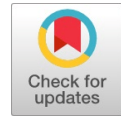


Does CBN Intervention Funds Contribute to Inflationary Pressure in Nigeria? An Empirical Investigation

Akinboyo Olorunoyomi 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 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 that there is divergence in the outcome of unconventional monetary policy in 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 in consistent with the claim that central banks of developing countries are more flexible in approach and rely more frequently on 'unconventional' monetary policy tools with proof that these tools have been successful in a stagflation economy. Nonetheless, the country still faces high supply side inflation rates, which only shows that these tools should be improved upon to increase efficiency and impact.*

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

I. INTRODUCTION

In Nigeria, a large gap exists between the demand and supply of credit, especially for Micro, Small and Medium Enterprises as evidenced by significantly high lending rates. This gap is sustained by the perceived risk of lending to the private sector; double-digit domestic inflation and high transaction costs. Paradoxically, Nigeria's spiralling inflation is mainly supply-side driven, thus, 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 further stimulate the declining economy. By 2010, the CBN 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 largely targeted towards addressing the rigidities which hamper appropriate risk-taking by the banking industry and constrain the flow of required funding to critical sectors of the economy. This approach was further necessitated by the weak transmission channels of the traditional monetary policy tool. 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 began with the 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 after monumental declines to the international price of crude. 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, and in response to the current health pandemic, a N50 Household and SMEs Support Facility and N100 billion Health Intervention Fund was reeled out. Hope Moses-Ashike (2021). However, as a result of these outlays, the central bank balance sheet has burgeoned.

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 increase 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 to the domestic economy through crowding out, further exacerbating the inflation conundrum. While funding from the central bank has become a building block for recent economic successes in Nigeria, it also calls to question policy conflicts as well as the sphere of operations for a central bank. 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.

Manuscript received on 26 June 2023 | Revised Manuscript received on 08 July 2023 | Manuscript Accepted on 15 November 2023 | Manuscript published on 30 November 2023.

* Correspondence Author (s)

Dr. Akinboyo Olorunoyomi Lawrence, Monetary Policy Department, Central Bank of Nigeria, Abuja, Nigeria. E-mail: lawrenceakinboyo2013@gmail.com, ORCID ID: [0000-0002-8252-1103](https://orcid.org/0000-0002-8252-1103)

© The Authors. Published by Lattice Science Publication (LSP). This is an open access article under the CC-BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

First, intervention and its liquidity undertones could worsen inflationary pressure in the economy. In other words, increased money supply sequel to intervention could lead to too much money in circulation, weakens the purchasing power of the naira. Second, excess liquidity can lead to increase lending to the government, as well as the extension of credits to private and core private sectors. It can also result in capital flight from the domestic economy to other economies by way of rent-seeking behaviors of economic agents. Such increased liquidity surge consequent upon increased intervention can exert significant pressure on the exchange rate (dollarization). Such scenario can underpin financial contagion and breach of corporate governance codes. Hence, the main objective of this paper is to empirically investigate the effects of the CBN intervention on inflation in Nigeria. This is imperative as there has been substantial funding of these interventions based on the theoretical assumptions and micro-level evaluations. A failure of the supposed linkages would pose inherent risks to monetary policy efficacy, macroeconomic stability and the operational processes of the Bank (through the 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 developing countries central banking, for further research and analyses.

II. STYLIZED FACTS

2.1. CBN Intervention and Nigerian Economy

The CBN has intervened in the economic activities through equity investment in many Development Finance Institutions (DFIs) and subsidized lending to these Institutions. In addition, the Bank has undertaken direct (not in collaboration with FGN) interventions in the real sector of the economy through commercial and microfinance banks. The involvement of the Bank in real sector interventions was part of the effort to address the country's peculiar development challenges. The interventions of the Bank in the real economy is to achieve a variety of economic objectives including: reduction of poverty and creating easy access to credit to provide the needed 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 to ensure lower prices. A concessionary interest rate implies that firms can borrow money to invest in their capital stock and pay less interest for it. It can also help in moving the real economy from being primary 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 (in the computation of the consumer price index (CPI), the Bank intervention to boost agricultural output will certainly dampen food prices and this in turn reduces inflation. Indeed, therefore the CBN is highly committed to intervening in the economy as evidenced in its various initiatives since 1978.

2.2. Sectoral Review

The Bank's interventions are focused on stimulating credit to the real sector for job and wealth creation and for the diversification of the economy. The interventions are therefore targeted at critical sectors of the economy with high multiplier effect. These sectors include: agriculture, manufacturing, airline, 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 climate 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 said to be cultivable (72.4 per cent of the total land area) S.Famoriyo (2021). These potentials, no doubt present agriculture as strategic to addressing Nigeria's challenges of economic growth, wealth creation, employment generation and food security. Despite the dominant role of the petroleum sector as the major 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 the need to intervene in the sector especially in correcting the inability of the market to attain equilibrium in the demand and supply of finance and capital funds to the agriculture sector.

2.2.2. The Manufacturing Sector

Although the manufacturing sector has the potential to create wealth and employment, it has stagnated over the years, its contributions to GDP and employment remain dismal. The activity mix in the sector is also limited and dominated by import-dependent processes. The manufacturing sector faces a number of constraints, however, access to investible resources in terms of long term finance and funds have portend a grave challenge that has impeded the effective use of other factors of production. Therefore, the need to provide strategic interventions aimed at stimulating 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, inhibiting investment and increasing the cost of doing business. Power is strategic and represents the most important infrastructure requirement for moving the private sector forward. It is estimated that parlous infrastructure indirectly accounts for an additional 16 per cent of the cost sales. Consequently, it is important to intervene in the power sector to create the right investment climate that would reduce generation deficits; enable rehabilitation of installations and expand transmission and distribution networks and increase 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 Borrower’s Programme	RSSF	NEMSF	YEDP
	National Food Security Programme	Textiles Interventions		
		Export Stimulation Facility		

Table 2: Interventions and the Targets

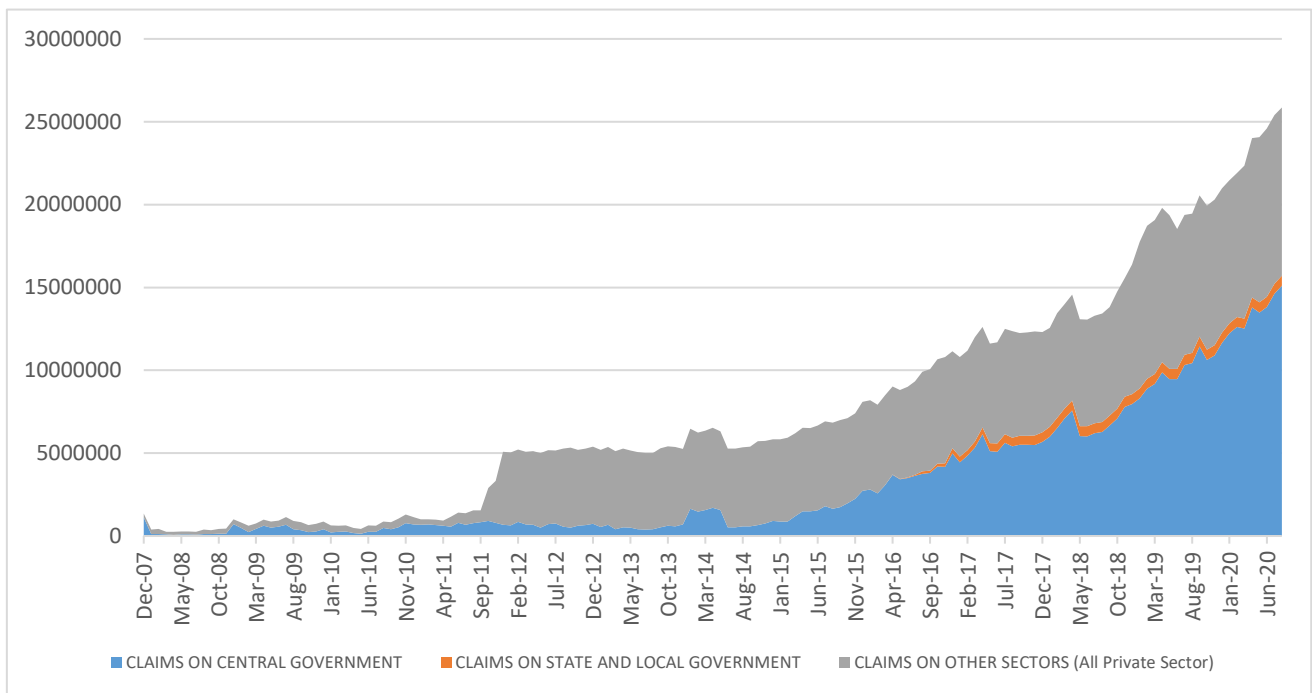
Intent	Objectives	Deliverables	Overall Targets	
Diversified economy with increasing inclusive economy growth and improve employment generation capacities	<ul style="list-style-type: none"> Stimulate finance to the real sector of the economy Improve access to Finance 	De-risk lending to targeted sectors	20% Increase in access to finance by MSMEs annually	
		Ease the challenge of collateral requirement	5% Increase in access to finance Women Businesses annually	
		Reduce the Cost of borrowing	20% Increase in the use of moveable assets as collateral annually	
			5% Decrease in the rate of lending to MSMEs annually	
	Accelerate financial inclusion	Increase in % Nigerian adults that are served by formal financial institutions from 43% in 2012 to 48.6% in 2019		66% Adult population using Payments by 2019
				56% Adult population using Savings by 2019
				73% Adult population using credit by 2019
	Improve productivity and economic growth	Ramp production of key agriculture produce		5% Increase in output of focal commodities annually
			Stimulate exports of agriculture 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

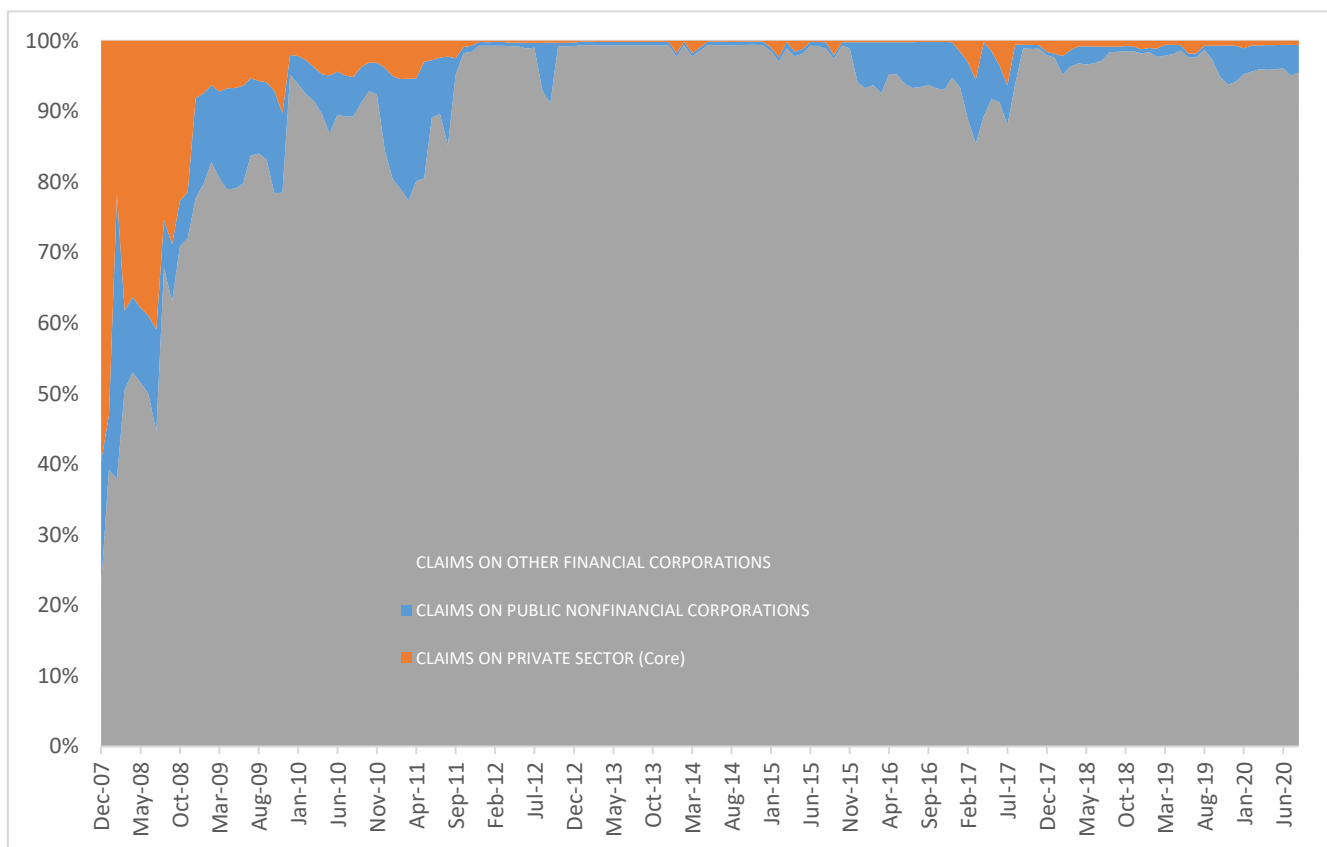
Central Bank Balance Sheet: Between 2007 and 2020, the central bank asset-side balance sheet has expanded by 1801.84%. Year on year, in August 2020, it grew by 32.98%. This growth has been led by both an increase in the claims on central government and the claims on the private sector. The expansion in the private sector is dominated by the claims on other financial institutions, which makes up 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 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. Prime lending rate has been relatively stable around 16 to 17%. In April 2019, the rate went up to 18.23% as at April 2019, 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 40.42% increase within the period.



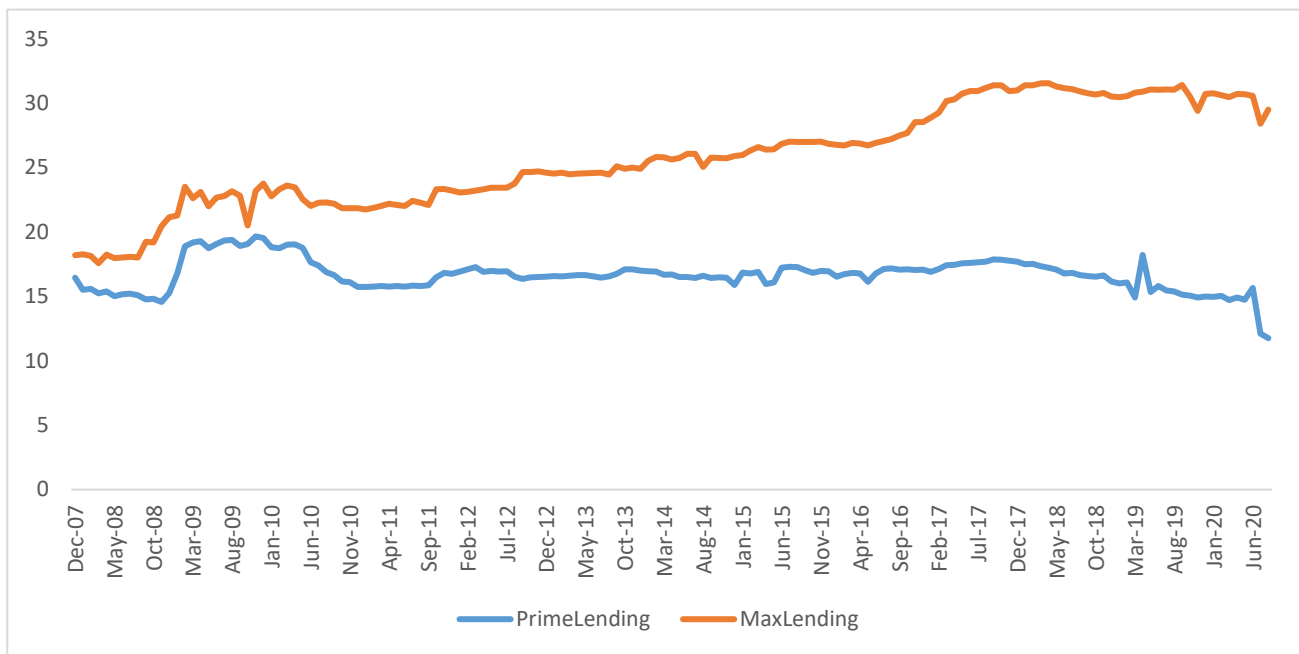


Figure 3: Prime and Maximum Lending Rates

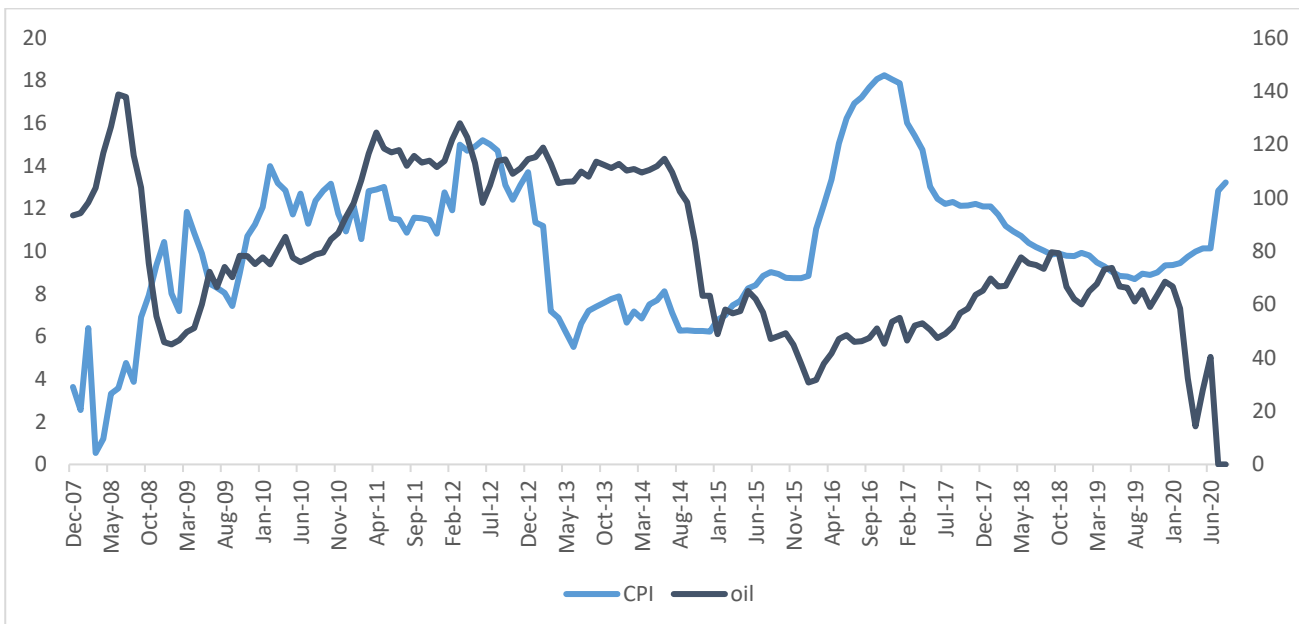


Figure 4: Inflation and Bonny Oil Price

In March 2014, inflation rate fell to a single digit of 7.78%, the lowest in the last one decade, driven by lower food prices. However, by September 2020, inflation had hit 13.71% following a 13th straight month expansion. Whereas, oil price fell to 44 Dollar per barrel in January 2009 following the global financial meltdown. In April 2012, oil price peaked at 122.62 dollar per barrel due to stronger oil demand and worries about supply disruptions linked to Iran's nuclear program.

U.S Energy Information Administration (2013). Oil price plunged to 31.7 in February 2016, owing to the escalation of tensions between Russia and Saudi Arabia, sparking fears of imminent all-out price war. As at April 14, 2020, oil price had fallen sharply to as low as 14.28 Dollar per barrel with the ramifications of the COVID-19 pandemic as the main driving force, resulting in 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). Exchange rate began to rise from November 2015 and peaked at N494 naira per dollar in February 2017, due to dwindling oil price, forex scarcity occasioned by high demand. Thereafter, it maintained stability from September, 2017 until the outbreak of COVID -19 pandemic in early March 2020. The volatility in the market came because of demand pressure coupled with liquidity paucity 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.



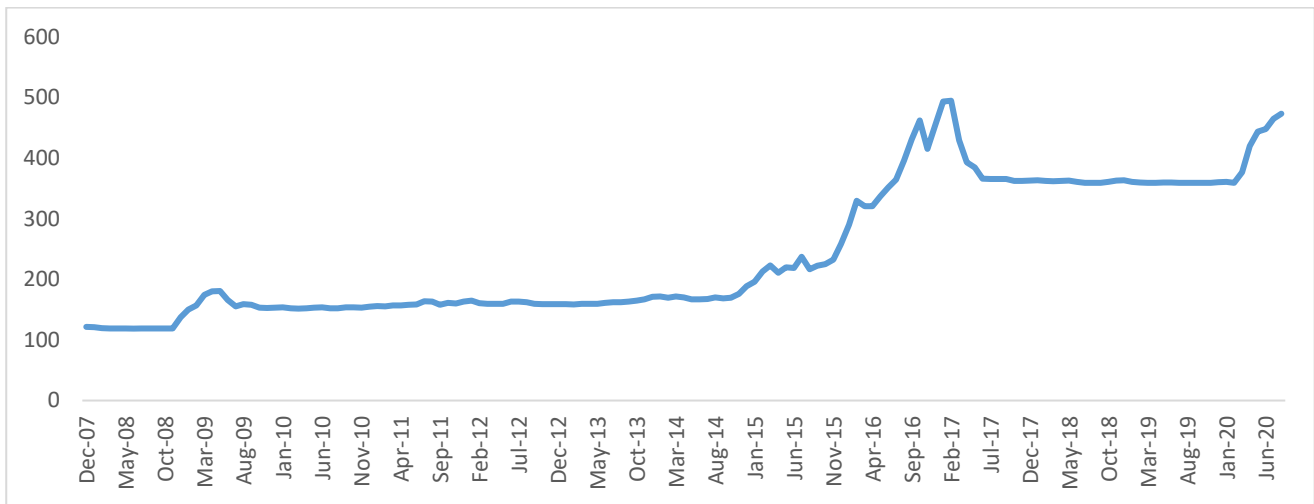


Figure 5: Bureau De Change (BDC) Exchange Rate

III. EMPIRICAL AND THEORETICAL LITERATURE REVIEW

The unconventional monetary policy involved the buying of assets from private institutions such as accounts Credit institutions, non-financial and financial organizations, “while corresponding claims are being held by their bank against the Bank of England also known as reserves. This automatically amounted to increasing money supply in the economy. Michaelis & Watzka, 2017) affirms that because the monetary authority in England has enabling laws that allows them to respond hold primary market instruments on record 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 effective evaluation of the 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 suggest that both core CPI and real GDP indicate an important time variation in the 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 quantitative easing policy. Researchers have also investigated quantitative easing with special attentions 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 through with the help of quantitative easing; the impact of impacts 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 evaluated the efficacy of quantitative easing policy of the Federal Reserve. Other studies also include the Japan’s existing quantitative easing of fiscal cost (Fujiki & Tomura, 2017)[11], quantitative easing’s effect in Europe area, United Kingdom, Japan and the United States (Hauskenand Ncube, 2013)[12]; bank lending implications of quantitative easing (Bowman, Cai, Davies, & Kamin,

2015)[4], assessments of counterfactual (Pesaran & Smith, 2016; Barroso, Pereira da Silva & Sales, 2016)[1][28], and the bond market side-effects of quantity easing (Steeley, 2015)[31]. There are studies that 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 its effect on the central banks’ balance sheet. By design, any transaction undertaken by the central bank, from foreign exchange operation to emergency bailouts is reflected in the central bank balance sheet. However, a large expansion and/or rebalancing of the central bank balance sheet is to 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, often both terms are 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 availability of credit or reduce the cost of credit, through the purchasing of private assets. Therefore, the CBN interventions which is characterized by lowered interest rates and increased loan outlay 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 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 from lending the funds made available, due to the 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 negative 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 emerging economies central banking objectives, such that these policies are not viewed as an extension of monetary policy, but 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 we have 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 in of 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 the estimating the effect of the credit-easing policies and not the entire balance sheet. In addition, we decomposed inflation to account for asymmetric impact which may stem from specific policy focus, 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 main 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

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

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 $m \times 1$ vector of variables like in a VAR; Dy_t is an $m \times 1$ vector if the first differences of the variables in y_t ; μ is an $m \times 1$ vector of intercept coefficients; Π and the Γ^* ’s are $m \times m$ coefficient matrices; ϵ_t is an $m \times 1$ error vector with contemporaneous correlation but no autocorrelation, like the error vector in a VAR. Γ_i^* ’s tell about the short-run dynamics, and Π tells about the cointegrating relationships.

4.3. Data

CBN’s *Asset Claims on Other Financial Institutions* which is a component of the CBN Balance sheet, was harnessed as a proxy of 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.



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

- ii. Credit based intervention funds are not disseminated 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. Particularly, 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 has not been published.

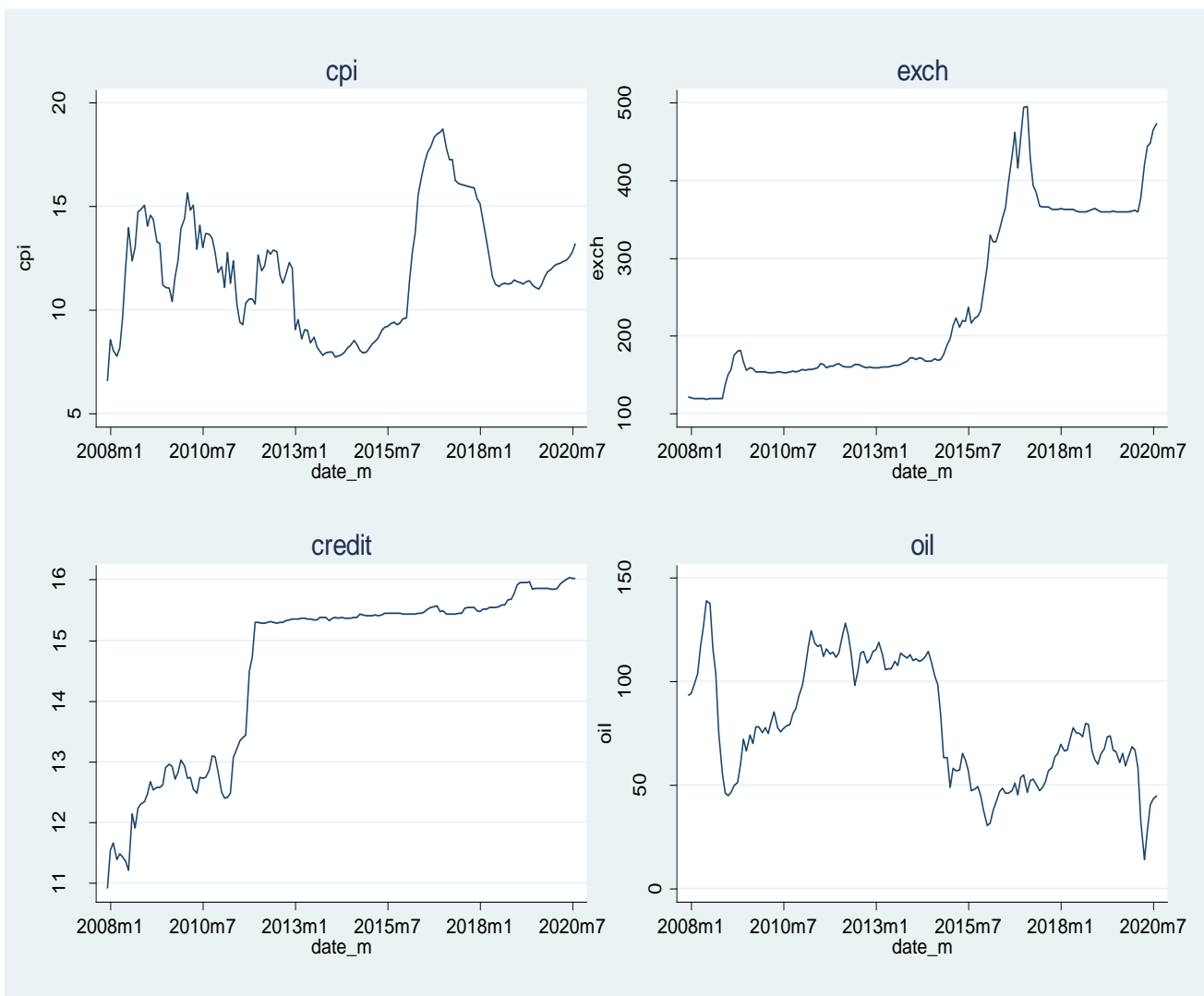
In the paper, CBN ‘Asset Claims on Other Financial Institutions’ is referred to as *credit*. It was log-transformed to account for its relative size, and afterwards referred to as *lncredit*. The year-on-year (Y-o-Y) growth rate of the consumer price index was the proxy for inflation in the main

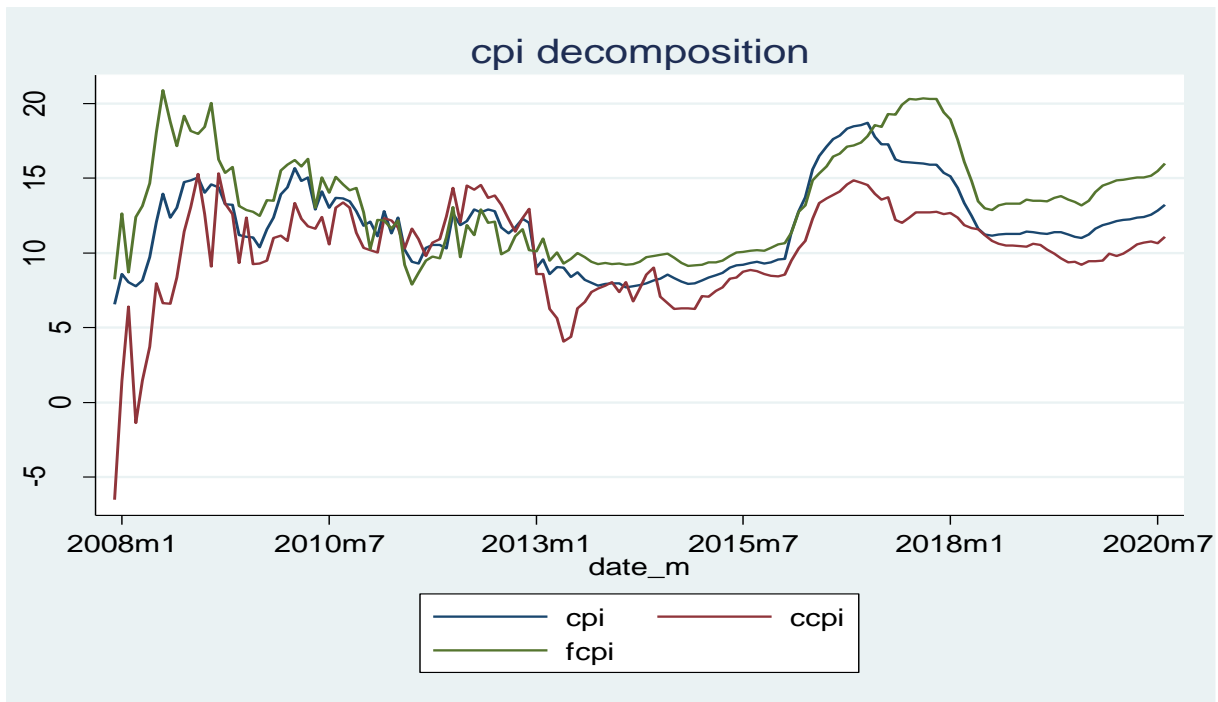
model and is referred to as *cpi*. However, in the secondary model, headline inflation is substituted for food inflation as such the inflation proxy becomes the Y-o-Y growth rate of the food component of the consumer price index and is, thus, referred to as *fcpi*. Exchange rate (*exch*) variable is the Bureau de change (BDC) exchange rate selected for its longer time period as well as nearness 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 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 t-stat approach

5.1.2. Determination of lags

The lag length was determined using six (6) different lag selection criterions; 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, maximum lag was set at 24 periods (2 years) and the optimal lag as given by the FPE was 3 and AIC was 24. While for the food inflation model, the optimal lag was given as 4 for both the FPE and AIC, given a maximum lag of 12 periods (1 year). A longer lag period was set in the headline inflation model to account for relatively stable core (less food and energy prices) inflation. 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 seen in table 4 show that the value of the trace statistic for both the trace and max exceed the critical 5% value for all ranks, thus, we reject the null assumption and conclude that there is co-integration amongst 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_Incredit				
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
Incredit				
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 1% level, showing evidence of robust relationships between the variables. Due to the application of the Johansen test, the coefficients must be interpreted with the opposing 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 exchange rate and inflation fit the theoretical assumptions. In the long term, an increase in headline inflation is related with a 0.02% depreciation in currency, while an increase in food inflation has a stronger depreciation effect on exchange rate at 0.03% per unit change.

Estimates of long-run Coefficients on Headline Inflation

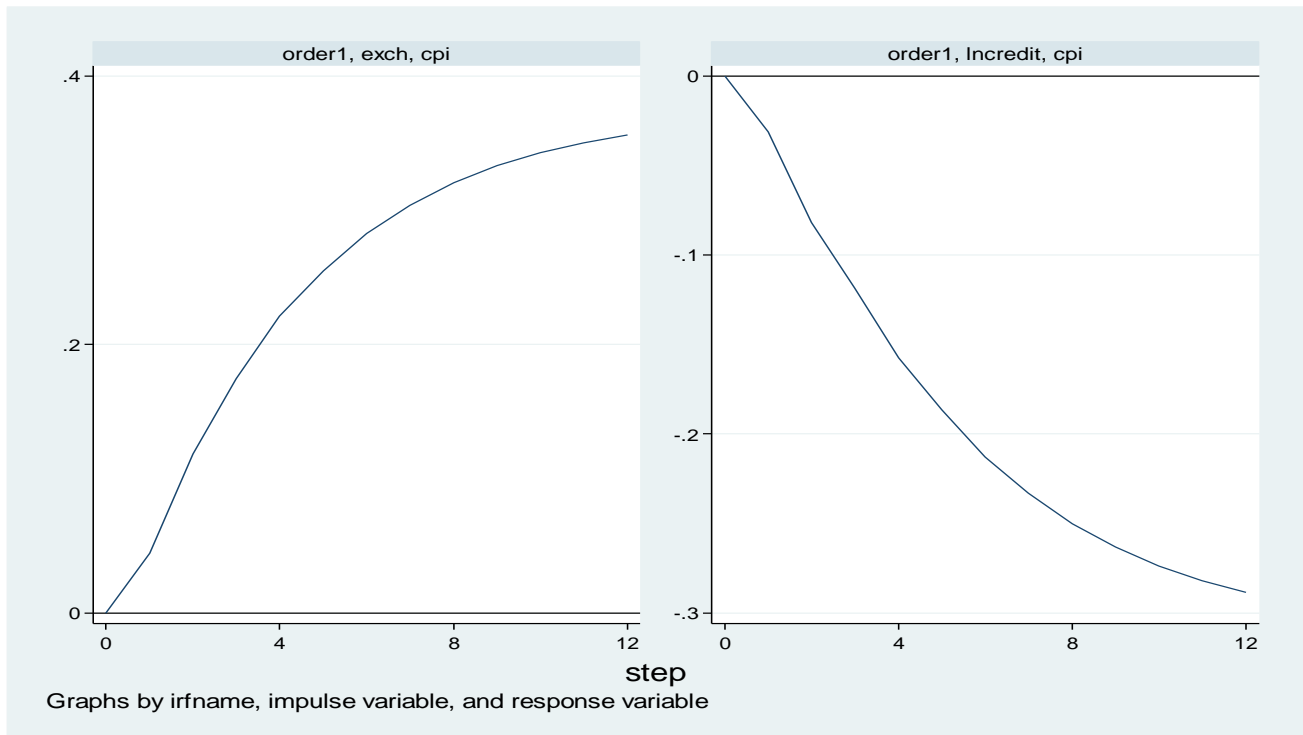
D_CPI	Coefficients	Std. Error	z	P> z
ECT				0.000
d_cpi	1			
d_Incredit	1.79***	0.509	-3.51	0.000
d_exch	-0.02***	0.006	-3.53	0.000
Cons	-25.36			

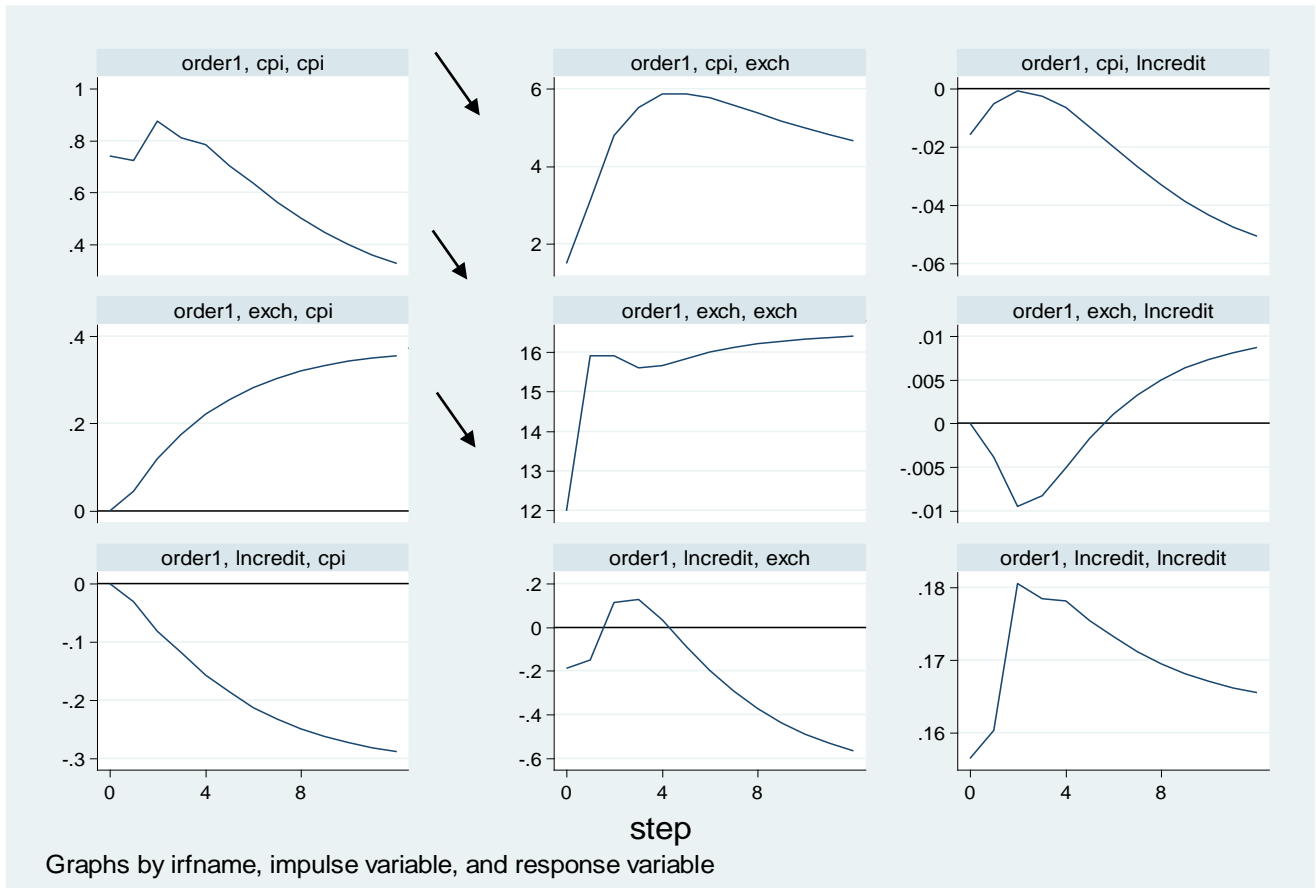
Estimates of long-run Coefficients on Food Inflation

D_CPI	Coefficients	Std. Error	z	P> z
ECT				0.000
d_fcpi	1			
d_Incredit	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)

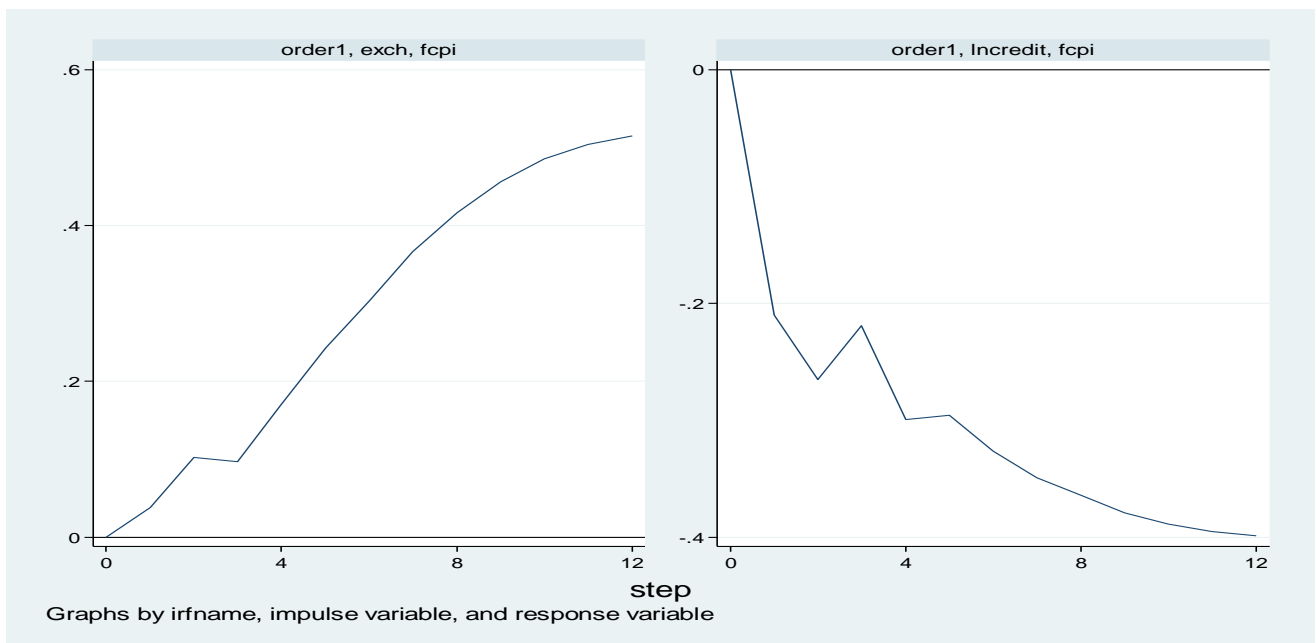
Headline Inflation Model

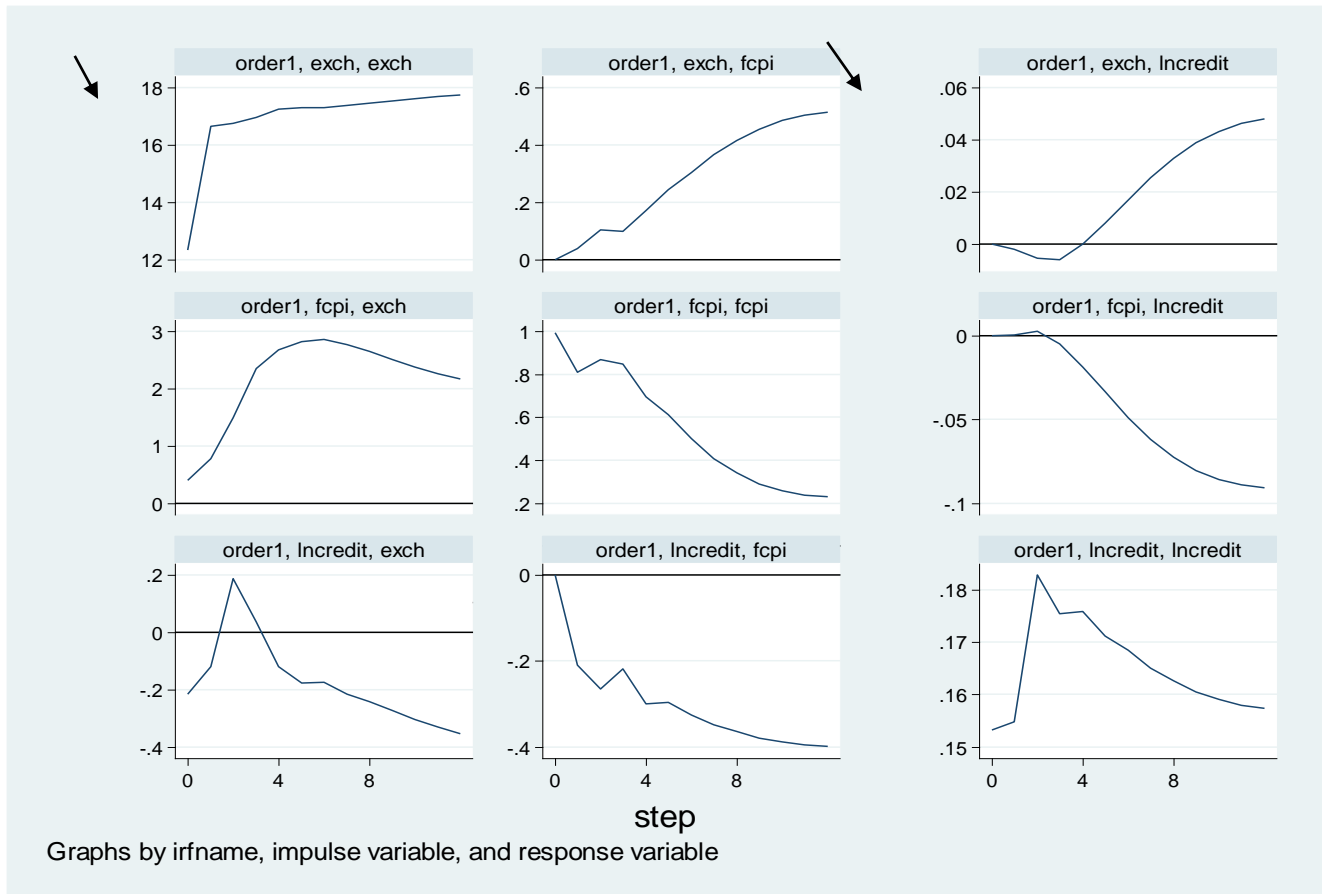




A one s.d. positive shock to intervention funds causes a decrease in headline inflation which is sustained for a year. While, a one s.d. positive shock to exchange rate (depreciation) causes a sharp increase in headline inflation which is sustained for a year. Other notable relationships are that a positive shock to headline inflation caused significant depreciation of the exchange rate, and although the impact declines over the year, the momentum of the exchange rate sustains the impact. In addition, an increase in intervention funds initially causes a depreciation in the first three months, before reverting below the mean to a appreciation which is sustained for the rest of the year.

Food Inflation Model

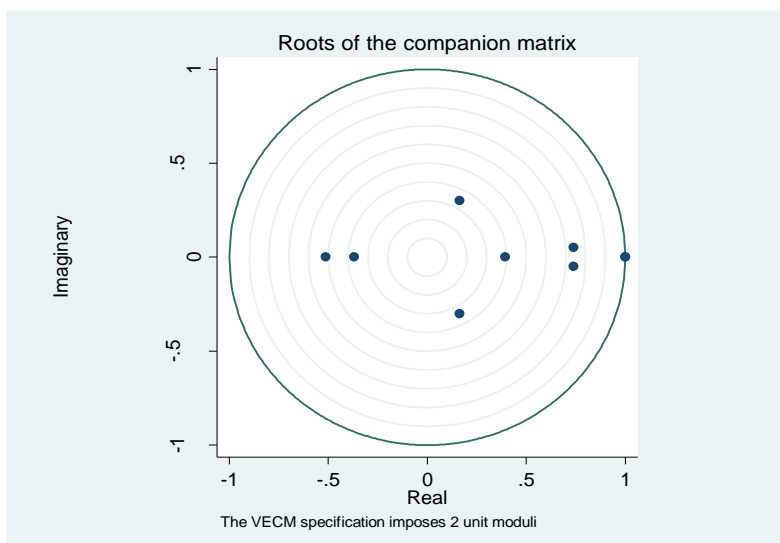




As observed in the coefficients of the two models, there is asymmetrical impact of the intervention funds on the components of inflation. The model finds that impact of intervention funds is stronger on food inflation. A one s.d. positive shock to intervention funds causes a sharper decrease in food 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 exchange rate is weaker than in the headline inflation model, albeit still significant.

Other notable relationships is the sustained effect of a one s.d. positive shock to inflation, which causes a sustained increase. In addition, the initial effect of a one s.d. positive shock to exchange rate i.e. an exchange rate depreciation on intervention is delayed for about three months before resulting in a sharp increase. The initial period in which intervention fund decreases, can be viewed as the average policy lag period for 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 find that the model is also stable. However, the model fails to reject the Jarque

VI. CONCLUSION AND POLICY RECOMMENDATIONS

The result shows that CBN interventions through credit-easing to specific industries reduces inflation in the long term, particularly food inflation. There is dynamism in response to intervention funding, which may explain weakness in previous findings in which only headline inflation is studied. The results also suggests that there is divergence in the outcome of unconventional monetary policy in 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 such that money demand-driven inflation rises. However, in developing countries which are typically import-dependent such as Nigeria, a negative economic shock which reduces income and weakens the exchange rate, only serves 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 claims that central banks of developing countries are more flexible in 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 supply side inflation rates. This indicates that these tools should be improved upon to increase efficacy and impact.

The implications of QE and CE can be observed in the balance sheet change in 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. The CB’s assets are collateralized against its liabilities and support the issued currency in addition to defending the price of the currency (i.e. using the CBs reserves). As the asset deteriorates, it increases the probability of recapitalization through monetary expansion (i.e. debt funding by the fiscal authority which may be monetized), bringing about inflationary pressures. Our paper does not take into account these effects, as such, we must advise that while the central banks’ leverage on the success of these interventions, they should note 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 and consent to participate with evidence.
Availability of Data and Material/ Data Access Statement	Not relevant.
Authors Contributions	I am only the sole author of the article.

REFERENCES

- 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]
- 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]
- Borio, C., & Disyatat, P. (2010). *Unconventional monetary policies: an appraisal. The Manchester School*, 78, 53–89. [CrossRef]
- 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]
- Brown, B. (2015). *How Fed Quantitative Easing Spread Asset Price Inflation Globally*. In *A Global Monetary Plague* (39-72). Palgrave Macmillan, London. [CrossRef]
- Chen, Q., Filardo, A. J., He, D. & Zhu, F. (2012). *International spillovers of central bank balance sheet policies. BIS Paper*(66p).
- Dori, N. A. S. (2016). The impact of central bank of nigeria’s development finance on economic growth and development of nigeria. *Afro Asian Journal of Social Sciences*, 7(1), 1–14.
- Evbomwan, G. O. & Okoye, L. U. (2017). Evaluating the prospects of the anchor borrowers’ programme for small scale farmers in nigeria.
- 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]
- Fawley, B. W., Neely, C. J., et al. (2013). *Four stories of quantitative easing*. Federal Reserve Bank of St louis. [CrossRef]
- Fujiki, H., & Tomura, H. (2017). Fiscal cost to exit quantitative easing: the case of Japan. *Japan and the World Economy*, 42, 1-11. [CrossRef]
- Hausken, K., & Ncube, M. (2013). Quantitative easing and its impact in the US, Japan, the UK and Europe. [CrossRef]
- Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of economic dynamics and control*, 12(2-3), 231-254 [CrossRef]
- Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with appucations to the demand for money. *Oxford Bulletin of Economics and statistics*, 52(2), 169-210. [CrossRef]
- 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]
- Kryzanowski, L., Zhang, J. & Zhong, R. (2017). *Cross-financial-market correlations and quantitative easing*. Finance Research Letters, 20, 13-21. [CrossRef]
- 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.
- Liew, V. K. S. (2004). Which lag length selection criteria should we employ?. *Economics bulletin*, 3(33), 1-9.
- 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]



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., Siyabola, 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 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 of Central Bank of Nigeria, Abuja, holds a B.Sc., 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 varied working experience in research, programming, statistical computing, economic analysis and has made several presentations at local and international meetings. He has served as secretary and chairmen of several committees and published scholarly articles in reputable international journals. His personal skills centered around ability to motivate organizations around a small set of critical outcomes and get things done.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of the Lattice Science Publication (LSP)/ journal and/ or the editor(s). The Lattice Science Publication (LSP)/ journal and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.