE in the US through an event study model but, likewise, report weak responses in inflation rates. Although this may be due to adverse signalling effects. Chen, Filardo, He, and Zhu (2012)[6] estimated a vector error correction (VECM) model which showed that QE in the US increased capital inflow into Asian countries. The literature on the effect of balance sheet policies in Nigeria or other emerging African markets is scarce. This may be due to the flexibility in the central banking objectives of emerging economies, such that these policies are not viewed as an extension of monetary policy, but rather as development initiatives to be evaluated on a micro-level. There are numerous studies on the efficacy of specific CBN intervention programs (see: Dori (2016)[7]; Evbuomwan and Okoye (2017)[8]; Olanrewaju, Osabohien, and Fasakin (2020)[26]; Oyefuga, Siyanbola, Afolabi, Dada, and Egbetokun (2008)[27]; Saheed, Alexander, Isa, and Adeneye (2018))[30] and there are other non-empirical studies such as Olaitan et al. (2015)[25] which give a cursory overview and extrapolate based on theoretical underpinnings. Only recently have we had studies that evaluated the impact of the CBN intervention in its entirety using the balance sheet expansion. Kure, Mbutor, Rotimi, and Adamu (2019)[17] analysed the monetary effects on the CBN's balance sheet using an unrestricted VAR model, and found evidence of a mild decline in inflation and weak improvement in economic growth. Similarly, Okotori and Gbalam (2020)[24] found little to no impact on GDP and inflation when specifying for an error correction model. Hence, this paper will build on the Klyuev et al. (2009) identification strategy using a Vector Error Correction (VEC) model to assess the impact of the CBN's intervention schemes on inflation. We deviate from Kure et al. in that we are specifically focused on estimating the effect of credit-easing policies, rather than the entire balance sheet. In addition, we decomposed inflation to account for the asymmetric impact that may stem from specific policy focuses, such as agricultural credit expansions. We hope to further contribute to the understanding of the impact of unconventional monetary policies in emerging markets and inflation dynamics.

## IV. METHODOLOGY

### 4.1. Main Model and Extension

The model utilised in this paper is a three-variable Vector Error Correction Model (VECM); in which headline inflation is examined as an endogenous function of the CBN intervention funds and exchange rate movements. For further robustness, we re-specify the model using food inflation as the primary variable, while retaining other variables to test for asymmetric responses within inflation components.

### 4.2. The Vector Error Correction Model

The VECM evaluates the long-run relationship between cointegrated variables. It is an extension of the vector autoregressive model (VAR), which utilises a maximum likelihood estimator to decompose the long-run convergence patterns from the short-run adjustment dynamics. Hence, the VECM contains both the long and short-run cointegrated relations in its Y vector. In VECM, the estimated co-integration term is known as the error correction term because it measures the deviation from the long-run equilibrium, which is corrected gradually through a series of partial short-run adjustments (Johansen and Juselius, 1990)[14]. Thus, the model can be expressed as follows:

Based on a vector autoregressive model containing I(1) cointegrated variables, such that

$$y_t = \mu + \Gamma_1 y_{t-1} + \cdots + \Gamma_p y_{t-p} + \epsilon_t$$

After subtraction of lag terms, which makes the model stationary, and collation of like-terms, the VECM model is then given by:

$$Dy_t = \mu + \left(\sum_{j=1}^{P} \Gamma_j - I\right) y_{t-1} + \sum_{i=1}^{P-1} * \left(-\sum_{j=i+1}^{P} \Gamma_j\right) Dy_{t-1} + \epsilon_t$$

New notation for the coefficient matrices gives:

$$Dy_t = \mu + \Pi y_{t-1} + \sum_{i=1}^{P-1} \Gamma_i^* \, Dy_{t-1} + \epsilon_t$$

$$\Pi = \sum_{j=1}^{P} \Gamma_j - I \ \text{ and } \ \Gamma_i^* = -\sum_{j=i+1}^{P} \Gamma_j$$

Where: $y_t$ is an m×1 vector of variables like in a VAR; $D_{yt}$ is an m×1 vector if the first differences of the variables in $y_t$; μ is an m×1 vector of intercept coefficients; Π and the Γ*'s are m×m coefficient matrices; $\varepsilon_t$ is an m × 1 error vector with contemporaneous correlation but no autocorrelation, like the error vector in a VAR. $\Gamma_i^*$ s tells about the short-run dynamics, and Π tells about the cointegrating relationships.

### 4.3. Data

CBN's *Asset Claims on Other Financial Institutions*, a component of the CBN's Balance sheet, was utilised as a proxy for the expended CBN credit-based intervention fund. This was for the following reasons:

i. No intervention funding is released without being recorded in the balance sheet.

ii.  Credit-based intervention funds are not disbursed directly by the CBN, but rather through financial institutions, such as private banks and microfinance institutions. Thus, they are recorded in the balance sheet under 'Asset claims on Other Financial Institutions'.

iii.  A cursory view of the balance sheet shows a correspondence between the asset claims on OFIs series and the reported news of CBN intervention activities. Notably, a steep increase in the CBN's asset claims on OFIs in 2010 is observed following the establishment of the Development Finance department, and once again in 2016, following the recession.

iv.  Time-series data on the quantum of CBN intervention releases have not been published.

In the paper, CBN's 'Asset Claims on Other Financial Institutions' is referred to as *credit*. It was log-transformed to account for its relative size and was thereafter referred to as *lncredit*. The year-on-year (Y-o-Y) growth rate of the consumer price index served as the proxy for inflation in the main model and is referred to as CPI. However, in the secondary model, headline inflation is substituted for food inflation; thus, the inflation proxy becomes the year-over-year (Y-o-Y) growth rate of the food component of the consumer price index, and is therefore referred to as *fcpi*. The exchange rate (exch) variable is the Bureau de change (BDC) exchange rate, selected for its more extended period as well as its proximity to free market indicators.

The sample is monthly and spans December 2007 – August 2020, thus consisting of 153 observation periods. All data was collected from the CBN's balance sheet report and the CBN's quarterly statistical reports.

**Table 4: Summary Statistics**

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|----------|-----|------|-----------|-----|-----|
| credit | 153 | 3995271 | 2702181 | 54125.3 | 9177034 |
| cpi | 153 | 11.85327 | 2.843512 | 6.56 | 18.72 |
| fcpi | 153 | 13.3183 | 3.360037 | 7.876968 | 20.88047 |
| Exch | 153 | 242.4018 | 109.505 | 118.7 | 494.7 |
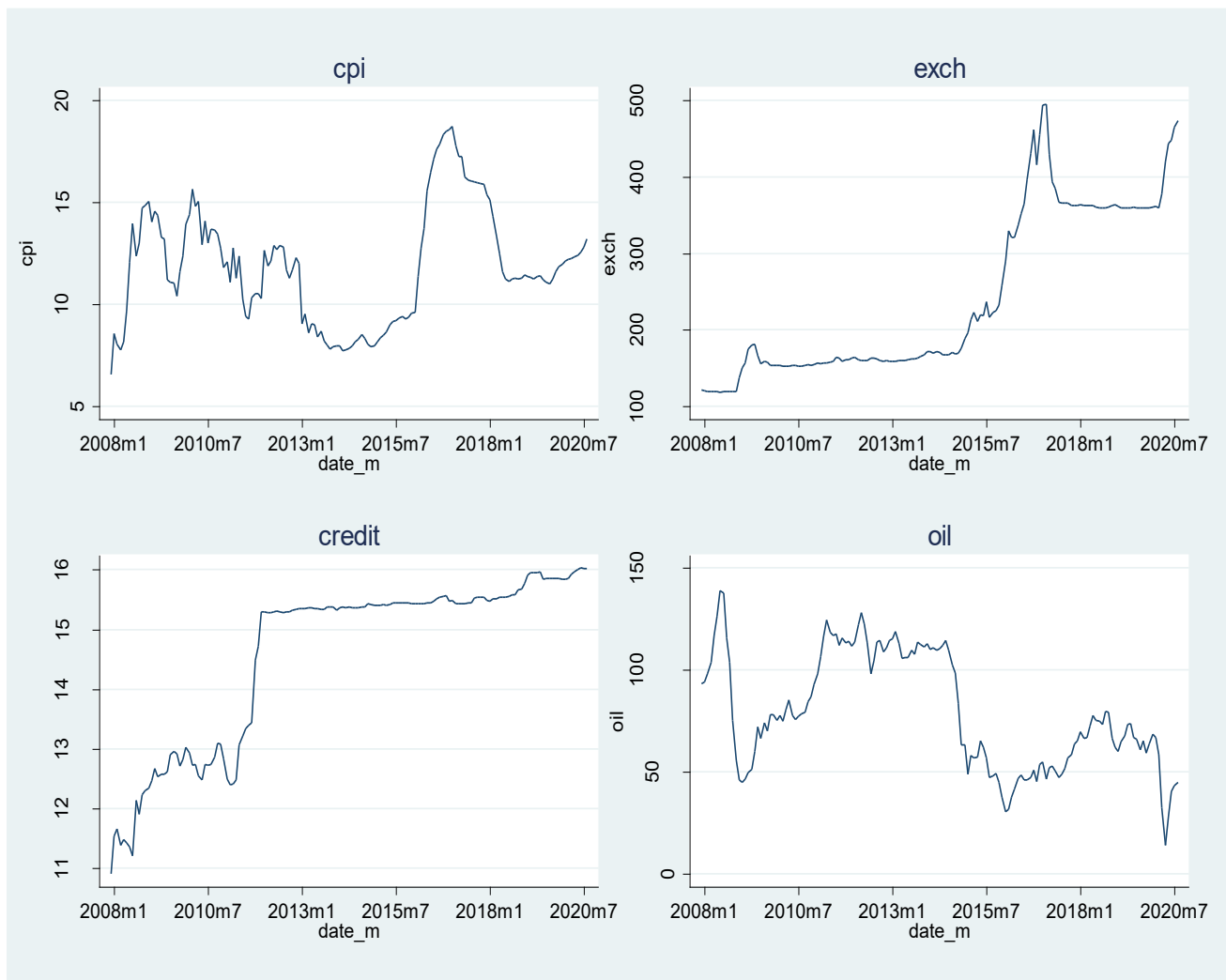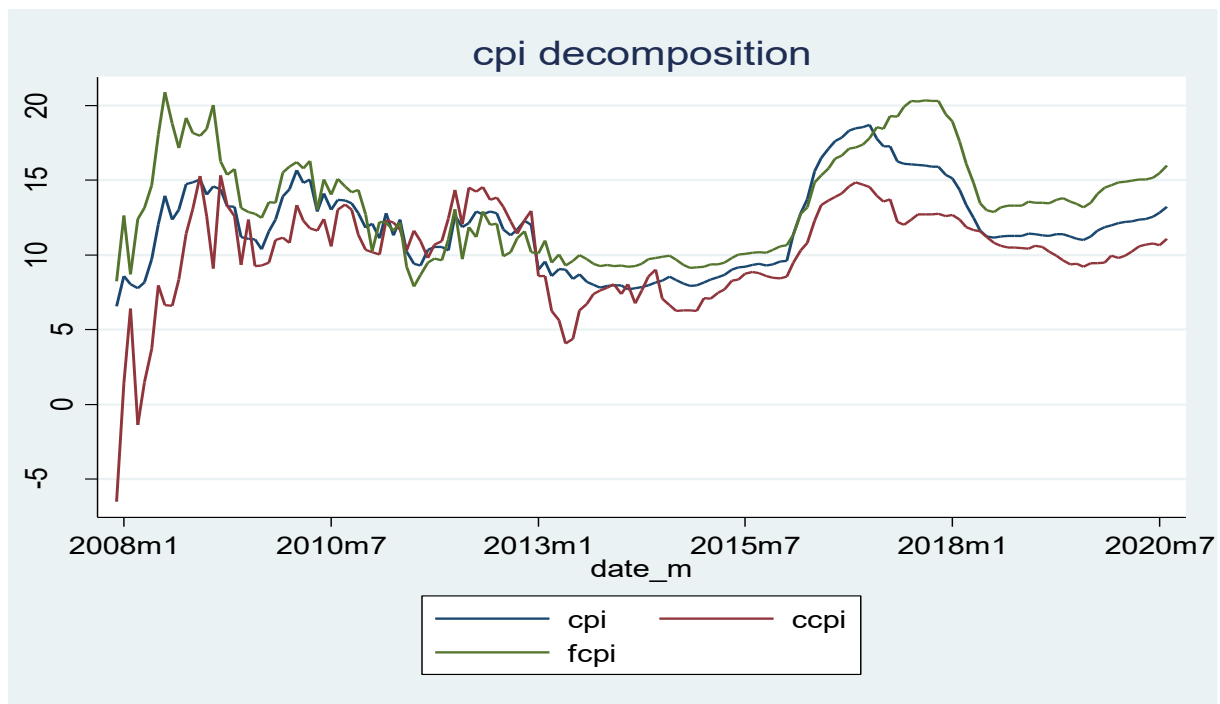
## V. RESULTS AND DISCUSSION

### 5.1. Pre-Estimation Test

#### 5.1.1. Unit Root test

The Augmented Dickey-Fuller (ADF) and the Phillips–Perron (PP) test was applied to test for stationarity of the variables. Both tests found that all the included variables were non-stationary at the level and stationary at their first difference at a 1% significance level.

**Table 2: ADF and PPP Unit Root Tests Table**

| Variable | ADF | | PP | |
| --- | --- | --- | --- | --- |
| | Level | First Difference | Level | First Difference |
| credit | -2.332 | -5.908*** | -2.647* | -12.109*** |
| cpi | -2.721* | -4.812*** | -2.517 | -12.112*** |
| fcpi | -2.24 | -5.002*** | -2.492 | 15.093*** |
| exch | -0.134 | -4.148*** | -0.004 | -8.725*** |

*Notes: **** denotes rejection of the null at 1% significance level using the t-stat approach*

#### 5.1.2. Determination of lags

The lag length was determined using six (6) different lag selection criteria: the Likelihood Ratio (LR), Final Prediction Error Criterion (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ). For the headline inflation model, the maximum lag was set at 24 periods (2 years), and the optimal lag, as given by the FPE, was 3, with an AIC of 24. For the food inflation model, the optimal lag was determined to be 4, as indicated by both the FPE and AIC, given a maximum lag of 12 periods (1 year). A longer lag period was introduced in the headline inflation model to account for relatively stable core inflation (excluding food and energy prices). Following Liew, Venus Khim-Sen(2004)[18], we opted to use the FPE estimate which set the lag at 3 for the headline inflation model and 4 for the food inflation model.

### 5.2. Johansen and Juselius Co-integration Test

Co-integration among variables was tested for using the Johansen test (1988) [13] which is designed to measure multiple co-integration vectors. The model is set against the null hypothesis of no co-integration. The results, as shown in Table 4, indicate that the value of the trace statistic for both the trace and max exceed the 5% critical value for all ranks. Therefore, we reject the null hypothesis and conclude that there is co-integration among the variables.

**Results of Co-integration Tests**

| $Rank_{trace}$ | Parms | LL | Eigenvalue | t stat | 5% critical value |
|---|---|---|---|---|---|
| 0 | 36 | -1226.51 | . | 153.0068 | 47.21 |
| 1 | 43 | -1198.67 | 0.31184 | 97.321 | 29.68 |
| 2 | 48 | -1177.07 | 0.25167 | 54.124 | 15.41 |
| 3 | 51 | -1160.9 | 0.19516 | | |

| $Rank_{max}$ | Parms | LL | Eigenvalue | t stat | 5% critical value |
|---|---|---|---|---|---|
| 0 | 36 | -1226.51 | . | 55.6862 | 27.07 |
| 1 | 43 | -1198.67 | 0.31184 | 43.197 | 20.97 |
| 2 | 48 | -1177.07 | 0.25167 | 32.351 | 14.07 |
| 3 | 51 | -1160.9 | 0.19516 | | |

## 5.3. Vector Error Correction Model Results

### Error Correction Model

The error correction term (ECT), which measures the speed of adjustment for both models, is negative and significant at the 1% level, thereby substantiating that the model is stable and will converge in the long run. The ECT for the Headline inflation model was -0.10, which suggests that deviation from long-run equilibrium is corrected at a convergence speed of 10%. While in the Food inflation model, the convergence speed increases to 17.85% (-0.1785).

**Estimates of Short-run Coefficients on Headline Inflation**

| D_CPI | Coefficients | Std. Error | z | P>|z| |
|---|---|---|---|---|
| ECT | -0.10092*** | 0.03 | -3.49 | 0.000 |
| d_cpi | | | | |
| LD. | 0.067486 | 0.08 | 0.86 | 0.391 |
| L2D. | 0.282238*** | 0.08 | 3.66 | 0.000 |
| d_lncredit | | | | |
| LD. | -0.01375 | 0.39 | -0.04 | 0.972 |
| L2D. | -0.14155 | 0.37 | -0.38 | 0.701 |
| d_exch | | | | |
| LD. | 0.00133 | 0.01 | 0.26 | 0.795 |
| L2D. | 0.002614 | 0.01 | 0.51 | 0.610 |
| cons | 0.722232*** | 0.21 | 3.40 | 0.001 |

**Estimates of Short-run Coefficients on Food Inflation**

| | Coefficients | Std. Error | z | P>|z| |
|---|---|---|---|---|
| ECT | -0.178512*** | 0.04 | -4.37 | 0.000 |
| fcpi | | | | |
| LD. | -0.007587 | 0.08 | -0.10 | 0.922 |
| L2D. | 0.2029224*** | 0.08 | 2.64 | 0.008 |
| L3D. | 0.1727696** | 0.07 | 2.41 | 0.016 |
| lncredit | | | | |
| LD. | -0.9394179* | 0.53 | -1.78 | 0.076 |
| L2D. | -0.1686401 | 0.52 | -0.32 | 0.748 |
| L3D. | 0.9383487* | 0.51 | 1.83 | 0.067 |
| exch | | | | |
| LD. | -0.0029216 | 0.01 | -0.42 | 0.672 |
| L2D. | -0.0015856 | 0.01 | -0.22 | 0.827 |
| L3D. | -0.0076088 | 0.01 | -1.09 | 0.275 |
| _cons | 0.8177131*** | 0.20 | 4.05 | 0.000 |

**Long Term**

All variables in the model are statistically significant at the 1% level, indicating robust relationships between the variables. Due to the application of the Johansen test, the coefficients must be interpreted with the opposite sign. Hence, the results indicate that a 1% increase in intervention funds is likely to reduce headline inflation by 1.78% and food inflation by 2.39%. Furthermore, the relationship between the exchange rate and inflation fits the theoretical assumptions. In the long term, a 0.02% increase in headline inflation is associated with a depreciation of the currency. In comparison, a 0.03% increase in food inflation has a more substantial depreciation effect on the exchange rate, corresponding to 0.03% per unit change.
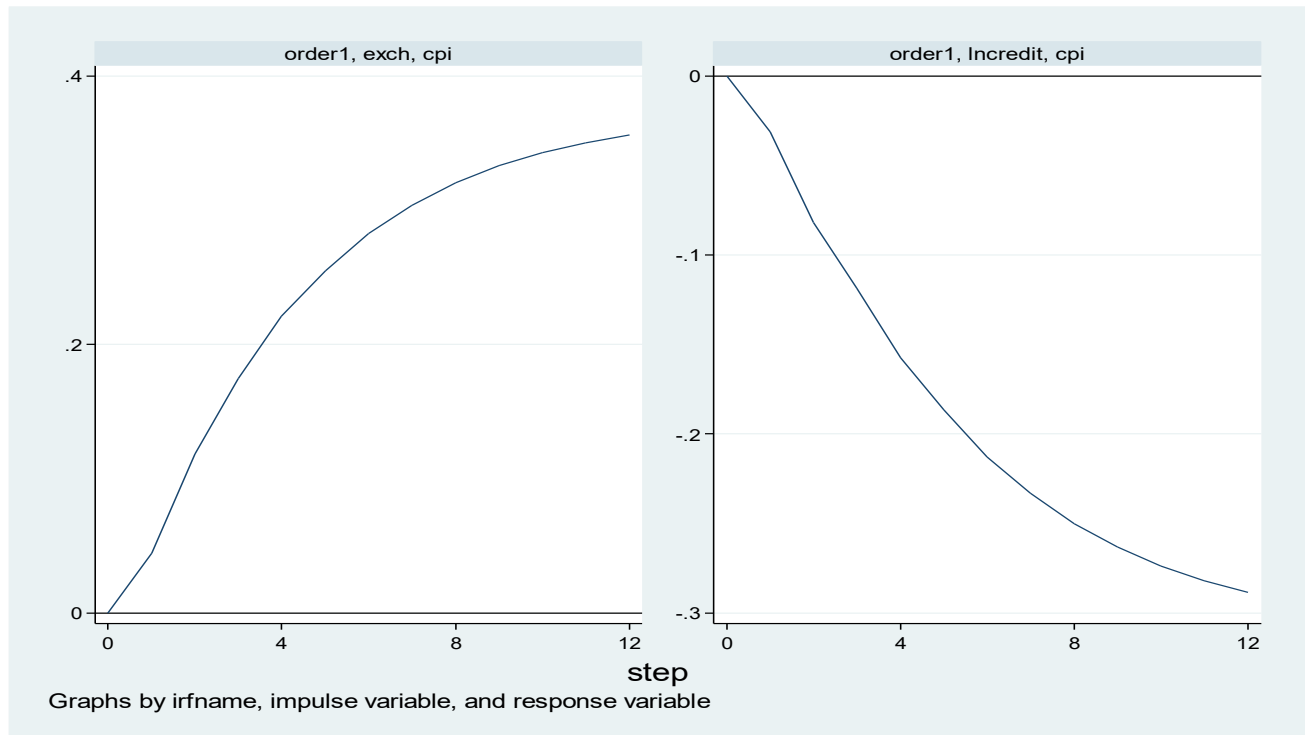
**Estimates of long-run Coefficients on Headline Inflation**

| D_CPI | Coefficients | Std. Error | z | P>|z| |
|---|---|---|---|---|
| ECT | | | | 0.000 |
| d_cpi | 1 | | | |
| d_lncredit | 1.79*** | 0.509 | -3.51 | 0.000 |
| d_exch | -0.02*** | 0.006 | -3.53 | 0.000 |
| Cons | -25.36 | | | |

**Estimates of long-run Coefficients on Food Inflation**

| D_CPI | Coefficients | Std. Error | z | P>|z| |
|---|---|---|---|---|
| ECT | | | | 0.000 |
| d_fcpi | 1 | | | |
| d_lncredit | 2.39*** | 0.373 | 6.41 | 0.000 |
| d_exch | -0.03*** | 0.004 | -6.87 | 0.000 |
| Cons | -35.80 | | | |

**Impulse Response Function (IRF)**

**Headline Inflation Model**



Graphs by irfname, impulse variable, and response variable

*Retrieval Number:100.1/ijef.B2547113223*
*DOI:10.54105/ijef.B2547.113223*
*Journal Website: www.ijef.latticescipub.com*

31

*Published By:*
*Lattice Science Publication (LSP)*
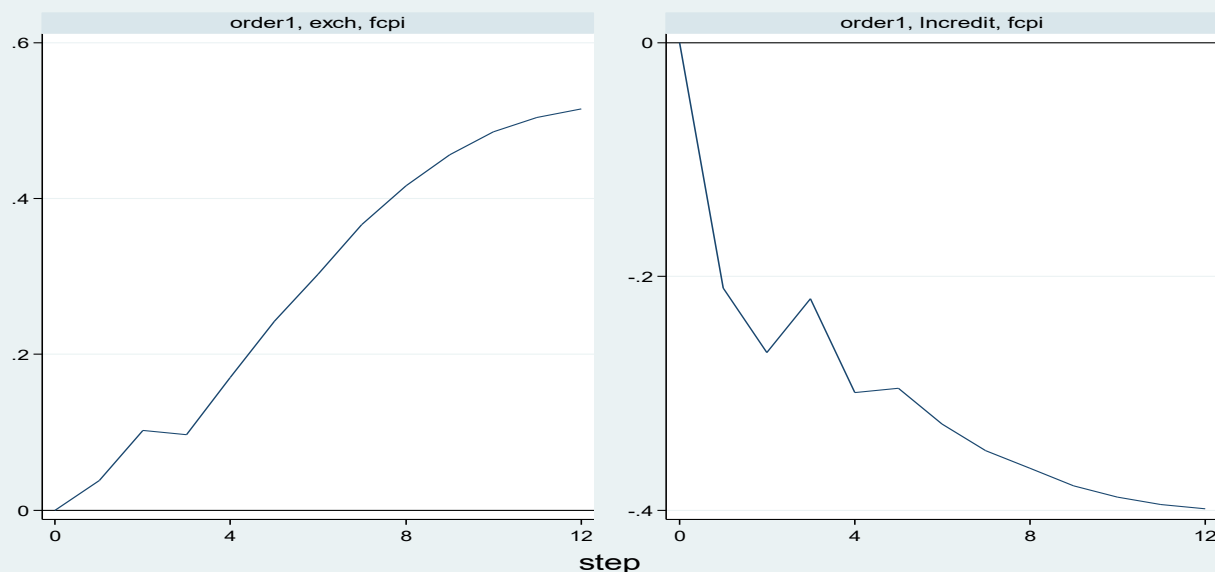*© Copyright: All rights reserved.*

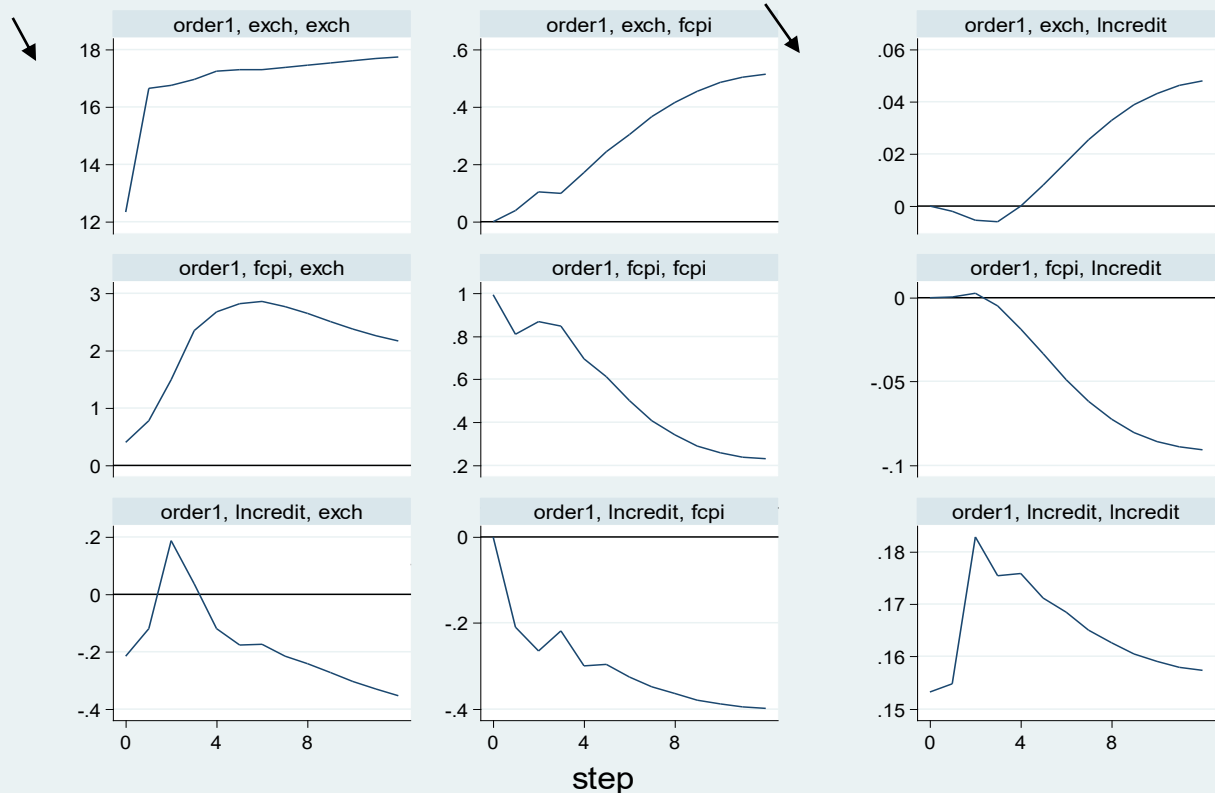Graphs by irfname, impulse variable, and response variable
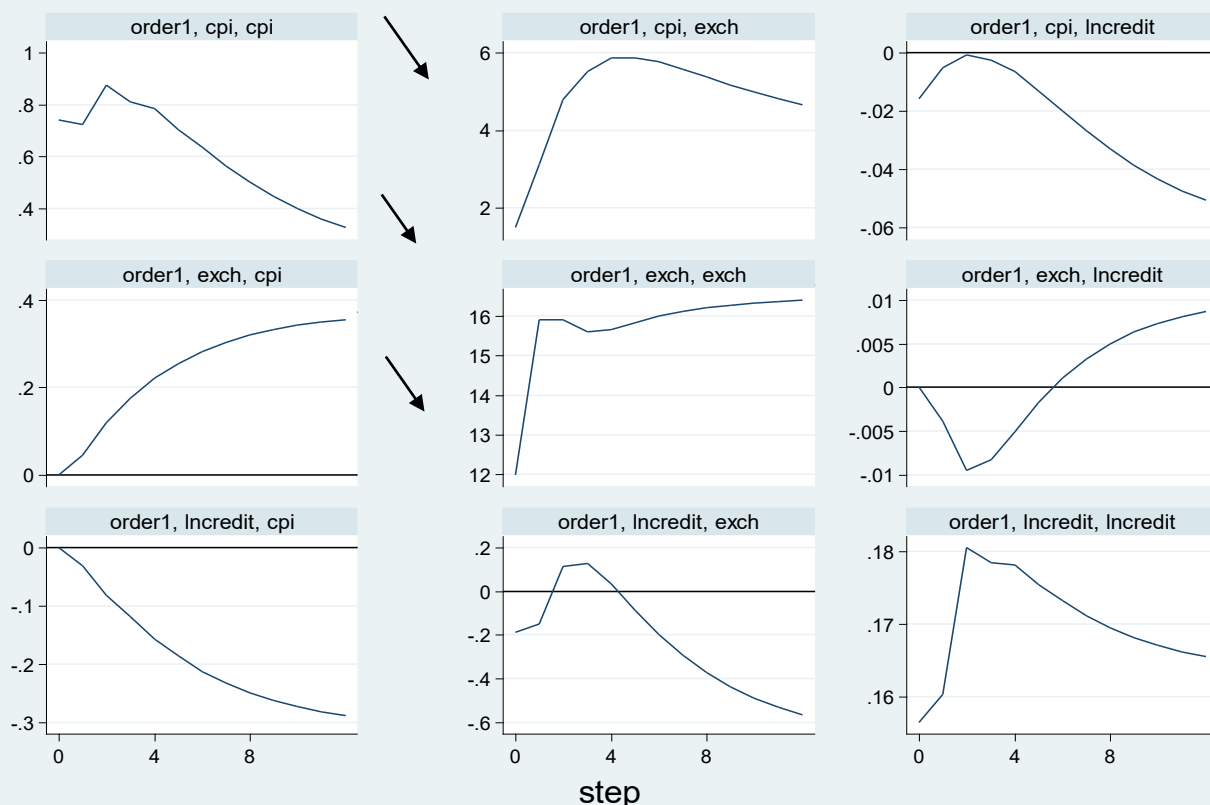
A one standard deviation positive shock to intervention funds causes a decrease in headline inflation, which is sustained for a year. At the same time, a one standard deviation positive shock to the exchange rate (depreciation) causes a sharp increase in headline inflation, which is sustained for a year. Other notable relationships include the fact that a positive shock to headline inflation causes a significant depreciation of the exchange rate. Although the impact declines over the year, the momentum of the exchange rate sustains the effect. In addition, an increase in intervention funds initially causes a depreciation in the first three months, before reverting to below the mean and then appreciating, a trend sustained for the rest of the year.

**Food Inflation Model**



Graphs by irfname, impulse variable, and response variable

Graphs by irfname, impulse variable, and response variable

As observed in the coefficients of the two models, there is an asymmetrical impact of the intervention funds on the components of inflation. The model finds that the effects of intervention funds are more substantial on food inflation. A one standard deviation positive shock to intervention funds causes a sharper decrease in food inflation, which is sustained for a year. This may be due to the focus of CBN intervention, many of which have been primarily agriculturally based. However, the model also finds that the impact of food inflation on the exchange rate is weaker than in the headline inflation model, albeit still significant.

Another notable relationship is the sustained effect of a one-standard-deviation positive shock to inflation, which causes a sustained increase. In addition, the initial impact of a one standard deviation positive shock to the exchange rate, i.e., an exchange rate depreciation, is delayed by about three months before resulting in a sharp increase in intervention. The initial period in which the intervention fund decreases can be viewed as the average policy lag period for the CBN.

## 5.4. Post Estimation Tests
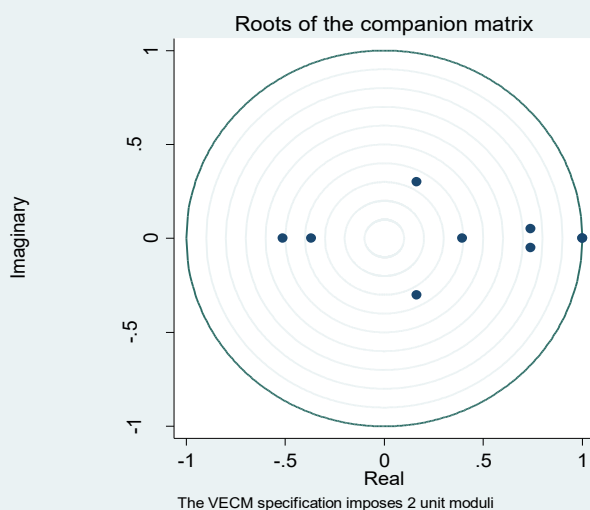


| lag | chi2 | df | Prob > chi2 |
|-----|---------|----|-------------|
| 1 | 14.2344 | 9 | 0.11423 |
| 2 | 14.5244 | 9 | 0.10485 |

H0: no autocorrelation at lag order

We test for autocorrelation using the Lagrange multiplier test and find that there is no autocorrelation at lag order. We also test the eigenvalue stability condition and see that the model is also stable. However, the model accepts the Jarque.

## VI. CONCLUSION AND POLICY RECOMMENDATIONS

The results indicate that CBN interventions through credit easing to specific industries can reduce long-term inflation, particularly food inflation. There is dynamism in response to intervention funding, which may explain the weakness in previous findings that only headline inflation was studied. The results also suggest a divergence in the outcomes of unconventional monetary policy between developed and developing countries. In developed countries, credit easing is undertaken during periods of negative economic shock, as the central bank approaches the zero lower bound, to boost economic activity and thereby prevent money demand-driven inflation from rising. However, in developing countries that are typically import-dependent, such as Nigeria, an adverse financial shock that reduces income and weakens the exchange rate serves only to increase inflation through the supply channel, thereby resulting in stagflation. Hence, credit-easing, which boosts economic activity and eases the supply channel, instead triggers a decline in inflation.

In addition, we find that there is a three-month policy lag window in CBN's response to inflation using intervention funds. This is a relatively short lag period, which highlights the prominence of unconventional monetary policy as a tool of the CBN. This supports the claim that the central banks of developing countries are more flexible in their approach and rely more frequently on 'unconventional' monetary policy tools. Our study finds that these tools have been successful in a stagflationary economy. Nonetheless, the country still faces high inflation rates on the supply side. This suggests that these tools should be enhanced to increase their efficacy and impact.

The implications of QE and CE can be observed in the changes to the balance sheet's composition and size. Changes in the quality and quantity of reserves and assets issued invariably impact the quality of money. Substituting low-quality assets for high-quality ones to inject liquidity invariably dilutes the quality of the assets backing the currency, and thus the quality of the currency itself. The CB's assets are collateralised against its liabilities and support the issued currency in addition to defending the price of the currency (i.e. using the CB's reserves). As the asset deteriorates, it increases the probability of recapitalisation through monetary expansion (i.e., debt funding by the fiscal authority, which may be monetised), thereby bringing about inflationary pressures. Our paper does not account for these effects; therefore, we advise that while the central banks' leverage on the success of these interventions is significant, they should also consider the risk of a large and unwieldy balance sheet.

## DECLARATION

| Funding/ Grants/ Financial Support | No, I did not receive. |
|---|---|
| Conflicts of Interest/ Competing Interests | No conflicts of interest to the best of our knowledge. |
| Ethical Approval and Consent to Participate | No, the article does not require ethical approval or consent to participate, as it presents evidence that is not subject to interpretation. |
| Availability of Data and Material/ Data Access Statement | Not relevant. |
| Authors Contributions | I am the sole author of the article. |

## REFERENCES

1. Barroso, J. B. R., Da Silva, L. A. P. & Sales, A. S. (2016). Quantitative Easing and Related Capital Flows into Brazil: measuring its effects and transmission channels through a rigorous counterfactual evaluation. *Journal of International Money and Finance*, *67(C)*, 102-122.[CrossRef]
2. Belke, A., Gros, D. & Osowski, T. (2017). The effectiveness of the Fed's quantitative easing policy: New evidence based on international interest rate differentials. *Journal of International Money and Finance*, *73(PB)*, 335-349. [CrossRef]
3. Borio, C., & Disyatat, P. (2010). *Unconventional monetary policies: an appraisal. The Manchester School*, *78*, 53–89. [CrossRef]
4. Bowman, D., Cai, F., Davies, S. & Kamin, S. (2015). Quantitative easing and bank lending: Evidence from Japan. *Journal of International Money and Finance*, *57 (C)*, 15-30. [CrossRef]
5. Brown, B. (2015). *How Fed Quantitative Easing Spreads Asset Price Inflation Globally*. In *A Global Monetary Plague* (39-72). Palgrave Macmillan, London. [CrossRef]
6. Chen, Q., Filardo, A. J., He, D. & Zhu, F. (2012). *International spillovers of central bank balance sheet policies. BIS Paper*(66p).
7. Dori, N. A. S. (2016). The impact of the Central Bank of Nigeria's development finance on the economic growth and development of Nigeria. *Afro Asian Journal of Social Sciences*, *7*(1), 1–14.
8. Evbuomwan, G. O. & Okoye, L. U. (2017). Evaluating the prospects of the anchor borrowers ' programme for small-scale farmers in Nigeria.
9. Fasano-Filho, M. U., Wang, M. Q. & Berkmen, P. (2002). *Bank of Japan's quantitative and credit easing: Are they now more effective* (No. 12). International Monetary Fund. [CrossRef]
10. Fawley, B. W., Neely, C. J., et al. (2013). *Four stories of quantitative easing*. Federal Reserve Bank of St louis. [CrossRef]
11. Fujiki, H., & Tomura, H. (2017). Fiscal cost to exit quantitative easing: the case of Japan. *Japan and the World Economy*, *42*, 1-11. [CrossRef]
12. Hausken, K., & Ncube, M. (2013). Quantitative easing and its impact in the US, Japan, the UK and Europe. [CrossRef]
13. Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, *12*(2-3), 231-254 [CrossRef]
14. Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, *52*(2), 169-210. [CrossRef]
15. Klyuev, V., de Imus, P., & Srinivasan, K. (2009). *Unconventional choices for unconventional times: credit and quantitative easing in advanced economies*. Imf staff position note (Tech. Rep..). SPN/09/27, November. [CrossRef]
16. Kryzanowski, L., Zhang, J. & Zhong, R. (2017). *Cross-financial-market correlations and quantitative easing*. Finance Research Letters, 20, 13-21. [CrossRef]
17. Kure, E., Mbutor, O., Rotimi, U., & Adamu, Y. (2019). The Central Bank Balance Sheet as a Tool for Monetary Policy: Evidence from Nigeria. *Economic and Financial Review, 57(2), 27 -58*.
18. Liew, V. K. S. (2004). Which lag length selection criteria should we employ?. *Economics bulletin*, *3*(33), 1-9.
19. Lim, J. J., & Mohapatra, S. (2016). Quantitative Easing and the Post-Crisis Surge in Financial Flows to Developing Countries. *Journal of International Money and Finance*, *68(C)*, 331-357. [CrossRef]

34

20. Matsuki, T., Sugimoto, K., & Satoma, K. (2015). Effects of the Bank of Japan's current quantitative and qualitative easing. *Economics Letters*, *133*, 112-116. [CrossRef]
21. Michaelis, H., & Watzka, S. (2017). Are there differences in the effectiveness of quantitative easing at the zero-lower-bound in Japan over time?. *Journal of International Money and Finance*, *70*, 204-233. [CrossRef]
22. Miyakoshi, T., Shimada, J., & Li, K. W. (2017). The dynamic effects of quantitative easing on stock price: Evidence from Asian emerging markets. *International Review of Economics & Finance*, *49(C),* 548-567. [CrossRef]
23. Moosa, I. A. (2014). *Quantitative easing as a highway to hyperinflation*. World Scientific. [CrossRef]
24. Okotori, T. W., & Gbalam, E. (2020). Policy perplexity of the central bank's interventions: An empirical appraisal. *Journal of Developing Economies*, *2* (1), 12–31. [CrossRef]
25. Olaitan, M., et al. (2015). An overview of CBN intervention in the Nigerian economy
26. Olanrewaju, O., Osabohien, R., & Fasakin, J. (2020). The Anchor Borrowers Programme and Youth Rice Farmers in Northern Nigeria. *Agricultural Finance Review*. [CrossRef]
27. Oyefuga, I. O., Siyanbola, W. O., Afolabi, O. O., Dada, A. D, & Egbetokun, A. A. (2008). SMEs' funding: an assessment of an intervention scheme in Nigeria. *World Review of Entrepreneurship, Management and Sustainable Development*, *4*(2-3), 233–245. [CrossRef]
28. Pesaran, M. H., & Smith, R. P. (2016). Counterfactual analysis in macroeconometrics: An empirical investigation into the effects of quantitative easing. *Research in Economics*, *70*(2), 262-280. *Reserve Bank of St. Louis Review*, *95*(1), 51–88. [CrossRef]
29. Rule, G., et al. (2015). *Understanding the central bank balance sheet*. Handbooks.
30. Saheed, Z. S., Alexander, A., Isa, A. A. & Adeneye, O. (2018). Anchor borrower programme on agricultural commodity price and employment generation in Kebbi State, Nigeria. *European Scientific Journal*, *14*(13), 240–255. [CrossRef]
31. Steeley, J. M. (2015). The side effects of quantitative easing: Evidence from the UK bond market. *Journal of International Money and Finance*, *51(C)*, 303-336. [CrossRef]
32. Van den End, J. W., & Pattipeilohy, C. (2015). Central bank balance sheet policies and inflation expectations. [CrossRef]
33. Yue, H.-Y., & Leung, K.-T. (2011). The effects of quantitative easing on the inflation rate: A possible explanation of the phenomenon. *European Journal of Economics, Finance and Administrative Sciences*, 41,34- 40.

## AUTHORS PROFILE

**Dr. Akinboyo Olorunyomi Lawrence**, a staff member of the Central Bank of Nigeria, Abuja, holds a B.Sc. and M.Sc. in Economics and obtained his Ph.D. in Public Policy and Administration from Walden University, U.S.A. For over three decades, he has gained extensive experience in research, programming, statistical computing, and economic analysis, and has made numerous presentations at local and international meetings. He has served as secretary and chairman of several committees and published scholarly articles in reputable international journals. His skills centred on the ability to motivate organisations around a small set of critical outcomes and achieve results.

*Retrieval Number:100.1/ijef.B2547113223*
*DOI:10.54105/ijef.B2547.113223*
*Journal Website: www.ijef.latticescipub.com*

35

*Published By:*
*Lattice Science Publication (LSP)*
*© Copyright: All rights reserved.*