ISSN 1957-2968

CENTRAL BANK OF NIGERIA

Assessing Systemic Risk in the Nigerian Interbank Money Market
Nakorji, M., Ekeocha P., Nwosu C. and Obikaonu P.

Macroeconomic Instability Index and Threshold for the Nigerian Economy
Amoo, B. A.G., Achua J. K., Audu N. P. and B. Hamma

Unofficial Dollarisation and Monetary Policy in Nigeria
Adamu, Y.

Determinants of Nigeria's External Sector Competitiveness
O. Duke, M. Yakub, M. Nakorji, B. Gaiya, F. Isma'il, Z. Sani, S. Zimboh, T. Obiezue, O. Asuzu and V. Aliyu

Economic and Financial Review
Volume 55, Number 2
June 2017

Central Bank of Nigeria
Economic and Financial Review
Volume 55, Number 2, June 2017

Aims and Scope
The Economic and Financial Review is published four times a year in March, June, September and December by the Research Department of the Central Bank of Nigeria. The Review contains articles on research undertaken at the Bank, in particular, and Nigeria, in general, mainly on policy issues both at the macroeconomic and sectoral levels in the hope that the research would improve and enhance policy choices. Its main thrust is to promote studies and disseminate research findings, which could facilitate achievement of these objectives. Comments on or objective critiques of published articles are also featured in the review.

Correspondence
Correspondence regarding the Economic and Financial Review and published articles should be addressed to:

Director of Research/Editor-in-Chief
CBN Economic and Financial Review
Central Bank of Nigeria
33 Tafawa Balewa Way
Central Business District
P. M. B. 0187 Garki
Abuja
Nigeria

Email: info@cbn.gov.ng
Website: www.cbn.gov.ng

Subscription
Subscription to the Central Bank of Nigeria Economic and Financial Review is available without charge to individuals, institutions and corporations, including embassies, and development agencies. Articles may be reprinted, reproduced, published, abstracted, and distributed in their entirety on condition that the author and the source—Central Bank of Nigeria Economic and Financial Review—are duly credited.

ISSN 1957-2968

Disclaimer
Any opinions expressed in the Economic and Financial Review are those of the individual authors and should not be interpreted to represent the views or policies of the Central Bank of Nigeria.

Notes to Contributors
Information on manuscript submission is provided on the last and inside back cover of the Review.

Contents

Assessing Systemic Risk in the Nigerian Interbank Money Market

Nakorji, M., Ekeocha P., Nwosu C.and Obikaonu P.*

Abstract

The interbank market is an important platform for strengthening financial integration. It also represents a medium for risk sharing among banks through the linkages and common exposures. Exposure between banks leads to a direct asset relation through borrowing from each other at the interbank market while banks are associated indirectly through ownership and sharing of similar portfolio exposures, that connects them, through a web of transaction network. The paper analysed the systemic risk implied in the Nigerian interbank network, based on various network measures using data on individual banks' bilateral exposures. The findings showed that few banks featured prominently in the analysis, owing to their level of exposures and the effect of these varying exposures on their capital base. In addition, the linkages between two prominent banks and other banks were exposed. Moreover, a scenario of two banks failing was observed, which could spark up the chain of other failures with contagion second-round effects. The study could be useful in the development of a monitoring system by the supervisory authorities, as well as in strengthening the bank-internal stress tests of default contagion.

Keywords: Interbank Markets, Financial Stability, Contagion
JEL Classification Numbers: D85, G21, G28

I. Introduction

The widespread impact of the 2007/2008 global financial crisis including the role of the interbank market, underscored the importance of understanding the interconnectedness in the financial system, particularly the need for a better assessment of systemic risk. Generally, financial institutions, especially the operators and regulators, have an interest in a well-functioning and robust interbank market. Central banks, as regulators, leverage on the efficient functioning of the interbank market to influence market interest rates, in a way that reflects the stance of monetary policy. For

* *The authors are staff of the Research Department, Central Bank of Nigeria.* *The authors acknowledge the extensive contribution of Mr Mohammed Jibrin Abubakar of the Financial Policy and Regulation Department (FPRD) to this study. The views expressed in this paper are those of the authors and do not necessarily reflect the opinions of the Central Bank of Nigeria.*

the operators, the interbank market helps in the reallocation of liquidity, but poses a common exposure to risks. The interbank market, not only allows intermediary financial institutions to pool and spread their risk, but also creates the possibility of one bank's crisis propagating through the system. This was the experience in the case of default of the Lehman Brothers (an American investment bank) in 2008 and the resultant chaos in the US interbank market. Similarly, the experience of the 2009 Nigerian banking crisis, due mainly to the second-round effect of the 2007/2008 global financial crisis, underscored the tendency for the crisis in a banking system to spread from one bank to another.

Though a robust and well-functioning interbank market is important for the reliability of the financial system, the aftermath of the failure of a single bank may cause a system failure through interbank exposures. This risk of contagion amongst banks, in terms of a problem in one bank spreading to another, has therefore, been recognised as an important form of systemic risk. Systemic risk of this form connotes the likelihood of a bank's failure or disruption in service in the banking system, leading to the failure or disruption of services of other banks. Therefore, understanding interbank exposure and, thus, systemic risk has received increased attention among policymakers and researchers. It has been established that at the heart of systemic risk are contagion effects, and various forms of external effects (De Bandt and Hartmann, 2000; Smaga, 2014; Gauthier and Souissi, 2012). However, the factors that contribute to the build-up of systemic risk and the eventual spreading of contagion are not definite, as systemic risk in banks appear to be driven by different factors, even in the US and European banks (Varotto and Zhao, 2014).

Blåvarg and Nimander (2002) asserted that the risk of contagion in the banking system could be driven directly, via financial exposure or where crisis with one bank is a possible cause of the problem with other banks. Studies on banks' systemic risk, however, have not only centred around the interconnectedness of financial institutions and their financial robustness, but have also considered firm size, vulnerability, and default probability (Varotto and Zhao, 2014; Inaoka et al., 2014; Langfield et al., 2014; Kanno, 2014; Black et al., 2012; Puhr et al., 2012; Soramaki et al., 2007). Perhaps some important policy questions, supervisors or regulators of financial institutions, especially financial intermediaries would want to ask include: what are the factors that could potentially cause systemic risk in the banking sector or the interbank market?

Could the failure of a bank, owing to those factors, trigger the subsequent failure of other banks? These are the issues examined in this study.

This study is similar to previous studies in understanding the systemic risk in the Nigerian banking sector, specifically the interbank market. It is, however, different regarding the choice of factors that contribute to the build-up of systemic risk and the eventual spreading of contagion in the Nigerian interbank market. In assessing systemic risk in the Nigerian interbank market, we assumed a default state for a bank by shocking it with credit default; credit and funding; and risk transfer in terms of contingent liabilities, after establishing interconnectedness among the banks. Since the financial crisis had put systemic risk firmly on the policy agenda, this study would aid in the identification of the major triggers of systemic risk and enhance an understanding of the potential resilience to contagion in the Nigerian interbank market. With such knowledge, policymakers can provide appropriate preventive macroprudential measures to mitigate systemic risk by reducing the externalities. This study, therefore, examined the interconnectedness (linkages) in the Nigerian interbank market and the various level of financial exposure to specific shocks (from 2014 to 2016), with a view to highlighting potential systemic risk and contagion effects. The study provided evidence of potential risks of a chain reaction in the interbank market in which the failure of one bank could lead to the default of other bank creditors. The study adopted the dynamic approach to Network Analysis framework for the simulation.

The rest of the paper is organised as follows: Section 2 provided a brief review of the conceptual issues and empirical literature, while Section 3 presented the trend in the Nigerian interbank market. Section 4 estimated and discussed the results of the simulation. Section 5 highlighted policy implications and recommendations of the study, while Section 6 concluded the paper.

II. Literature Review

II.1 Conceptual Literature

The interbank market is an important platform for strengthening financial integration. It represents a medium for risk sharing among banks, through the linkages and common exposures. The linkages and interconnectedness of the

interbank market operations may serve as a channel of contagion through which problems affecting one bank, or one country, may spread to other banks or other countries (Degryse and Nguyen, 2004). Iori et al., (2006) identified sources of systemic failure already documented in the literature as follows:

- a bank run may arise from an attempt by depositors to draw funds, which lead to a collapse of the system, otherwise self-fulfilling panic;
- where banks invest in similar types of assets, significant fall in the price of the asset, which causes a bank's failure, may affect the solvency of other banks that hold the same asset; and
- inter-locking (interbank) exposures among financial institutions, which serve the purpose of mutual support but, also, create the potential for one institution's failure to have a ripple effect on the financial health of other institutions.

The last source of systemic risk underscores the dangers of contagion in the interbank market, which arise from short-term, mainly overnight interbank lending. Iori et al., (2006) further emphasised the trade-off between mutual insurance and systemic risk on the overall stability of the system under interbank lending.

II.1.1 Systemic Risk

Systemic risk comprises the risk to the proper functioning of the system as well as the risk created by the system (Zigrand, 2014). Put differently, it refers to the possibility that a triggering event like bank failure or market disruption could cause widespread disruption of the stability of the entire financial system. Systemic risk could be classified according to various groups, dimensions, or general types as shown in Table 1.

Table 1: Classification of Systemic Risk

Classes			References
Groups	Common exposure to asset price bubbles		Allen and Carletti (2011)
	Liquidity provision and mispricing of assets		
	Multiple equilibria and panics		
	Contagion		
	Sovereign default		
	Currency Mismatch		
Dimensions	Macroeconomic	When the financial system becomes exposed to aggregate risk resulting from exposures.	Nier 2009
	Microeconomic	When the failure of an individual institution has an adverse impact on the system as a whole.	
Type	Macro shocks	Negative external disturbance, preventing financial system from properly fulfilling its functions	Bancarewicz (2005)
	Failure chains	Losses incurred by one institution, leading to losses in related institution (Spreading of risk)	
	Reassessment failures	Based on the increase in information asymmetry concerning the correlation in institutions risk exposure and limited possibility of differentiating them.	

Author's compilation based on Smaga, 2014.

II.1.2 Contagion

A financial contagion could be defined as the diffusion of either eeconomic crises throughout a geographic region. According to Investopedia (online), this could occur at the international and domestic levels, but it had become more noticeable as the global economy grows, and economies within certain geographic regions became more connected with one another. At the domestic level, it could occur if one large bank sells most of its assets quickly and the confidence in other large banks, drops accordingly[1].

To estimate the danger of contagion, owing to exposures in the interbank loan market, Upper (2011) provided a summary of the results of other works done by various researchers in Table 2. He presented a critical assessment of the

[1] *www.investopedia.com*

modeling assumptions on which they were based and discussed their use in financial stability analysis. He noted further that, though contagion due to interbank exposures might be rare, when it happens, it could destroy a sizable proportion of the banking system's total assets and that contagion could happen through a multitude of channels.

Table 2: Channel of Contagion in the Banking System

	Channel	References
Liability-Side	Bank runs – Multiple equilibria/fear of other withdrawals	Diamond and Dybvig (1983), Temzelides (1997), Goldstein and Pauzner (2004)
	Common pool of liquidity	Aghion et al. (2005), Acharya et al., (2008), Diamond and Rajan (2005), Brunnermeier and Pedersen (2009)
	Information about asset quality	Chen (1999), Acharya et al.,(2008)
	Portfolio rebalancing Fear of direct effects	Kodres and Pritsker (2002), Dasgupta (2004), Iyer and Peydró-Alcalde (2005), Lagunoff and Shreft (2001), Freixas et al. (2000)
	Strategic behaviour by potential lenders	Acharya et al. (2008)
Asset side – Direct Effects	Interbank Lending	Rochet and Tirole (1996)
	Payment System	Humphrey (1986), Angelini, et al. (1996), Bech and Garratt (2006)
	Security Settlement	Northcott (2002)
	FX Settlement	Blavarg and Nimander (2002)
	Derivative exposures	
	Equity cross-holding	
Asset side – Indirect Effects	Asset prices	Cifuentes et al. (2005), Fecht (2004)

Adapted from: Upper, 2011

II.2 Empirical Literature

In the years following the 2007/2008 global financial crisis, many studies had focused on the analysis of the financial system with a view to understanding the

various sources and transmission processes of systemic risks, especially in the banking system. Economists studying contagion have resorted to simulation methods to test whether, given a set of exposures; failures could have knock-on effects or not (Upper, 2011). In assessing systemic risk in the interbank market, network analysis is often applied (Kanno,2015). Applying the network analysis allows one, not only to look beyond the immediate "point of impact" of a shock, but also to see the likely spillovers, arising from the inter-linkages in the system. Thus, the use of the interbank network analysis aids in alerting supervisory authorities on possible contagion risk and the channels through which shocks spread within the system. It serves as a resilience test of network and a means of identifying systemically significant nodes. The network model could be analysed using the static and the dynamic approaches.

The static network approach describes the network structure of the financial system, using topological indicators, while the dynamic approach measures the strength of the contagion channels and network resilience by observing the responses of financial structure to shocks. Some of the studies that adopted the network approach included Inaoka et al., (2014), Soramaki et al., (2007), Puhr et al., (2012), Langfield et al., (2014) and Masayasu (2015). Many studies have analysed systemic risk in interbank market from a network perspective. However, a sizeable number of studies had also attempted to analyse the dynamics of systemic risk in the market, from different points of view.

Allen and Gale (2000) introduced interbank liquidity market into the model of Diamond and Dybvig (1983) and found that the system was more resilient when every bank was connected to all other banks, due to wider risk-sharing effect. However, where the network structure was incomplete, such market was fragile because banks were unable to have a wider platform for risk sharing and diversify their portfolio structure against idiosyncratic shocks. Nier et al., (2008) investigated how the interactive features of the interbank network could be related to the financial stability of the system. They found out that the higher the risk-sharing among banks, the greater the size of the domino effect. This was usually in a situation where one of the banks, in the system was hit by a shock, although higher capitalisation level might reduce the number of defaults in case the shock permeated the system.

Iori et al., (2006) investigated the potential for the interbank market to act as a propagation mechanism for liquidity crises. Using a dynamic model, in which

banks interacted in the interbank market, they showed that the market played a stabilising role. The study found that interbank market unambiguously stabilised a system with homogeneous banks, while chances of contagion effect were more apparent with heterogeneous banks, notwithstanding that the interbank market still played the stabilising role. In other words, they observed that through fluctuations in liquid assets and stochastic investment opportunities that mature with delay, creating the risk of liquidity shortages, banks activities in the market created interconnections in the market that might turn out to be channels for the propagation of initial bank-specific shocks.

Generally, the first of the two popular approaches to measuring contagion tries to isolate contagion from other shocks affecting the economy. To examine the issue of systemic risk in the Swiss interbank market, Sheldon and Maurer (1998) simulated the outcomes of the failure of one bank, based on estimated interbank exposures, and looked at the potential domino effects. They x-rayed the first round and potential contagion effects. They found that the potential of contagion, arising from interbank linkages in Switzerland, was quite low, although the failure of a large Swiss bank would have serious implications.

Using a similar approach to study the German interbank market, Upper and Andreas (2002) observed that contagion risk of failure in a bank could trigger domino or contagion that would affect a substantial part of the banking system. The study identified the role of the safety net as a veritable measure to mitigate the spread of systemic risk from interbank activities. Overall, the consensus among authors[2], based on the findings in their separate studies, emphasised that the interbank system was necessary to pool idiosyncratic risk and ensure an efficient system. However, the system could also be a source for the propagation of systemic risk. In other words, the findings emphasised the dualism of interbank connections and, thus, underscored the need for proper risk management in the financial system, in order to forestall over-exposure and ensure an adequate safety net.

Other studies on systemic risk in the banking sector include Varotto and Zhao (2014); Laeven et al., (2014); Black et al., (2012); Gauthier and Souissi (2012); Huang et al., (2012); and De Brandt and Hartmann (2012). Varotto and Zhao

[2] *Gai and Kapadia (2010) and Cifuentes (2003),*

(2014) analysed aggregate and firm-level systemic risk for the US and European banks from 2004 to 2012. They observed that common systemic risk indicators were driven primarily by firm size, which implied an overriding concern for "too-big-to-fail" institutions. They, however, posited that smaller banks might still pose considerable systemic threats, as exemplified by the Northern Rock debacle in 2007. By introducing a simple standardisation, they obtained a new risk measure that identified Northern Rock as a top ranking systemic institution, up to 4 quarters before its bailout.

In a similar study on bank size and systemic risk, Laeven et al., (2014) revealed that large banks tended to be riskier and create more systemic risk, when they have lesser capital and less-stable funding. This was because the failure of large banks tended to be more disruptive to the financial system than failure of small banks, as it generated liquidity stress in the banking system. However, Black et al., (2012) examined the systemic risk of banks, using a hypothetical distress insurance premium. Economically integrating the main characteristics of systemic risk, which included size, default probability, and interconnectedness, the authors designed a systemic risk measure for the European banking system and showed that European banking systemic risk reached its height in late 2011, while the sovereign default factor was the dominant driver of the European debt crisis. Huang et al., (2012) also measured the systemic risk of a portfolio of twenty-two major banks in Asia and the Pacific, illustrating the dynamics of the spillover effects of the global financial crisis to the region. Their findings revealed that the increase in the perceived systemic risk was driven mainly by the heightened risk aversion and the liquidity squeeze, particularly after the failure of the Lehman Brothers. The result from Huang et al. (2012) analysis of the marginal contribution of individual banks to systemic risk, suggested that "too-big-to-fail" was a valid concern from a macroprudential perspective of bank regulation.

Gauthier and Souissi (2012) employed the macro-financial risk assessment framework (MFRAF) in facilitating the understanding of systemic risk in the Canadian banking system. They found that failure to account for either liquidity risk or network spillover effects could cause a significant underestimation of the extent of systemic risk in an undercapitalised banking system that relies extensively on the short-term funding market. Thus, they posited that any regulatory framework that intends to control for systemic risk should consider the bank's capital, holdings of liquid assets and short-term liabilities, comprehensively.

III. The Nigerian Interbank Money Market

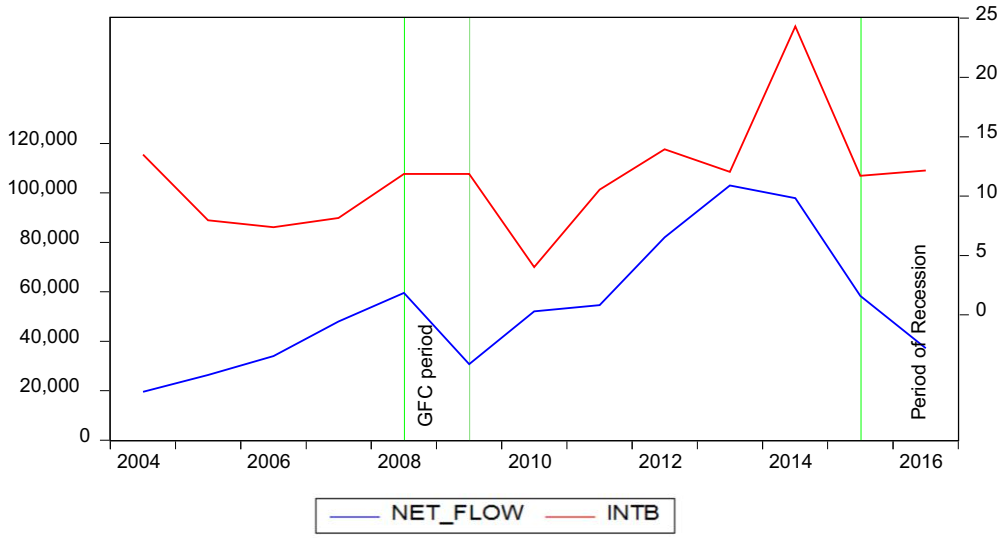
The Interbank market, as an integral part of the money market, is the market where banks and discount houses trade unsecured overnight loans. In the market, impulses, which influence the dynamics of interest rate determination and structure, are generated. The market also provides the platform for banks to take care of daily imbalances, either as fund-takers or as fund-givers. Hence, the market, as in many other countries, plays a critical role in the conduct and transmission mechanism of monetary policy. When banks extend credit, they do so with the belief that their debtors would be committed to repaying the loans at the due date. These debtors, in some cases, however, may fail to honour their debts obligations. This potentially causes severe contagious events, resulting in the loss of equity (Gai and Kapadia, 2010).

If a bank wants to minimise its risk when advancing such credit, the bank would need to have sufficient information regarding the financial situations of the bank it extends credit to, including all the bank's exposures. However, no bank can peep so deeply into the interbank credit network to evaluate the probability of defaults due to contagion effects. If a single bank fails, only those banks to which it owes money suffer directly, the remainder of the system is unaffected. The direct impact, however, may cause one or more of the bank's counter-party to fail, destroying further institutions within the interbank market. Since the creation of the interbank market in the 1970s, the market has grown to be very efficient and thus continue to serve as a veritable platform for facilitating the efficiency of a central bank's monetary policy. It is a subset of the money market for unsecured placements and borrowings of finance, amongst players in the economy.

Transactions on the Nigerian interbank market, as in other countries, involve placement of funds on a short-term basis, ranging from overnight, up to a period of three years. Most of the trading in the Nigerian interbank market are carried out directly between pairs of banks over-the-counter (OTC), as opposed to a centralised location. Some banks need to borrow money in the interbank market to cover temporary shortfalls in liquidity or regulatory reserve requirements, while others, on the other hand, hold excess liquid assets beyond their liquidity requirements, and lend money in the interbank market earning interest on the assets. The interbank market trades in all the money market instruments, using them as security or collateral.

Over the years, the Nigerian monetary authority had adopted policies aimed at ensuring the stability of the interbank market and the financial system. However, the 2007/2008 global financial crisis affected the domestic interbank market, mainly through trade and capital flows from other countries because of the openness of the economy and the massive dependence on the export of crude oil for government revenue and foreign exchange earnings (Figure 1).

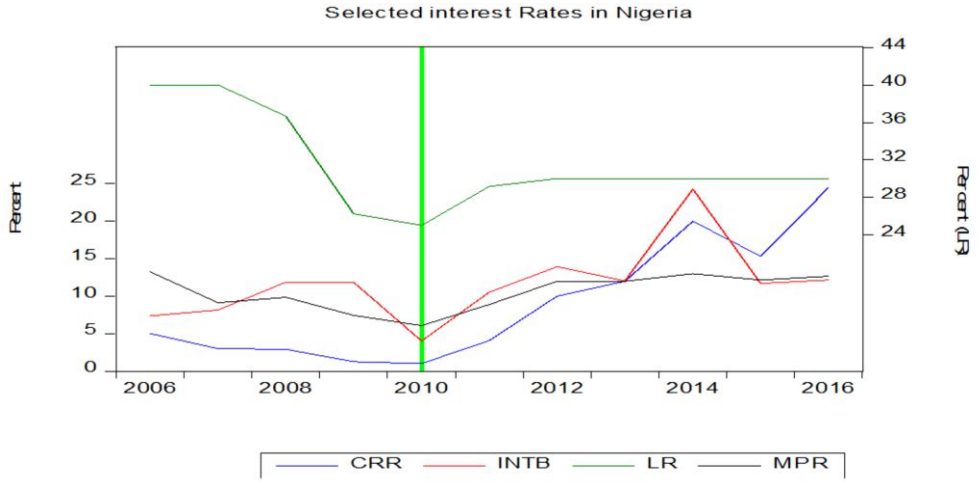
Figure 1: Forex flows and Interbank Money Market Rate (2004-2016)



At a time, the banks were unable to carry out their statutory function, due to the tightening of liquidity because of rising capital outflow, and lower monetisation of oil earnings. Furthermore, a special audit of the banking industry revealed that banks had large volumes of non-performing loans (heavily exposed to oil & gas, margin lending), capital erosion, poor risk management, illiquidity and poor corporate governance practices, among others. This led to liquidity pressures, thereby pushing up domestic interest rates that posed a threat to systemic risk.

However, in a bid to mitigate the effects of these negative developments, the regulatory authorities took active steps to infuse more liquidity into the market. The measures included reduction of the monetary policy rate from 10.25 per cent to 9.75 per cent in 2008; cutting down the liquidity ratio from 40.0 per cent in 2008 to 25.0 per cent in 2009; and reducing the cash reserve requirement from 4.0 per cent in 2008 to 1.0 per cent in 2009 (Figure 2). The Monetary Authority injected N620 billion into some of the banks, removed their top executive management and appointed interim ones (Sanusi,2010).

Figure 2: Selected Interest Rates in Nigeria



The Central Bank of Nigeria (CBN) also guaranteed interbank transactions by Nigerian banks that were denominated in the local currency and allowed banks to buy back their securities, while extending the discount window to 365 days (1 year), as opposed to overnight lending. As part of the Bank's efforts to meet the resolution cost of restoring financial stability, while guarding against further risk, the Asset Management Corporation of Nigeria (AMCON) was established in 2010 to resolve the issues of non-performing loans in banks and recapitalise the technically-insolvent banks. Furthermore, the Financial Stability Fund (FSF) was also set up in 2010 by the Bank, in collaboration with the banks, to ensure that future bailouts of these banks could be achieved with minimum delay and little contribution, if at all, from taxpayers' money. The Fund had an initial target of N1.5 trillion (about US$10 billion). The CBN was to contribute N50 billion annually to the Fund, while each bank was to contribute 0.4 per cent of its total assets annually for ten (10) years. These actions stabilised the interbank rates and restored confidence in the financial system.

IV. Methodology

IV.1 The Network Model

Globalisation has expanded trade beyond borders and links markets across countries. As a result, cross-border financial flows have increased affecting financial institutions through various assets and liabilities on their balance sheets. Exposure between banks leads to a direct asset relation through

borrowing from each other at the interbank market, while banks are associated indirectly through ownership and sharing of similar portfolio exposures that connects them through a web of transaction network. A network representation of financial system can conveniently capture the complex structure of linkages between financial institutions. The network concept depicts a set of nodes and links between them that may represent objects, individuals, firms or countries. A link for instance, is a social setting, which could mean a bond between friends or family members. While in the financial system context, the links indicate financial obligations among banks that are created through mutual exposures in the interbank market, owing to ownership or dealing with the same bulk of depositors. The creation of risk assets, in the interbank market, has exposed banks thereby endangering their capital on a different magnitude.

To prevent a local financial crisis from expanding into a global concern, the network analysis is imperative as it is instrumental in identifying the vulnerabilities of an institution and the negative externalities it may create for other related institutions within the system. Moreover, an understanding of network externalities may lead to the appreciation of macroprudential framework adopted for financial supervision. This regulatory framework takes into consideration vulnerabilities of an individual institution that may pose a systemic risk to the entire financial system. The concept of network analysis is relevant in explaining the impact of network formation and structure of a financial system. On the formation of the network in the interbank market, the driving force is predicated on the need to share risk aimed at curtailing the evolving threat of contagion. The network structure provides an insight on how the financial system responds to the risk of contagion either promptly or with a lag. Financial institutions that play more of the role of intermediation benefit more and are saddled with more risks. When the risk associated with lending funds on the interbank market becomes too high and the links are too costly relative to their benefits, freezes occur in network formation.

IV.2 Theoretical Application of Network Model

The network concept has been applied to a wide range of scenarios. According to Allen and Ana (2008), various research work from Calvó-Armengol and Jackson (2004), Arrow and Borzekowski (2004) and Loannides

and Soetevent (2006) have established the behavioural pattern of employers, using the social network of their current employees to hire recommended applicants. Corominas-Bosch (2004) explained transaction dynamics between buyers and sellers are connected through a web of network links. Transactions occured only between parties that were connected by a link and multiple links indicate multiple transactions. Allen and Gale (2000), Diamond and Dybvig (1983), Leitner (2005), Vivier-Lirimont (2004), Masayasu (2015) applied network analysis to a financial system, focusing on financial stability, interbank market, and contagion.

IV.3 The Interbank Network Model

The lending relationship in the interbank market was modelled with links and the banks represented by nodes. Time periods were indexed by $t \in N$ Banks are indexed by $i \in \{1, \ldots, N\}$. In each period, banks were subjected to funding shocks that occasionally crystalised into credit shocks and consequently influenced banks' payment accounts in their daily business operations. Banks wished to smoothen these shocks by borrowing and lending funds from each other in an over-the-counter market. As an outside option, banks had unlimited recourse to the central bank's standing facilities (discount window) with deposit rate r_d and lending rate r_l with $r_l \geq r_d$ Banks entered the market with the objective to maximise expected discounted interbank market profits from lending and borrowing funds by: (i) choosing which banks to approach for bilateral bargaining on loan and interest rates with other banks; and (ii) setting bilateral monitoring expenditures to mitigate uncertainty about counterparty credit risk.

The first set of simulations probed the likely impact of the assumed credit default from an institution, which was tagged as credit shocks. The second set of simulations captured the potential effect of credit-plus funding scenario, whereby the defaulting institution creates liquidity squeeze for other institutions that relied on it for funding. Following from Espinosa-Vega and Sole (2011), the potential systemic implications of interbank linkages could be assessed through a network of N institutions. The balance sheet identity of the bank can be shown as:

$$\sum_j x_{ji} + a_i = k_i + b_i + d_i + \sum_j x_{ij} \qquad (1)$$

Where x_{ji} represented bank i loans to the bank j, a_i indicated bank i other assets, k_i stood for bank i's capital, b_i were long-term and short-term borrowing (excluding interbank loans), d_i denoted deposits, and x_{ij} stands for bank i borrowing from bank j.

In assessing systemic risk in the interbank market, we assumed a default state for a bank, by shocking it with credit default, credit-plus funding shocks, and shocks emanating from risk transfer, regarding contingent liabilities.

IV.3.1 Credit Default Shocks

The default of each of the 23 banks, captured for this study, was simulated. The likely loss from the default was denoted by the parameter λ. Borrowing from Espinose-Vega and Sole (2011), it was assumed that banking system capital absorbed losses from the default. Taking into consideration the assumed default of say bank h, the balance sheet identity of bank i transformed to:

$$a_i + \sum_{j \neq h} x_{ji} + (1 - \lambda)x_{hi} = (k_i - \lambda x_{hi}) + b_i + d_i + \sum_j x_{ij} \qquad (2)$$

However, bank i is said to have failed, if its capital is insufficient to fully cover its losses (i.e., if $k_i - \lambda x_{hi} < 0$).

IV.3.2 Credit-Plus-Funding Shocks

Liquidity in the money market influences the extent to which a bank can replace an unforeseen withdrawal of interbank funding. With liquidity surfeit in the market, bank-funding sources are assured at an affordable cost of fund. However, in a scenario of liquidity squeezes, and the absence of alternative sources of funding, a bank may resolve into a fire sale of assets to mend its balance sheet identity. For ease of analysis, we assumed that the bank's capital absorbed the loss induced by a funding shortfall and the possibility of the bank raising new capital was not considered. Consequently, a bank's vulnerability not only emanates from the credit exposure but also from funding sources, through its inability to roll over its funding.

The simulations were premised on the assumption that bank i was able to replace only a fraction $(1-\rho)$ of the lost funding from bank h, and its assets traded at a discount, so that bank i was forced to sell assets worth $(1+\delta)\rho x_{ih}$ in book value terms. The funding shortfall induced loss, $\delta\rho x_{ih}$, was absorbed by bank $i's$ capital, and thus the new balance sheet identity for bank i was given by

$$a_i + \sum_j x_{ji} - (1+\delta)\rho x_{ih} = (k_i - \delta\rho x_{ih}) + b_i + d_i + \sum_j x_{ij} - \rho x_{ih} \quad (3)$$

IV.3.3 Risk Transfers Shocks

Contingent liabilities deserve special consideration in times of stress as its crystallisation activates dormant linkages across banks and bring new exposures onto the balance sheet of the bank. However, owing to data constraints, we were unable to cover this segment of the analysis.

IV.4 Data

In this study, we used data from FinA, produced on the platform of Central Bank of Nigeria. FinA is a database containing information about all banks operating in Nigeria. Each of the 23 banks' reports contains detailed unconsolidated and or consolidated, balance sheet and income statements. Given that the variables of interest, namely: interbank exposure, which was a combination of both secured and unsecured lending in the market and total qualifying capital of banks were all stock variables, a point analysis was conducted for the end periods December 2014, June 2015, December 2015, and June 2016.

V. Simulation Results

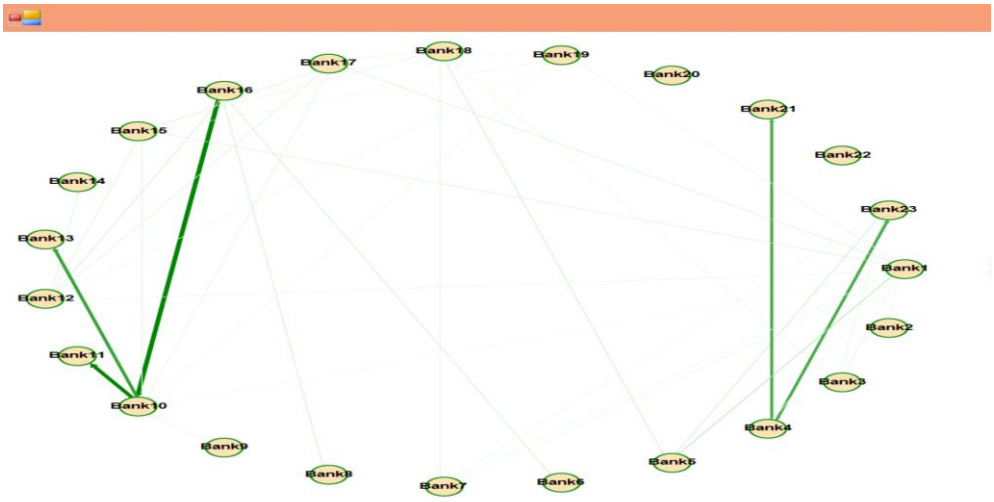
V.1 Bank Network Exposures

The analysis began with the interconnectedness of financial institutions in the interbank market, based on their credit exposures. The network can transmit systemic risk bilateral exposures, possibly causing contagion defaults that are triggered by a bank's stand-alone default. Figure 3 presented network exposure for the period end-December 2014 among the sampled Nigerian banks.

V.1.1 Network Exposures for Period End-December 2014

The network diagrams displayed the exposures of various banks within the interbank market. From the analysis, the exposure between bank 16 and 10 was the largest[3], as bank 16 owed bank 10, 238.5 per cent of bank 10's capital. This was followed by the exposure of bank 10 to bank 11, which was 114.5 per cent of bank 11's capital. Others were: the exposure of bank 10 to bank 13 (75.7 per cent of bank 13 capital); bank 4 to bank 23 (69.0 per cent of bank 23's capital) and bank 4 exposure to bank 21 (66.4 per cent of bank 21 capital).

Figure 3: Interbank Exposure Network Diagram for End-December 2014



Source: Authors' Computation

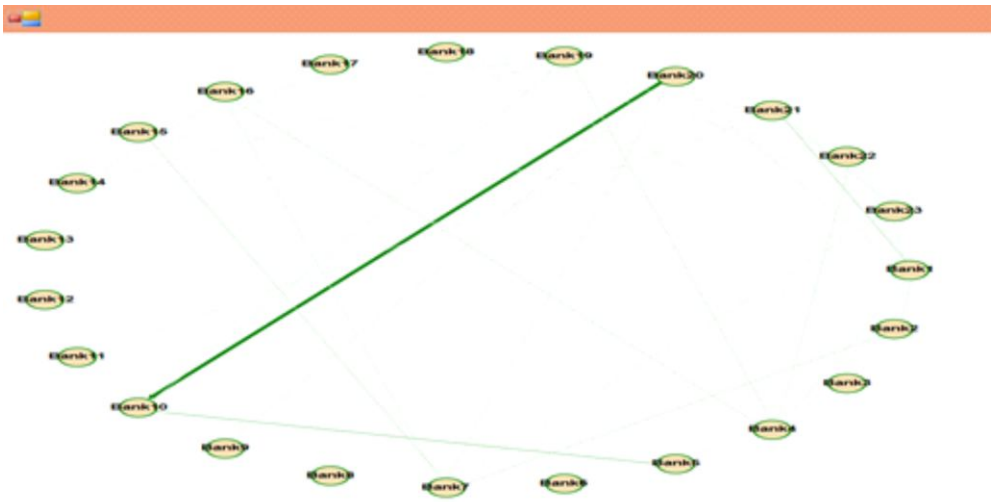
V.1.2 Network Exposures for Period End-June 2015

The Network exposures for the half-year period of 2015, as shown on Figure 4, indicated a huge exposure between bank 20 and 10, where bank 20 owed bank 10 (200,000 per cent of bank 10's capital that had a negative capital base as at that period). The lack of capital, on the part of bank 10, could be attributed to either real loss of capital or a situation of merger and acquisition, whereby bank 10 capital was absorbed by bank 20. Similarly, bank 1 owed bank 2, 20.9 per cent of bank 2 capital, while bank 7 owed bank 2 (13.2 per

[3] *The thickness of the network lines indicates the level of exposure, the thicker the line the greater the level of exposure.*

cent of bank 2's capital) and bank 7 owed 15 (10.4 per cent of bank 15's capital). A systemic crisis might emerge if bank 20 or 2 decides to recall their funds, given that the exposure between bank 10 and 20 was quite substantial as indicated by the thickness of the link among the banks. The intuition here was not the amount but the percentage of the borrowed funds on the capital of the creditor.

Figure 4: Interbank Exposure Network Diagram for End-June 2015



Source: Authors' Computation

V.1.3 Network Exposures for Period End-December 2015

For the end-December 2015, exposures activities among the banks were at its lowest ebb. The exposure between bank 14 and 21 was dominant, as indicated in Figure 5. Bank 14 owed bank 21,928.9 per cent of bank 21's capital). This was followed by the exposure of bank 18 to 21, whereby bank 18 owed bank 21 (13.4 per cent of bank 21's capital). Likewise, bank 23 owed bank 21 (5.3 per cent of bank 21's capital), bank 9 owed bank 2,093.1 per cent of bank 20's capital), while bank 16 owed bank 14 (2.9 per cent of bank 14's capital). Other noticeable exposures included bank 15 owed bank 19 (2.2 per cent of bank 19's capital); bank 4 owed bank 16 (2.2 per cent of bank 16's capital) and bank 20 owed bank 19 (2.0 per cent of bank 19's capital). Also, bank 10 owed bank 19 (1.2 per cent of bank 19's capital); and bank 16 owed bank 3 (1.1 per cent of bank 3's capital).

Figure 5: Interbank Exposure Network Diagram for End-December 2015

Source: Authors' Computation

V.1.4 Network Exposures for Period End-June 2016

As shown in Figure 6, the exposure between bank 16 and 10 was the dominant one, not in terms of the amount borrowed but rather the percentage of the borrowed fund on the capital of the lender. Bank 16 owed N18.27 billion to bank 10 and given that bank 16 had no capital as at the period of the simulation, making the exposure more pronounced. Other exposures are bank 10 owed (105.7 per cent of bank 11's capital); and bank 4 owed bank 23 (64.0 per cent of bank 23's capital). Similarly, bank 4 owed bank 21(48.1 per cent of bank 21's capital); and bank 10 owed bank 13 (48.4 per cent of bank 13's capital); and bank 1 owed bank 5 (25.0 per cent of bank 5's capital). Bank 1 owed bank 17 (11.5 per cent of bank 17's capital) and bank 1 owed bank 15 (9.8 per cent of bank 15's capital).

Figure 6: Interbank Exposure Network Diagram for End-June 2016

Source: Authors' Computation

V.2 Credit Shock Transmission

Simulating the transmission of credit shocks, we adapted a scenario in which institutions could rollover their debt obligations and do not necessarily have to resort to fire sales of assets. The credit shock analysis focused on a hypothetical default of a bank to other banks within the interbank market.

V.2.1 Credit Shocks Transmission for the Period End-December 2014

The simulation results were reported in Table 3. It was indicated in the Table that banks 7, 22, 9, 1 and 19 were systemic players in the market. As at end-December 2014, the default of these banks would have led to losses – after all contagion rounds of effects – of 13.9, 12.5, 9.6, 8.3 and 7.6 per cent, for bank 7, 22, 9, 1 and 19, respectively.

Induced failures and number of contagion rounds of the aftershocks, triggered by each hypothetical failure, were shown in columns 1 and 3 in Table 3. The failure of bank 10 would trigger distress in only one round contagion. Likewise, the failure of Bank 16 would trigger the failure of two additional banks in two round contagion.

The analysis further revealed the recognition of institutions whose stress posed systemic risk and institutions that became vulnerable because of such risks. At the end of December 2014, banks 1, 10, 12, 16 and 18 were systemic institutions that triggered light contagion within the market, while bank 7 and 22 experienced high capital losses, because of the induced failures. For the absolute hazard, also known as vulnerability, level indicated that out the 23 simulations, banks 10 and 11 were affected once and twice, respectively, in scenarios in which they were not the trigger institutions.

Table 3 – Simulation Results for Credit Shocks Transmission for the Period End-December 2014

Banks	Induced Failures	% of Failed Capital	Contagion Rounds	Index of Contagion	Index of Vulnerability
Bank 1	0	8.33	0	2.03	0.47
Bank 2	0	2.35	0	0	0.12
Bank 3	0	6.17	0	0	0.46
Bank 4	0	6.56	0	0.7	0.04
Bank 5	0	1.18	0	0	2.39
Bank 6	0	5.15	0	0	0.53
Bank 7	0	13.91	0	0.34	0.2
Bank 8	0	4.68	0	0	0.58
Bank 9	0	9.63	0	0	0.31
Bank 10	1	0.54	1	1.36	4.55
Bank 11	0	0.29	0	0	9.09
Bank 12	0	3.80	0	1.46	0
Bank 13	0	0.44	0	0	6.88
Bank 14	0	4.46	0	0	0.3
Bank 15	0	2.53	0	0.47	1.47
Bank 16	2	2.94	2	2.87	0.55
Bank 17	0	2.38	0	0	1.99
Bank 18	0	3.16	0	1.02	0
Bank 19	0	7.57	0	0	0.63
Bank 20	0	1.31	0	0	0
Bank 21	0	0.49	0	0	3.02
Bank 22	0	12.50	0	0	0
Bank 23	0	0.47	0	0.53	3.14

Source: Authors' Computation

V.2.2 Credit Shocks Transmission for the Period End-June 2015

The result of credit shocks simulation output for the period ended June 2015, presented on Table 4, indicated that an induced failure of bank 20 that consequently triggered capital loss of 9.04, 7.39, 15.46, 9.97, 8.06 and 12.71, respectively, to banks 1, 4, 7, 9,19 and 22. Capital erosion of banks 7 and 22 was quite significant, owing to the systemic impact of bank 20 on these two banks.

The contagion round of effects was also limited to one round, implying that there was no second-round contagion effect from the induced failure of bank 20. Apart from identifying bank 20 as a systemic player, the simulation also detected bank 10 as the most vulnerable in the system with a high 4.55 per cent index of vulnerability. However, the capital impairment of bank 10 was zero because it had a status of negative capital before the simulation.

Table 4: Simulation Result for Credit Shock Transmission for the Period End-June 2015

Banks	Induced Failures	% of Failed Capital	Contagion Rounds	Index of Contagion	Index of Vulnerability
1	0	9.04	0	0.15	0.88
2	0	1.38	0	0.27	0.6
3	0	6.64	0	0	0
4	0	7.39	0	1.12	0.34
5	0	1.03	0	0	3.38
6	0	5.14	0	0	0
7	0	15.46	0	0.57	0.18
8	0	4.88	0	0	0
9	0	9.97	0	0	0.07
10	0	0.00	0	0.67	4.55
11	0	0.29	0	0.03	0
12	0	0.00	0	0	0
13	0	0.64	0	0	0
14	0	3.25	0	0.91	0
15	0	2.90	0	0.42	0.47
16	0	2.75	0	1.61	0.1
17	0	2.46	0	0	0.11
18	0	3.27	0	0.96	0
19	0	8.06	0	0	0.96
20	1	1.62	1	1.19	0
21	0	0.63	0	0	1.51
22	0	12.71	0	0	0.66
23	0	0.48	0	0.64	0

Source: Authors' Computation

V.2.3 Credit Shocks Transmission for the Period End-December 2015

Table 5 presented showed the simulation result of credit shock transmission for the period end-December 2015. Owing to the low exposures activities observed from the network diagram, the simulator did not induce failure for any bank, as depicted on column 2 of Table 5. However, the possible erosion of capital was captured more for bank 7 with 14.43 per cent. This was followed by bank 22, 1, 19, 4, 3, 23, 8 and 6 with 11.49, 9.19, 7.72, 7.21, 6.0, 5.13, 5.13 and 4.69 per cent levels of capital failure, respectively.

On the other hand, bank 20 tended to have more contagion as exhibited by more lines, linking it to other banks as shown in Figure 5, with 0.52 per cent, while bank 18 with 0.34 per cent, came second with the largest volume of activities within the network. Other likely cases of contagion were bank 14, 16, 7, 15, 23, 10, 4 and 9 with 0.23, 0.20, 0.18, 0.17, 0.17, 0.09, 0.06 and 0.05 per cent, respectively. Bank 19 was the most vulnerable in the system.

Table 5: Simulation Results for Credit Shocks Transmission for the Period End-December 2015

Banks	Induced Failures	% of Failed Capital	Contagion Rounds	Index of Contagion	Index of Vulnerability
1	0	9.19	0	0	0
2	0	1.34	0	0	0
3	0	6.00	0	0	0.05
4	0	7.21	0	0.06	0.13
5	0	0.00	0	0	0
6	0	4.69	0	0	0
7	0	14.43	0	0.2	0.06
8	0	5.13	0	0	0
9	0	9.41	0	0.05	0.05
10	0	0.70	0	0.09	0
11	0	0.42	0	0	0
12	0	0.00	0	0	0
13	0	0.60	0	0	0
14	0	3.80	0	0.23	0.13
15	0	2.70	0	0.17	0
16	0	2.59	0	0.18	0.1
17	0	2.41	0	0	0
18	0	2.98	0	0.34	0
19	0	7.72	0	0	0.32
20	0	1.49	0	0.52	0.14
21	0	0.58	0	0	2.16
22	0	11.49	0	0	0.06
23	0	5.13	0	0.17	0.16

Source: Authors' Computation

V.2.4 Credit Shocks Transmission for the Period End-June 2016

Three induced failures were simulated for the credit shocks, one for bank 10 and two for bank 16. This, however, produced one round contagion effect for bank 10 and a second-round effect for bank 16. Contagion index of 2.47 per cent for bank 16 was the highest, followed by 1.91, 1.31 and 1.29 per cent for bank 1, 12 and 10, respectively. The result also indicated bank 11 as the most vulnerable with vulnerability index of 9.09 per cent, trailed closely by bank 10 and 23 with 4.55 and 2.91 per cent index of vulnerability, respectively.

Table 6: Simulation Results for Credit Shocks Transmission for the Period End-June 2016

Banks	Induced Failures	% of Failed Capital	Contagion Rounds	Index of Contagion	Index of Vulnerability
1	0	9.04	0	1.91	0.41
2	0	1.38	0	0	0.18
3	0	6.64	0	0	0.4
4	0	7.39	0	0.66	0.03
5	0	1.03	0	0	2.55
6	0	5.14	0	0	0.49
7	0	15.46	0	0.33	0.17
8	0	4.88	0	0	0.52
9	0	9.97	0	0	0.28
10	1	0.29	1	1.29	4.55
11	0	0.29	0	0	9.09
12	0	0.00	0	1.31	0
13	0	0.64	0	0	4.4
14	0	3.25	0	0	0.38
15	0	2.90	0	0.44	1.2
16	2	3.04	2	2.47	0.45
17	0	2.46	0	0	1.81
18	0	3.27	0	0.95	0
19	0	8.06	0	0	0.55
20	0	1.62	0	0	0
21	0	0.63	0	0	2.18
22	0	12.71	0	0	0
23	0	0.48	0	0.5	2.91

Source: Authors' Computation

V.3 Funding Shocks Transmission

The effect of funding shocks was considered based on the assumption that banks were unable to roll over credit arrangements, thereby falling back to a fire sale of their assets to meet due obligations. Given the fact that such assets disposal would be done with some level of desperation, we further assumed that a discount value of 35 per cent, implying that such assets would be disposed at a market rate less the discount value (i.e., at 65 per cent).

V.3.1 Funding Shocks Transmission for the Period End-December 2014

From the simulation results, in Table 7, the funding shock exhibited a similar pattern like the credit shocks transmission, except for bank 10 and 16, where the percentage of failed capital were 0.25 and 2.40 per cent, which were less than 0.54 and 2.94, respectively, recorded for 10 and 16 under the credit shocks transmission. The vulnerability of banks was more pronounced in the preceding analysis of credit shock when compared to the funding shocks transmission analysis, except for bank 4,7, 8 and 10.

Table 7 – Simulation Result for Funding Shocks Transmission for the Period End-December 2014

Banks	Induced Failures	% of Failed Capital	Contagion Rounds	Index of Contagion	Index of Vulnerability
Bank 1	0	8.33	0	0.28	0.35
Bank 2	0	2.35	0	0.02	0
Bank 3	0	6.17	0	0.23	0
Bank 4	0	6.56	0	0.02	0.16
Bank 5	0	1.18	0	0.22	0
Bank 6	0	5.15	0	0.22	0
Bank 7	0	13.91	0	0.25	0.03
Bank 8	0	4.68	0	0.22	0
Bank 9	0	9.63	0	0.13	0
Bank 10	0	0.25	0	0.21	8.93
Bank 11	0	0.29	0	0.12	0
Bank 12	0	3.80	0	0	0.59
Bank 13	0	0.44	0	0.12	0
Bank 14	0	4.46	0	0.11	0
Bank 15	0	2.53	0	0.26	0.29
Bank 16	0	2.40	0	0.11	1.18
Bank 17	0	2.38	0	0.34	0
Bank 18	0	3.16	0	0	0.5
Bank 19	0	7.57	0	0.36	0
Bank 20	0	1.31	0	0	0
Bank 21	0	0.49	0	0.11	0
Bank 22	0	12.50	0	0	0
Bank 23	0	0.47	0	0.11	1.79

Source: Authors' Computation

V.3.2 Funding Shocks Transmission for the Period End-June 2015

For the funding shocks, the induced failed banks were 1 and 19, triggering the same pattern of capital loss, as with the case of credit shocks. The index of contagion and vulnerability differed, slightly with the credit shocks; bank 10 stood as one of the most vulnerable banks, with vulnerability index of 13.64 per cent, followed by bank 23 with vulnerability index of 2.14. While the index of contagion was just one round effect, implying that the effect of the induced failures wore off with the first-round effect.

Table 8 – Simulation Results for Funding Shocks Transmission for the Period End-June 2015

Banks	Induced Failures	% of Failed Capital	Contagion Rounds	Index of Contagion	Index of Vulnerability
Bank 1	1	9.04	1	0.56	0.02
Bank 2	0	1.38	0	0.06	0.31
Bank 3	0	6.64	0	0	0
Bank 4	0	7.39	0	0.21	0.22
Bank 5	1	1.03	1	0.03	0
Bank 6	0	5.14	0	0	0
Bank 7	0	15.46	0	0.26	0.05
Bank 8	0	4.88	0	0	0
Bank 9	0	9.97	0	0.06	0
Bank 10	0	0.00	0	0.02	13.64
Bank 11	0	0.29	0	0	0.16
Bank 12	0	0.00	0	0	0
Bank 13	0	0.64	0	0	0
Bank 14	0	3.25	0	0	0.43
Bank 15	0	2.90	0	0.11	0.23
Bank 16	0	2.75	0	0.02	0.9
Bank 17	0	2.46	0	0.02	0
Bank 18	0	3.27	0	0	0.45
Bank 19	1	8.06	1	0.58	0
Bank 20	0	1.62	0	0	0.74
Bank 21	0	0.63	0	0.07	0
Bank 22	0	12.71	0	0.74	0
Bank 23	0	0.48	0	0	2.14

Source: Authors' Computation

V.3.3 Funding Shocks Transmission for the Period End-December 2015

The likely percentage of failed capital from funding shock transmission simulation for the period end- December 2015 mimicked the credit pattern for the same period, ascribable to low exposures activities within the network. Bank 19 came first on the contagion index with 0.21 per cent, while bank 20 with 0.54 per cent was the most vulnerable.

Table 9 – Simulation Results for Funding Shocks Transmission for the Period End-December 2015

Banks	Induced Failures	% of Failed Capital	Contagion Rounds	Index of Contagion	Index of Vulnerability
Bank 1	0	9.19	0	0	0
Bank 2	0	1.34	0	0	0
Bank 3	0	6.00	0	0.02	0
Bank 4	0	7.21	0	0.08	0.01
Bank 5	0	0.00	0	0	0
Bank 6	0	4.69	0	0	0
Bank 7	0	14.43	0	0.08	0.02
Bank 8	0	5.13	0	0	0
Bank 9	0	9.41	0	0.04	0.01
Bank 10	0	0.70	0	0	0.2
Bank 11	0	0.42	0	0	0
Bank 12	0	0.00	0	0	0
Bank 13	0	0.60	0	0	0
Bank 14	0	3.80	0	0.04	0.09
Bank 15	0	2.70	0	0	0.1
Bank 16	0	2.59	0	0.02	0.11
Bank 17	0	2.41	0	0	0
Bank 18	0	2.98	0	0	0.18
Bank 19	0	7.72	0	0.21	0
Bank 20	0	1.49	0	0.02	0.54
Bank 21	0	0.58	0	0.1	0
Bank 22	0	11.49	0	0.05	0
Bank 23	0	5.13	0	0.07	0.05

Source: Authors' Computation

V.3.4 Funding Shocks Transmission for the Period End-June 2016

The outcome of the funding shocks transmission presented in Table 10 mimicks the pattern of failed capital exhibited in the interbank market for the period end-June 2015. There were eight induced failures, for banks 1, 15 and 19 the induced failure was twice but the effect was just one round, while banks 9,11,13,14 and 16 had one induced failure with only one round contagion effect. The index of contagion for the period was equally mild with 0.46 per cent as the highest; this also reflected the contagion round that lie between zero and one. The index of vulnerability indicated bank 10 as the most vulnerable in the system with 31.82 per cent level of vulnerability, followed by 12 with 27.27 per cent level. Similarly bank 16, 23, 18, 11, 5, 4 and 7 had 3.22, 1.66, 0.45, 0.31, 0.23, 0.13 and 0.03 per cent level of vulnerability, respectively.

Table 10 – Simulation Result for Funding Shocks Transmission for the Period End-June 2016

Banks	Induced Failures	% of Failed Capital	Contagion Rounds	Index of Contagion	Index of Vulnerability
Bank 1	2	9.04	1	0.32	0.31
Bank 2	0	1.38	0	0.02	0
Bank 3	0	6.64	0	0.22	0
Bank 4	0	7.39	0	0.02	0.13
Bank 5	0	1.03	0	0.2	0
Bank 6	0	5.14	0	0.21	0
Bank 7	0	15.46	0	0.24	0.03
Bank 8	0	4.88	0	0.2	0
Bank 9	1	9.97	1	0.22	0
Bank 10	0	0.00	0	0.19	31.82
Bank 11	1	0.29	1	0.2	0
Bank 12	0	0.00	0	0	27.27
Bank 13	1	0.64	1	0.2	0
Bank 14	1	3.25	1	0	0
Bank 15	2	2.90	1	0.36	0.23
Bank 16	1	2.75	1	0	3.22
Bank 17	2	2.46	1	0.43	0
Bank 18	0	3.27	0	0	0.45
Bank 19	2	8.06	1	0.46	0
Bank 20	0	1.62	0	0	0
Bank 21	0	0.63	0	0.11	0
Bank 22	0	12.71	0	0	0
Bank 23	0	0.48	0	0.11	1.66

Source: Authors' Computation

VI. Conclusion

The paper appraised the effect of bank lending relationships in the Nigerian interbank market for the four periods namely: end-December 2014, end-June 2015 end-December 2015 and end-June 2016, using network model. We analysed the systemic risk implied in the Nigerian interbank network, based on various network measures. In our analysis, we represented the interbank market exposures as a network consisting of nodes (banks) and time-varying number of weighted and directed links between them (representing interbank exposures or loans). The direction of the links followed the flow of money from lenders to borrowers. We further established (with network diagram) the systemic risk inherent in the interbank market exposure. Our dataset included a sample of 23 banks in Nigeria. For each bank, we included information about the total qualifying capital and the interbank exposures (both secured and unsecured). Data on individual banks bilateral exposures were extracted from the FinA.

The main findings showed that few banks, namely: bank 1,2, 4, 10, 13, 15, 17, 20, 21 and 23 featured prominently in the analysis, owing to the level of exposures and the effect of these varying exposures on their capital base. Also, the analysis exposed the linkages between bank 10 and 16 and among other banks and these two banks as systemic to the market, regarding the magnitude of the exposure, effect on capital and vulnerability. A scenario of these two banks failing would spark up the chains of other failures with contagion second-round effects. Globally, bank supervisors use a combination of both on-site examination and off-site surveillance in their supervisory tasks. While on-site examinations are recognised as the cornerstone of bank supervision, regulators usually support their on-site examinations with off-site surveillance, which entails quarterly reviews of banks' financial data. This analysis or usage of network analysis would assist the supervisors in:

- taking prompt actions in response to emerging supervisory issues before such issues exacerbate into major concerns, and
- focusing on the institutions presenting the greatest risk to the financial system.

References

Acharya, V.V., Gromb, D., & Yorulmazer, T., (2008). Imperfect Competition in the Interbank Market for Liquidity as a Rationale for Central Banking. *Mimeo*. Nigeria.

Aghion, P., Nicholas, B., Richard, B, Rachel, G., & Peter, H. (2005). Competition and Innovation: An Inverted-U Relationship. *The Quarterly Journal of Economics*, 120(2): 701–728.

Allen, F. & Ana, B. (2008). Networks in Finance. *Wharton Financial Institutions Center Working Paper* No. 08-07. Available at SSRN: https://ssrn.com/abstract=1094883

Allen, F. & Gale, D. (2000). Financial Contagion. *Journal of Political Economy* 108, 1-33.

Allen, F., & Carletti, E. (2011). Systemic Risk and Macroprudential Regulation. *University of Pennsylvania and European University Institute*, mimeo, 1-13.

Angelini, P. Mariesca, G., & Russo, D. (1996). Systemic Risk in the Netting System. *Journal of Banking and Finance*, 20, pp. 853–868.

Arrow K. J. & Borzekowski, R. (2004). Limited Network Connections and the Distribution of Wages. *Finance and Economics Discussion Series 2004-41*.

Bancarewicz, G. (2005). The Classification Criteria and the Privileged Position of Systemically Important Banks and Equal Opportunities for Banks in the Financial System. *Bank and Credit,* No. 11/12, Warszawa November-December.

Bech, M. L., & Garratt, R., (2006). Liquidity in the Interbank Payment System Following Wide-Scale Disruptions. *Staff Report* No. 239. Federal Reserve Bank of New York.

Black, Lamont., Correa, R., Huang, X., & Zhou, H (2012). The Systemic Risk of European Banks during the Financial and Sovereign Debt Crises. *Federal Reserve Board*, Washington, D.C., USA

Blåvarg, M. & P. Nimander (2002). Interbank Exposures and Systemic Risk. *Penning och Valutapolitik*, No. 2, pp. 18-44. Sveriges Riksbank.

Brunnermeier & Pedersen, M. K. (2009). Market Liquidity and Funding Liquidity. *Review of Financial Studies*, 22 (6) (2009), pp. 2201–2238

Calvó-Armengol, A., & Jackson, M. O. (2004). The Effects of Social Networks on Employment and Inequality. *American Economic Review*, 94(3): 426-454. DOI: 10.1257/0002828041464542

Centre Special Paper No 1, January, 3.

Chen, Y (1999). Banking Panics: The Role of First-come, First-served Rule and Information Externalities. *Journal of Political Economy*, 107 (5) pp. 946–968

Cifuentes, R., Ferrucci, G., & Shin, H. S. (2005). Liquidity Risk and Contagion. *Journal of the European Economic Association*, 3 (2–3), pp. 556–566

Cifuentes, R. (2003). Banking Concentration: Implications for Systemic Risk and Safety Net Designs. *Central Bank of Chile Working Papers* No 231, Central Bank of Chile, 21-22.

Corominas-Bosch, M. (2004). Bargaining in a Network of Buyers and Sellers. *Journal of Economic Theory, Elsevier*, vol. 115(1), pages 35-77.

Dasgupta, A. (2004). Financial Contagion through Capital Connections: A Model of the Origin and Spread of Banking Panics. *Journal of the European Economic Association*, 2 (6) (2004), pp. 1015–1048

De Bandt, O. & Hartmann, P. (2000). Systemic Risk: A Survey. E*uropean Central Bank, Working Paper Series* No 35.

Degryse, H. & Nguyen G, (2004). Interbank Exposures: An Empirical Examination of Systemic Risk in the Belgian Banking System. *Working Paper Research* 43, National Bank of Belgium.

Diamond, D. W. and Dybvig P. H. (1983). Bank Runs, Deposit Insurance, and Liquidity. *The Journal of Political Economy*, Vol. 91, No. 3, pp. 401-419, 1983.

Diamond, D.W. & Rajan, R.G. (2005). Liquidity Shortages and Banking Crises. *Journal of Finance*, 60 (2), pp. 615–647.

Espinosa-Vega & Solé (2011). Cross-Border Financial Surveillance: A Network Perspective. *IMF Working Paper* WP/10/105

Fecht, F. (2004). On the Stability of Different Financial Systems. Journal of the *European Economic Association*, 2 (6) (2004), pp. 969–1014.

Freixas, X., Parigi, B., & Rochet, J.C. (2000). Systemic Risk, Interbank Relations and Liquidity Provision. Central Bank J*ournal of Money, Credit and Banking*, 32, pp. 611–638

Gai, P., & Kapadia, S. (2010). Contagion in Financial Networks. *Proceedings of the Royal Society Series A*, 466(2120), 2401-2423.

Gauthier, C. & Souissi, M (2012). Understanding Systemic Risk in the Banking Sector: A Macrofinancial Risk Assessment Framework. *Bank of Canada Review*.

Goldsteina, I. and Pauzner, A. (2004). Contagion of Self-fulfilling Financial Crises due to Diversification of Investment Portfolios, *Journal of Economic Theory* Vol. 119, p. 151–183.

Huang, Xin, Zhou, H. & Zhu, H. (2012). Assessing the Systemic Risk of a Heterogeneous Portfolio of Banks during the Recent Financial Crisis. *Journal of Financial Stability* 8 (2012) 193–205 www.elsevier.com/locate/jfstabil

Humphrey, D. B. (1986). Payments Finality and the Risk of Settlement Failure. A. Saunders, L.J. White (Eds.), *Technology and the Regulation of Financial Markets: Securities, Futures and Banking*, Lexington Books, Lexington, MA

Inaoka, H., Ninomiya, T., Taniguchi, K., Shimisu, T., & Takayasu, H. (2014). Fractal Network Derived from Banking Transaction–An Analysis of Network Structures Formed by Financial Institutions. *Bank of Japan Working Papers, 4*.

Iori, G., Saqib, J., & Francisco G. P. (2006). Systemic Risk on the Interbank Market. *Journal of Economic Behavior & Organisation* Vol. 61 (2006) 525–542

Iori, G., Jafarey, S., & Padilla, F., 2006. Systemic Risk on the Interbank Market. *Journal of Economic Behaviour and Organisation* 61 (4), 525–542.

Iyer R. & Peydró-Alcalde, J. L. (2005). How Does a Shock Propagate? A Model of Contagion in the Interbank Market due to Financial Linkages. *Mimeo*.

Kanno, M. (2014). An Assessment of Systemic Risk in the Japanese Banking Sector. *Global Credit Review*, 04(01), 1–15.

Kanno, M. (2015). The Network Structure and Systemic Risk in the Japanese Interbank Market. *Japan and the World Economy*. 36, 102–112.

Kodres, L. & Pritsker, M. (2002). Rational Expectations Model of Financial Contagion. *Journal of Finance*, 57 (2) (2002), pp. 769–799.

Laeven, L., Ratnovski, L. & Tong, Hui (2014). Bank Size and Systemic Risk Some International Evidence. *International Monetary Fund Discussion Note* SDN/14/04. https://www.imf.org/external/pubs/ft/sdn/2014/sdn1404.pdf.

Lagunoff, R. & Shreft, S.L (2001). A Model of Financial Fragility. *Journal of Economic Theory*, 99 (2001), pp. 220–264

Langfield, S., Z. Liu, & T. Ota (2014). Mapping in the UK Interbank System. *Journal of Banking & Finance*, 45, 288–303.

Leitner, K.-H. (2005). Managing and Reporting Intangible Assets in Research Technology Organisations. *R&D Management*, 35: 125–136.

Loannides, Y.M., & Soetevent. A. R. (2006). Wages and Employment in a Random Social Network with Arbitrary Degree Distribution. *American Economic Review*, 96(2): 270-274.

Masayasu K., (2015). Assessing Systemic Risk using Interbank Exposures in the Global Banking System. *Journal of Financial Stability*, 20, (C), 105-130.

Mattia M. & ChristofferKok (2016). Multi-layered Interbank Model for Assessing Systemic Risk. *Working Paper Series* No.1944.

Nier, E. W. (2009). Financial Stability Frameworks and the Role of Central Banks: Lessons from the Crisis. *IMF Working Paper* WP/09/70, IMF, 24-25.

Nier, E., Yang, J., Yorulmazer, T., Alentorn, A. (2008). Network Models and Financial Stability. *Working Paper* no 346/2008, Bank of England.

Northcott, C.A., (2002). Estimating Settlement Risk and the Potential for Contagion in Canada's Automated Clearing Settlement System. *Working Paper* 2002-41. Bank of Canada.

Puhr, C., Seliger, R. & Sigmund, M. (2012). Contagiousness and Vulnerability in the Austrian Interbank Market. *Oesterreichische National Bank Financial Stability Report*, 24.

Rochet, J. C. & J. Tirole, (1996). Interbank Lending and Systemic Risk. *Journal of Money, Credit, and Banking*, 28(4), 733-762.

Sanusi, L. S. (2010). The Nigerian Banking Industry: What went wrong and the way Forward, CBN Governor's Speech, 1-23.

Sheldon, G. & Maurer M., (1998). Interbank Lending and Systemic Risk: An Empirical Analysis for Switzerland. *Swiss Journal of Economics and Statistics,* 134 685- 704.

Smaga, P., (2014). Post-Crisis Challenges for Central Banks Monetary Policy and Its Challenges in Modern Economies, M. Szyszko, eds. *The Poznan School of Banking Research Journal*, 2014, Vol. 56, No. 5, pp. 29-41.

Soramäki, K., Bech, M. L., Arnold, J., Glass, R. J., and Beyeler, W. E., (2007). The Topology of Interbank Payment Flows. Physica A: *Statistical Mechanics and its Applications*, 379(1), 317-333.

Temzelides, T., (1997). Evolution, Coordination, and Banking Panics. *Journal of Monetary Economics, Elsevier*, Vol. 40(1), Pages 163-183, September.

Upper, C. & Andreas W., (2002). Estimating Bilateral Exposures in the German Interbank Market: Is there a Danger of Contagion. *Deutsche Bundesbank Discussion Paper* 9.

Upper, C., (2011). Simulation Methods to Assess the Danger of Contagion in Interbank Markets. *Journal of Financial Stability* 7 (2011) 111–125.

Varotto, S & Zhao, Lei (2014). *Systemic Risk and Bank Size*. ICMA Centre, Henley Business School, University of Reading.

Vivier-Lirimont, S., (2004). Interbanking Networks: Towards a Small Financial World? *Cahiers de la Maison des Sciences Economiques*, Université Panthéon-Sorbonne (Paris 1).

Zigrand, J. P. (2014). Systems and Systemic Risk in Finance and Economics. *Systemic Risk Centre Special Paper* No 1, January, 3.

Macroeconomic Instability Index and Threshold for the Nigerian Economy

Amoo B. A. G., Achua J. K., Audu N. P. and Hamma B. *

Abstract

The paper employed statistical algorithms, factor analysis and threshold autoregressive models to address the gaps in management of macroeconomic instability in Nigeria. Using data spanning 2010q1 to 2017q2, the findings showed that the values of macroeconomic instability index (MII) fluctuated between 0.316 and 0.609, with a threshold of 0.461. This showed an inverse relationship between macroeconomic instability and economic growth. This framework could serve as a mechanism to gauge early warning signal of instability in Nigeria.

Keywords: Macroeconomic Instability Index, Threshold Autoregressive, Self-exciting Threshold Autoregressive, Nigeria

JEL Classification Numbers: E1, E6, O2, O4

I. Introduction

The prevalence of macroeconomic instability has become evident in global, regional and country-specific economic crises in the 21st century. Even though it is a global phenomenon, developed and developing countries experience macroeconomic instability, differently. Developing economies experience more chronic cyclical macroeconomic instability than developed ones (Easterly, 2001a). These experiences are associated with dire consequences. In Sub-Saharan Africa, for instance, macroeconomic instability is highly associated with political instability, social unrest and political violence (Ibe, 2002). In the business sphere, macroeconomic instability has been identified as the main constraint to firm growth in South Africa (Beaumont-Smith et al., 2003). In Nigeria, the 2016-2017 economic recession has highlighted the negative impact of macroeconomic instability, including spiralling inflation, unstable exchange rates, escalating debt levels and dwindling economic activities. These accentuate high unemployment, prevalent poverty and high social insecurity.

* *The authors are staff of the Real Sector Division, Research Department, Central Bank of Nigeria. The usual disclaimer applies.*

Consequently, the nature, causes and measures of macroeconomic instability have continued to be a source of concern to economists and policy makers. The phenomenon is complex and multi-dimensional, due to the multiplicity of its consequences on growth potential of economies, diverse causes and the numerous methods of measurement (Cariolle & Goujon, 2015). This accounts for the lack of effective measuring methods to monitor the phenomenon, especially in developing economies, over time. In the literature, however, attempts have been made to develop measuring tools for macroeconomic instability condition indices for different developing countries. The results include construction of macroeconomic instability index (MII) for 20 developing countries across Europe and Asia (Kaminsky, 1998), Latin American countries (Herrera & Garcia, 1999), Turkey (Ismihan, 2003), as well as the Dominican Republic and Haiti (Jaramillo & Sancak, 2007). These indices became important economic tools of an early warning system (EWS) of macroeconomic conditions and planning (Herrera & Garcia, 1999).

Even though the Nigerian economy has always been prone to macroeconomic instability, due to its oil-dependency syndrome, literature reveals that MII is yet to be modelled for the economy. Rather, policy makers, academics and analysts have continued to examine the economy based on disaggregated macroeconomic stability factors (Kolawole, 2013). This deficiency poses the challenge of deriving a holistic indicator of instability to reflect the economy's macroeconomic condition. This measurement gap has implications for researchers and policy makers because a positive relationship exists amongst measurement, theory and decision-making (Jacobs & Šlaus, 2010). The need for MII to provide clear objectives for policy and decision-making has become apparent with Nigeria's experience of 2016-2017 economic recession.

In order to fill the research gap, this paper developed a threshold effect of macroeconomic instability indicator for Nigeria. Specifically, the paper sought to: (i) construct a MII that captures the aggregate macroeconomic instability trajectory for the Nigerian economy; and (ii) determine the threshold for the macroeconomic instability condition, as an early warning system. The study is imperative due to knowledge gaps in terms of analytical framework and methodology.

Following this introduction, the rest of the paper is organised as follows. Section 2 provides the literature review made up of conceptual and methodological framework. Section 3 highlights the methodology of the study, data characteristics and estimation procedure and techniques while Section 4 presents the empirical findings, results and discussions of the study. Section 5 concludes the paper.

II. Literature Review

The concept and paradigm shift in modelling macroeconomic instability index have continued to receive attention in economic literature.

II.1 Conceptual Issues

Macroeconomic conditions are the aggregate outcomes of economic behaviour, arising from fluctuations in monetary and fiscal economic variables that affect the overall business activities at the national level. According to Fischer (1993, p. 487):

> *Macroeconomic framework can be described as stable when inflation is low and predictable, real interest rates are appropriate, fiscal policy is stable and sustainable, the real exchange rate is competitive and predictable and the balance of payments is perceived as viable.*

Macroeconomic stability condition is attained when an economy minimises vulnerability to external shocks and increases its prospects for sustained growth. On the other hand, macroeconomic instability is an imbalanced economic condition, characterised by protracted fiscal deficits, mounting outstanding loans, unfavourable balance of payments, declining foreign exchange reserves, persistent currency depreciation, and escalating inflationary pressure, leading to low confidence level in the crisis prone economy. The spontaneous impact of these creates a condition of macroeconomic imbalance, which render traditional monetary policy ineffective; thus, requiring intervention of unconventional monetary policy to correct the distortions and reverse the economic downturn.

The dichotomy between macroeconomic stability and instability accounts for economic growth differences (Ramey & Ramey, 1995; Dabušinskas et al., 2012). While macroeconomic stability is the centerpiece for sustainable economic growth (Easterly, 2001b), macroeconomic instability impedes economic growth (Ali & Rehman, 2015). There are obvious linkages between macroeconomic instability and economic growth (Bleaney, 1996). Firstly, instability in inflation and nominal exchange rates causes a higher real exchange rate risk for investments in export-oriented and import-dependent productions. This is because potential earnings depend on these highly unstable variables. Secondly, domestic demand is affected both directly and indirectly by variability in inflation and exchange rates. These fluctuations directly affect the terms-of-trade; thus, shifting demand from domestically produced goods to imported goods, or the other way round. Thirdly, it indirectly affects the levels of production, income, and consumption demand in the economy. These developments increase the level of uncertainty about future earnings of firms, due to investment risks.

Studies have shown that developing economies experience more severe consequences of macroeconomic instability than developed economies (Easterly, 2001a). Developing countries are exposed to fluctuations of commodity prices, which are occasioned by booms, bursts and slumps that often define their macroeconomic volatility conditions(Céspedes & Velasco, 2012 and Jacks, 2013). These economies enjoy favourable external credit funding in boom days but suffer credit contraction during burst and slump episodes. Commodity price burst and credit retractions constrain fiscal and monetary policy options from smoothening the decline in output, as the economies become choked up by high country premia (Daniel, 2011). Thus, failure to make the right investments and savings decisions, during the boom period, exposes developing countries to macroeconomic instability (Powell, 2015).

The established link between economic growth and macroeconomic behaviour, within the context of an economy, has attracted development economists' attention to causes of macroeconomic instability. Kharroubi (2006) identifies three main sources of instability in economic growth of developing countries, as: (i) significant external influences, which originate from financial markets and external trade terms; (ii) domestic influences, due to inherent instability; and (iii) self-inflicted policy faults. It should be noted that,

apart from financial market shocks, countries that depend on resource extraction and exports of commodities could run into adverse commodity price shocks that portend macroeconomic risks to them and the risks are greater for economies that are less diversified and more dependent on commodities (UNCTAD, 2012).

It has also been observed that domestic shocks create more macroeconomic instability than external shocks in developing nations (Raddatz, 2007). This stance was strengthened by Kraay & Ventura's (2007) argument that the adoption of traditional technologies and unskilled labour by developing countries make their output more volatile. Yet another important source of economic instability in developing countries is what has been described by De Ferranti & Ferreira (2000) as 'weak shock absorption capacity'. Dornbusch & Edwards (1990), Onis (1997) and Easterly & Kraay (2000), all conclude that the predominance of macroeconomic instability in developing countries is characterised by poor management of fiscal and monetary policies, as well as structural inequality in income distribution.

Some economists have attempted to define macroeconomic instability condition without the theoretical underpinnings, for precise policy implications. It is not surprising, therefore, that several authors have used inflation as a proxy for measuring macroeconomic instability (see Azam, 1999; Caballero, 2007; Iqbal & Nawaz, 2010; Shahbaz, 2013). The plausibility of this measure lies in the fact that high inflation leads to high volatility in relative prices, thus, making investments riskier. For instance, the entire financial system is at risk when the banking system is exposed to firms and households during inflation. Consequently, high inflation affects the standard of living in an economy negatively by lowering growth and redistributing inequitably real income and wealth.

However, the need to determine macroeconomic instability by assessing the combined effect of the various relevant macroeconomic variables, concurrently with a single indicator, has been emphasised by Fischer (1993) and Sahay & Goyal (2006) because macroeconomic factors impact simultaneously on the economy. In some cases, multiple macroeconomic influences are counteracting, making interpretation of a clear economic trajectory very difficult. For instance, low exchange rate may be maintained at the cost of depleting international reserves and constraining exports. In an

analysis of the relationship between macroeconomic factors and economic growth in Nigeria, spanning from 1980 to 2011, Kolawole (2013) establisheD that while real interest rate significantly affects growth positively, external debt and real exchange rate have negative impact on growth. This ambiguity is common when macroeconomic factors are examined individually, to establish their relative effects on growth. This does not clearly indicate whether the economic condition is stable or not.

Barro (1991), Baker (1998) and Caballero (2007) emphasised the contemporaneous influences of internal and external factors on macroeconomic instability. It follows that a measure of macroeconomic instability that does not encompass all relevant factors, that impinge substantially on the economic situation concurrently, amounts to partial analysis. When the factors, leading to macroeconomic instability in an economy, become prevalent, a single variable may not give a clear indication of the economic path. An incorporation of all the different relevant components of the instability drivers is necessary to provide an optimal indicator (Kaminsky, 1998). These factors are dynamic; and any effective model has to be adaptable to changing macroeconomic influences within the economic context. Consequently, Azam (2001) suggested that a MII, comprising inflation and nominal exchange rate, would be a more appropriate macroeconomic instability measure, rather than relying on inflation rate only.

The need to devise tools to facilitate informed predictions of economic conditions necessitates the development of MII. Kaminsky (1998) constructed a complex multi-stage indicator for forecasting financial crises. First, the leading indicators were selected and examined, individually. A composite indicator was then developed from the individual indices by aggregating the individual indicators through several techniques, such as quadratic probability score, the log probability score, and the global-squared bias score, for the selected composite indicators. This was then compared to exchange rate, which was adjudged empirically to be the best univariate indicator. The score statistic was reported as "Crisis Times" and "Tranquil Times", separately to test the variability of the key indicators across regimes. Overall, the composite index performed more accurately in predicting financial crises than the leading indicator.

Herrera and Garcia (1999) developed a variation of MII as a precautionary measure for imminent macroeconomic distortions for several Latin American countries. The models' out-of-sample predictive ability on economic crises was successfully tested in several Latin American vulnerable economic situations in the late 1990s. The interesting thing about this model is its use of fewer variables, which are widely available and reported with timeliness to generate the index. In addition to the operational tool, which the index provides, it also generates an early warning signal. Apart from the aggregation of the variables, which produce the composite index, the procedure can generate signals with each variable individually.

A MII for Turkey was modeled by Ismihan (2003), consisting of inflation and exchange rates along with external debt to GNP public and deficit to GNP ratios. The model was constructed in two steps. The framework explored several macroeconomic issues, especially the links between overall macroeconomic performance and fiscal decisions. The main feature of this model was that it made a distinction between productive and non-productive public spending. Sanchez-Robles (1998) employed error correction model to develop MII for the Spanish economy, using inflation, deficit balance, various types of public expenditure in relation to gross domestic product (GDP), and market distortions as variables.

Over time, more variables were progressively included in the determination of MII. A more inclusive approach to the concept of macroeconomic stability by Ocampo (2005) encompassed price stability, fiscal policy, public debt, as well as private and public sector balance sheets. The framework, which was specially modelled for developing countries, was elaborate and a broad view of macroeconomic stability, involving multiple objectives and significant tradeoffs. It also emphasised counter-cyclical dimensions of macroeconomic and financial policies. Jaramillo & Sancak (2007) constructed MII as the weighted sum of inflation and exchange rates volatility, less-accumulated foreign reserve, as a percentage of monetary base at the beginning of the period, minus the fiscal balance, as a percent of GDP. Each variable in the model was weighted by the inverse of its standard deviation. The weighting standardised the variables to normalise the volatilities of all the components of the index and ensured that the index was not overwhelmed by the most volatile components. The model was such that an increasing value for the index indicated increasing instability.

Several economists had taken advantage of the lack of consensus that pervades the concept and definition of macroeconomic instability to devise differing measures. Iqbal & Nawaz (2010) had constructed Misery Index, consisting of inflation and unemployment rates, as a measure of macroeconomic instability in Pakistan. The authors employed ordinary least squares (OLS) and Gaussian Mixture Model (GMM) models. Ali (2015) employed inflation and unemployment rates, together with budget and trade deficits for measuring macroeconomic instability in Pakistan by applying the error correction model.

Though the varieties in methodologies have produced useful macroeconomic instability indices in different contexts, lack of consensus is still a major challenge. The real problem is that the criteria for the selection of variables for MII are hardly clearly articulated. Therefore, the variations suggest that merely deriving MII from two or several variables would not fully explain the macroeconomic condition of an economy. Hence, the reality of the economic context defines the composition of macroeconomic instability of an economy at any given period.

Although theory is yet to provide unambiguous conditions as to the precise causes of macroeconomic instability, it has provided reasonable clarifications as to what could amount to possible proxies of macroeconomic instability. These indicators range mostly between monetary and fiscal policy variables, including inflation, exchange rate, interest rate, foreign reserves, base money, fiscal balances, public debts, trade deficits and foreign direct investment. These variables could constitute building blocks in the construction of the indicators of macroeconomic instability.

Literature reviewed so far has revealed that there was no conscious effort to construct MII for the Nigerian economy. Considering the importance of the index as a tool for early warning signal and planning, it has become imperative to fill the gap, especially with Nigeria's experience of the 2016-2017 economic recession.

II.2 Modelling Macroeconomic Instability

Over time, several methodologies had been employed to determine macroeconomic instability indices. Ismihan (2003) and Ismihan et al., (2005)

employed Turkey data, ranging from 1963 to 1999, to establish a MII based on four macroeconomic instability indices - inflation rate, changes in exchange rate (variability of exchange rate), public deficit to GDP and foreign debt to GDP ratios. Each factor was calculated, using the formula in equation (1).

$$MII_t = \frac{X_t - X_{min}}{X_{max} - X_{min}} \quad (1)$$

The simple average of the variables was then computed as the MII, with values ranging between +1 and 0.

Jaramillo & Sancak (2007) constructed MII as total weighted rate of inflation (cpi), exchange rate (er) fluctuation minus accumulation of foreign reserves (res) as a percentage of monetary base (bm) at the start of each period and financial balance as a ratio to GDP. The model appeared thus:

$$MII_t = \frac{ln\left(\frac{cpi_t}{cpi_{t-1}}\right)}{\sigma_{cpi}} + \frac{ln\left(\frac{er_t}{er_{t-1}}\right)}{\sigma_{er}} + \frac{ln\left(\frac{res_t - res_{t-1}}{bm_{t-1}}\right)}{\sigma_{res}} - \frac{ln\left(\frac{fbal_t}{gdp_t}\right)}{\sigma_{fbal}} \quad (2)$$

Each variable in model (2) was converted to natural logarithm, then weighted inversely to the standard deviation of its numerator. The study was targeted at small economies of Dominican Republic and Haiti.

Haghighi et al. (2012) combined features of Ismihan (2003) and Jaramillo & Sancak (2007) macroeconomic instability indices to model a macroeconomic instability condition index as total weight of inflation rate (inf), real exchange rate(er) fluctuations, and change in the budget deficit (bd) and fluctuations in the terms of trade (tot) relationship. As shown in the model (3), each variable's weight varied equivalently to its standard deviation.

$$MII_t = \alpha\left(\frac{inf_t - inf_{min}}{inf_{max} - inf_{min}}\right) + \beta\left(\frac{er_t - er_{min}}{er_{max} - er_{min}}\right) + \gamma\left(\frac{bd_t - bd_{min}}{bd_{max} - bd_{min}}\right) + \varphi\left(\frac{tot_t - tot_{min}}{tot_{max} - tot_{min}}\right) \quad (3)$$

The relationship between the coefficients and MII were determined, such that their sum was equal to one, that is $\alpha+\beta+\gamma+\varphi = 1$. Vector normalisation and determination of the coefficients' significance were carried out, using maximum likelihood ratio.

Though several macroeconomic instability indicators have been modeled over time, each has several drawbacks. Some of the models are mainly confined to limited key macroeconomic variables, like inflation and exchange rate, to reflect the general picture of macroeconomic instability situations even though their interrelationships only have partial information within the system. Dearth of discernible statistical test of fitness is yet another shortcoming. For instance, even though Ismihan (2003), Ismihan et al., (2005) and Jaramillo & Sancak (2007) variables were normalised to take care of volatilities, the models were, nonetheless, deficient in statistical tests of fitness. This limitation, noted in the configuration and the structure of the models, was improved upon by Haghighi's et al., (2012) model, which employed maximum likelihood techniques to check for the model's statistical fitness. However, the common weakness to all of the models is the intuitive basis of their structure. Consequently, the identification, selection and employment of appropriate variables appear to be based on whims and caprices. Thus, a meaningful comparative interpretation of macroeconomic instability across borders has remained a challenge.

III. Methodology

To overcome the difficulties in the identified in the models discussed above, this study isolated several monetary, fiscal and socio-economic indicators as possible variables and processed them through factor analysis techniques to identify the latent macroeconomic instability variables for Nigeria. Factor analysis is a complex, multi-step method, which is appropriately designed for exploring a data set (Costello & Osborne, 2005). The main concept of this analysis is that several identified variables have similar patterns of behaviour, which may be explained by their association with the latent variable. The overarching goal of the analysis is to establish statistical patterns of relationships among the variables that can largely or entirely explain an underlying "latent factor" common to all the measures. The use of factor analysis to select the model variables recognises the fact that each economy is unique.

III.1 Data Robustness

This study employed two varieties of factor analysis, namely: Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) for selection of an

optimised dataset for the model. The EFA specifies the pattern of relationships among the variables to explore the likely underlying factor of an observed dataset without imposing a preconceived construct on the outcome (Child, 1990). The aim is to test whether a relationship exists between observed variables and their underlying latent constructs. The model also suggests the nature of those factors, the pattern of relationships among the variables, how well the hypothesised factors explain the observed data, and the randomness or unique variance of each observed variable. Therefore, embed in the EFA are inbuilt measures for determining the econometric robustness, or otherwise, of the model.

Several variables were identified from monetary, fiscal, and socio-economic spheres of the macroeconomic environment of Nigeria, out of which four were eventually selected by the EFA, as shown in Appendix I. The factor loadings were good measures in determining the appropriateness of latent variables. The other measures of importance were communality and uniqueness. Communality is the variance of observed variables accounted for by a common factor. A large 'communality' value indicates a strong influence by an underlying construct. 'Uniqueness' is the variance that is distinct to the variable and not shared with other variables. The lower the 'uniqueness' of a variable, the greater is the relevance of the variable in the factor model. Reliability and interpretability play a significant role in the determination of the factor structure. Appendix II shows that the model exhibited good reliability on all threshold test parameters espoused by Costello & Osborne (2005) and Hu & Bentler (1999), as shown in Appendix III.

The CFA technique of Principal Components Analysis (Appendix IV) confirms the robustness and corroborates that of EFA in both magnitudes and dimensions. A good model should have at least three variables with significant loadings (>0.30) that share some conceptual meaning (Suhr, 2006). The strength of the weights and correlations between each variable and the factor depend, on the relationship theoretically assumed to exist between the latent variable and observed indicators. The absolute magnitudes of factor loadings, derived from CFA, are one of the most important factors in determining reliable factor solutions (Field, 2000). The higher the loading, the more relevant the variable is in defining the factor's dimensionality. A negative value indicates an inverse impact on the factor.

III.2 Data Characteristics

The EFA and CFA techniques ensure the macroeconomic instability index variables are selected according to the theoretical underpinnings and empirical dictates. Both techniques confirm the robustness of variability in fiscal balance to GDP ratio, foreign reserves to base money ratio, inflation, and the ratio of non-performing loans to total loans of deposit money banks (DMBs), as macroeconomic instability variables for the Nigerian economy.

III.2.1 Fiscal Balance to GDP Ratio

A fluctuation in fiscal revenue is a function of the tax system. A tax system based on income and consumption is an automatic stabilisation device. However, if revenue is highly dependent on price of a commodity, the destabilising effect is that revenues decrease precisely when the commodity price decreases, thereby generating a fiscal deficit at the same time as a trade deficit. Consequently, the difficulty in solving fiscal deficit creates an inflation bias as the effects of public expenditure that are not properly financed, which rely heavily on the inflation tax, are completely undermined. Therefore, the long-term macroeconomic consequence of fiscal balance depends on whether it is a surplus or deficit; and how the surplus is invested or whether the deficit arises due to stimulus for infrastructure or grants to businesses. Fiscal profligacy undermines the growth objectives (Fatima et al., 2011). As a stimulus, however, fiscal deficit positively affects economic growth in Nigeria (Odhiambo et al., 2013; Maji and Achegbulu, 2012).

III.2.2 Foreign Reserves to Base Money Ratio

The foreign reserve to base money ratio is a potentially useful indicator for resident-based capital flight from the currency. In assessing foreign reserves adequacy, sizable money, stock in relation to reserves, suggests a large potential for capital flight (Cervena, 2006). Money-based measures of reserves adequacy are a measure of potential impact of a loss of confidence in the domestic currency that have played a very successful role as predictors of recent crises in emerging markets (Supriyadi, 2014). The ratio, as a signaling or external vulnerability indicator, is used to ensure that countries accumulate sufficient foreign reserves, to avoid negative assessment by the international

community. Though, it is important to note that, in economies with stable money demand and high confidence in the domestic currency, domestic money demand tends to be larger and the foreign reserves over base money ratio relatively small without much risk (IMF, 2000).

III.2.3 Inflation

Inflation has been used as a proxy for macroeconomic instability (Azam, 1999; Caballero, 2007; Iqbal & Nawaz, 2010; and Shahbaz, 2013). The plausibility of this measure lies in the fact that high inflation leads to high volatility in relative prices, thus, making investments riskier. Stable low inflation encourages higher investment, which is a determinant of improved productivity and non-price competitiveness. On the other hand, very high inflation rates are detrimental to economic growth, which negatively affects the standard of living in a society.

III.2.4 Non-Performing Loans (NPLs) Ratio

Monetary policy tools leverage on the fact that economies are heavily dependent on credit provision by banks to influence the cost of credit in the private sector. It has been established that changes in the rate of NPLs is inversely related to economic growth in Nigeria (Morakinyo & Sibanda, 2016) and other developing economies (Ishfaq et al., 2016; Rajha, 2016; Muthami, 2016; Farhan et al., 2012). Of the 33 banking crises studied by Hoggarth and Sinclair, 2004, it was found that high NPLs was the main feature of the crises between 1977 and 2002. The consequences of an increase in NPLs include decline in aggregate credit, increased inflation, exchange rate volatilities and low output growth.

III.3 MII Model Specifications

This study adapted Jaramillo & Sancak's (2007) MII model mainly because of its non-linearity construct. The PCA, which has been employed to reduce the dimensionality of multivariate dataset does not have the property of linearity (Mishra, 2016). The adapted MII model for this study is:

$$MII_t = \frac{\left(\frac{fbg_t}{fbg_{t-1}}\right)}{\sigma_{fbg}} + \frac{\left(\frac{fbm_t}{fbm_{t-1}}\right)}{\sigma_{fbm}} + \frac{\left(\frac{inf_t}{inf_{t-1}}\right)}{\sigma_{inf}} + \frac{\left(\frac{npl_t}{npl_{t-1}}\right)}{\sigma_{npl}}, \mathrm{t} = 1,2,3, \ldots \mathrm{N} \qquad (4)$$

In model (4), MII represents macroeconomic instability index, fbg is the ratio of fiscal balance to nominal GDP, fbm is the ratio of stock of foreign reserves position to base money, inf is the headline inflation rate, npl is the ratio of non-performing loans to total loans of deposit money banks (DMBs), t is time and σ is the standard deviation. The variables are standardised to normalise the volatilities in the components of the index (Supriyadi, 2014). The model assumes that deviation of observed values of a broad spectrum of macroeconomic indicators from their reference or trend value causes the occurrence of deviations around the trend of aggregate macroeconomic stability (Cariolle & Goujon, 2015). This implies that more variance in some crucial macroeconomic variables has higher rates of instability (Cardenas & Urrutia, 1995). The closer the index is to 1, the higher the rate of instability.

Unlike Jaramillo & Sancak (2007), the data in this model are not logged because the goal of the model defines which scale is important. This model is designed for real data such that its values are assumed to have absolute scale. This informed the transformation into ratios and further normalisation by the standard deviations of the respective variables to neutralise the scales of measurement and make their values compatible. With this transformation, the variables are scale-free and, therefore, additive to calculate a cumulative index to represent some construct or concept. In addition, the variables are selected, using the maximum likelihood technique of EFA to eliminate the problem of multicollinearity and heteroscedasticity.

III.4 MII Threshold Model Estimation Procedure and Techniques

Thresholds serve as an important EWS, which is described as a system of behavioural control on economic parameters indicating that exceeding predetermined threshold limits is considered the likely occurrence of future crisis (Berg et al., 2004). Several models provide detailed algorithms for MII threshold estimation procedures and techniques. Apparently, macroeconomic instability threshold would be an important issue for effective economic growth. There is a likely threshold level of macroeconomic condition, below which growth becomes difficult or even reversed.

III.4.1 Sameti Statistical Model

Sameti et al. (2012) devised a simple model for computing MII threshold for the Iranian economy. In this model, the periods in which the MII was more than 1.5 times of the standard deviation of the entire sample were considered as the critical periods. This crisis threshold was represented in model (5).

$$MII_t > mean(MII) + 1.5 \times stdev(MII), t \in (sample\ startpoint: sample\ endpoint) \quad (5)$$

In this model, stdev stands for the standard deviation of the macroeconomic instability. The choice of the threshold ensures that the number of estimated crises in the samples should be, at least, 5 per cent of the entire sample size. The advantage of this model is its simplicity of construction and interpretation. Its major shortcoming, however, is lack of econometric parameters to test its robustness. This may account for its limited use. However, it is used to compare with the robustness of autoregressive threshold analysis.

III.4.2 Autoregressive Threshold Models

Threshold in time series modelling is designed to capture asymmetric effects of shocks over shifts in economic relationships. This nonlinear model is used to determine a threshold value, or set of threshold values, used to predict the behaviour of variables in some important way. In this study, the threshold of MII is intended to serve as a warning signal that the level of macroeconomic instability is trending beyond the tolerance level. A central hypothesis is that there is some unobservable threshold, such that when exceeded, brings about a change in the behaviour of the MII.

Threshold regression model categorises the sample consistent with the realised value of some observed threshold variable (Yu and Phillips, 2014). The model employs Hansen (1996, 2000) methods for sample splitting and threshold estimation. The dependent variable, MII, with its lags, is regressed against its explanatory variables, using the Bai-Perron tests of sequentially determined threshold (Bai and Perron, 2003). Where this observed data lies in relation to some unobserved threshold, which is presumed to trigger regime changes in the MII, the model is called a threshold autoregressive (TAR) model.

III.4.2.1 TAR Model

In a threshold autoregressive (TAR) model for univariate time series, AR models are estimated separately in two or more intervals of values as defined by the dependent variable. These AR models may, or may not, be of the same order. Formal threshold models include the two-step TAR model of Tong & Lim (1980) as illustrated in (6).

$$y_t = \begin{cases} \chi_1 + \beta_1 y_{t-1} + \varepsilon_{1t} \ \ if \ q_{t-k} < \gamma \\ \chi_2 + \beta_2 y_{t-1} + \varepsilon_{2t} \ \ if \ q_{t-k} \geq \gamma \end{cases} \quad (6)$$

In the TAR model, γ ands for a threshold estimated jointly with all the parameters in the model. The variable qt-k is the state determining variable. The integer k determines the number of lags that the state-determining variable influences the regime in time t. The basic assumption in the TAR model is that the regime is determined by a variable qt-k, relative to a threshold value. In estimating the TAR model, when qt-k = yt-k, the result is a self-exciting TAR (SETAR) model.

III.4.2.2 SETAR Model

The SETAR model is a subset of autoregressive models, which provides for higher degree of flexibility in the model parameters through a regime switching behaviour in a time series data. The model is a tool for predicting future values of data series, which respond to different regime changes of its past values. In a SETAR(k, p) model, k is the number of regimes and p is the order of the autoregressive part. The SETAR(k, p) model allows for changes, triggered by delay in past values of the data series, in the model parameters in response to the value of weakly-exogenous threshold variable. A two-step Self-Exciting TAR (SETAR) model is given (7).

$$y_t = \begin{cases} \chi_1 + \beta_1 y_{t-1} + \varepsilon_{1t} \ \ if \ y_{t-k} \ \ < \gamma \\ \chi_2 + \beta_2 y_{t-1} + \varepsilon_{2t} \ \ if \ y_{t-k} \ \ \geq \gamma \end{cases} \quad (7)$$

This study explores the TAR and SETAR alternative models with a view of selecting the optimum.

IV. Empirical Findings

IV.1 MII Results and Diagnostics

Employing the data described in III.2.1 to III.2.4 on model 4 in III.3, the quarterly MII spanning for the Nigerian economy spanning from 2010q1 to 2017q2 was computed. Figure 1 depicted a graph of the computed MII values, compared with the corresponding GDP growth rates for the economy from 2010q1 to 2017q2. The result showed that calculated values for the index of macroeconomic instability over the study period fluctuated between 0.3155 and 0.6088, with a mean of 0.4095. The lowest MII value of 0.3155 (Point A) was attained in 2011q2, while the highest value of MII of 0.6088 (Point B) was recorded in 2016q1, when negative real GDP growth was first recorded.

Figure 1: Macroeconomic Instability Index and Economic Growth in Nigeria

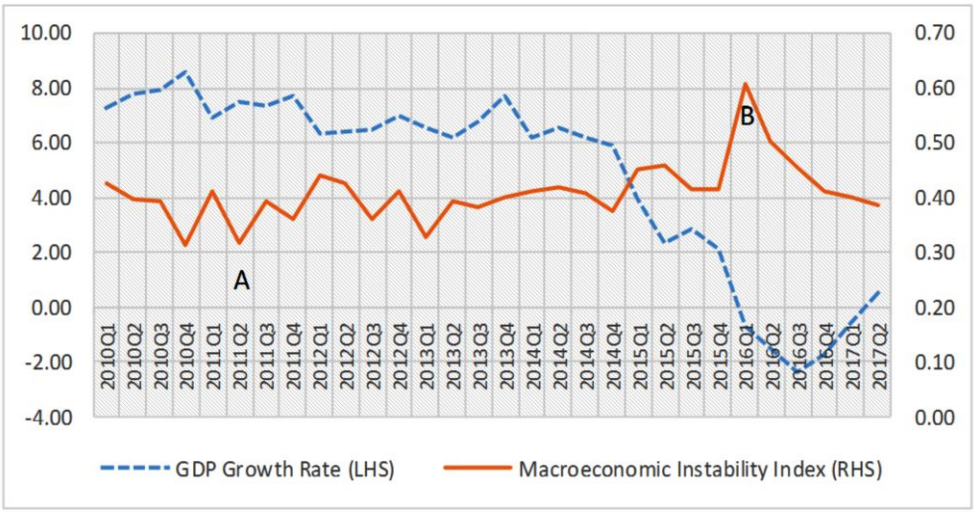


Table 1 indicated a significant negative correlation (-0.58) of MII and GDP growth rate in Nigeria. This confirmed the general findings that macroeconomic instability has an inverse relationship with economic growth. This compared favourably with the negative correlation (-0.6) reported by Haghighi et al., (2012) in a study of the Iranian economy from 1974 to 2008.

Table 1: Correlation Analysis

Variables	MII	FBG	FBM	INF	NPL	GRT
MII	1.0000§					
FBG	0.4122§	1.0000§				
	[2.3937]	-----				
	0.0236*	-----				
FBM	-0.3773§	-0.4813§	1.0000§			
	[-2.1560]	[-2.9056]	-----			
	0.0398*	0.0071*	-----			
INF	0.9137§	0.2504§	-0.2736§	1.0000§		
	[11.8936]	[1.3688]	[-1.5052]	-----		
	0.0000*	0.1820*	0.1435*	-----		
NPL	0.8170§	0.5157§	-0.4092§	0.5121§	1.0000§	
	[7.4984]	[3.1846]	[-2.3730]	[3.1550]	-----	
	0.0000*	0.0035*	0.0247*	0.0038*	-----	
GRT	-0.5849§	-0.2968§	0.7072§	-0.4515§	-0.5954§	1.0000§
	[-3.8154]	[-1.6447]	[5.2923]	[-2.6776]	[-3.9210]	-----
	0.0007*	0.1112*	0.0000*	0.0123*	0.0005*	- ----

(§) is the correlation; t-statistics are in parenthesis []; and (*) is probability, indicating the level of significance.

IV.2 The MII Thresholds Diagnostic Tests and Results

Threshold autoregressive models hypothesise that there are some unobservable thresholds, such that when crossed, brings about a change in the behaviour of the target variable, in this case, the macroeconomic instability index. The aim is to determine when the transition between regimes is made, and which transition variable (or threshold value) is more significant in explaining the regime change between the TAR and SETAR models.

Using the quarterly MII for the Nigerian economy spanning from 2010q1 to 2017q2 as displayed in Figure 1 (section IV.1), (section IV.1), an autoregressive conditional heteroskedasticity (ARCH) test was carried out to ensure that the presence of heteroskedasticity was not likely to have a significant influence on the results of the models. However, the Breusch-Godfrey test for serial

correlation was first performed, to ensure the validity of the ARCH test. The null hypothesis was that there was no serial correlation. The null hypothesis was accepted, as shown in Table 2a.

Table 2a: Breusch-Godfrey Serial Correlation

F-statistic	0.617767	Prob. F(2,19)	0.5496
Obs*R-squared	1.526440	Prob. Chi-Square(2)	0.4662

Table 2b: Ljung-Box Q-statistic

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |* . |	. |* . |	1	0.192	0.192	1.0345	0.309
. |* . |	. |* . |	2	0.135	0.102	1.5667	0.457
.*| . |	.*| . |	3	-0.103	-0.153	1.8929	0.595
. | . |	. | . |	4	-0.040	-0.010	1.9452	0.746
. |**. |	. |*** |	5	0.306	0.375	5.1106	0.403
. | . |	.**| . |	6	-0.038	-0.213	5.1620	0.523
. |* . |	. |* . |	7	0.161	0.118	6.1313	0.525
.*| . |	. | . |	8	-0.081	-0.001	6.3918	0.603
. | . |	. | . |	9	-0.001	-0.036	6.3918	0.700
. | . |	.*| . |	10	-0.052	-0.154	6.5150	0.770
.*| . |	. | . |	11	-0.159	-0.037	7.7321	0.737
. | . |	.*| . |	12	-0.023	-0.071	7.7590	0.804

**Probabilities may not be valid for this equation specification*

Table 2c: Ramsey RESET Test

	Value	Df	Probability
t-statistic	0.182858	20	0.8568
F-statistic	0.033437	(1, 20)	0.8568
Likelihood ratio	0.041762	1	0.8381

The three statistics of the Breusch-Godfrey serial correlation (Table 2a); the Ljung-Box Q-statistic test for autocorrelation and partial autocorrelation (Table 2b); and the Ramsey RESET test (Table 2c), all rejected the presence of serial correlation, indicating that there was no serial correlation in the model. The

tests for heteroskedasticity in Table 3 rejected the null hypothesis of the presence of heteroskedasticity. These tests justified the robustness of the SETAR models.

Table 3: Heteroskedasticity Test (ARCH)

F-statistic	0.260345	Prob. F(1,22)	0.6150
Obs*R-squared	0.280691	Prob. Chi-Square(1)	0.5962

In the SETAR model, the threshold variable was the endogenous lagged dependent variable. The best fitting delay parameter for lagged values of MII was found by minimising the sum of square residual (SSR) of the SETAR model. The delay parameter was allowed to vary from 1 to 5, while specifying the model and choosing the delay parameter that minimised the SSR. The maximum number of regimes was set to five and the models were estimated iteratively, capturing the SSR for each specification through the Bai-Perron method of L+1 vs L sequentially determined thresholds (Bai & Perron, 1998).

Table 4: SETAR Model Selection Criteria

Threshold Variable	SSR	Regimes
MII(-3)	0.039491	2
MII(-4)	0.046771	2
MII(-1)	0.079538	1
MII(-2)	0.079538	1
MII(-5)	0.079538	1

Table 4 showed that the best fitting threshold variable for the SETAR model was found to be MII(-3) with SSR of 0.0395. This corresponded with the value of the best fitting threshold variable for the TAR model which was found to be MII(-5) as shown in Appendix V. The congruence of results of the two models eliminated the problem of selection between TAR and SETAR through further tests to determine the one with the minimum SSR, since the derived threshold would remain same for the two models.

Table 5: Summary of SETAR Specifications and Threshold Values

Dependent Variable: MII
Method: Threshold Regression
Threshold type: Bai-Perron tests of L+1 vs. L sequentially determined thresholds
Threshold variables considered: MII(-1) MII(-2) MII(-3) MII(-4) MII(-5)
Threshold variable chosen: MII(-3)
Threshold selection: Trimming 0.15, , Sig. level 0.05
Threshold value used: 0.4606442

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MII(-3) < 0.4606442 -- 22 obs				
MII(-5)	0.084273	0.157153	0.536251	0.5974
C	0.371303	0.064384	5.766969	0.0000
0.4606442 <= MII(-3) -- 3 obs				
MII(-5)	-5.082672	1.336222	-3.803764	0.0010
C	2.514060	0.536982	4.681833	0.0001

R-squared	0.503509	Mean dependent var	0.413662
Adjusted R-squared	0.432582	S.D. dependent var	0.057569
S.E. of regression	0.043365	Akaike info criterion	-3.292687
Sum squared resid	0.039491	Schwarz criterion	-3.097667
Log likelihood	45.15859	Hannan-Quinn criter.	-3.238597
F-statistic	7.098953	Durbin-Watson stat	1.374286
Prob(F-statistic)	0.001794		

Figure 2 indicated that at 0.9180, the probability of Jarque-Bera was well above the 5 per cent model acceptance level of goodness of fit. Thus, the SETAR model was normally distributed and, hence, a reliable MII threshold prediction framework.

Figure 2: SETAR Model Normality Test

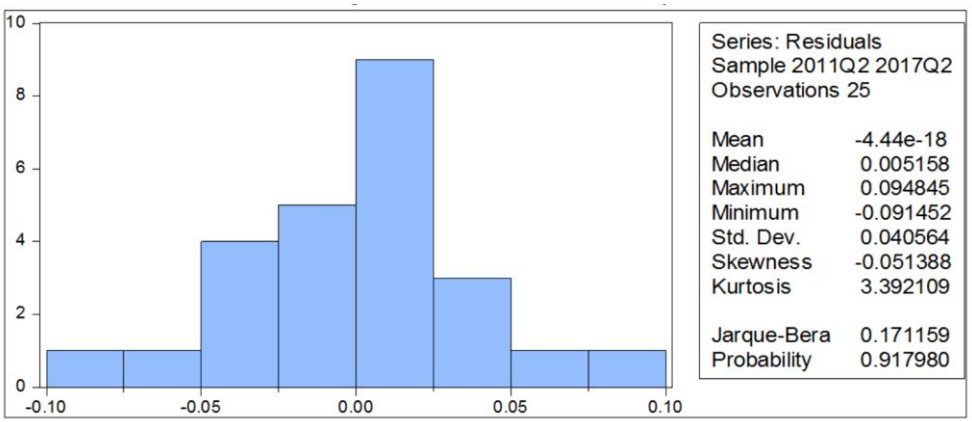


Table 5 summarised the threshold specification and the associated threshold values for the TAR model. The MII threshold was 0.461 at 5 per cent significant level. This compared well with the Sameti's (2012) crisis threshold model given as follows:

Given that mean (MII) = 0.4095; and stdev(MII) = 0.0574,

$$MII_t > 0.4957, t \in (2010_{q1}: 2017_{q2})$$

This value exceeded the 0.461 from the SETAR model. It should be noted, however, that the Sameti threshold was designed to identify crisis periods, which is usually a point when the economy is already plunged into economic predicament. This is different from the autoregressive thresholds, which were intended to be early warning signals as the economy moves gradually away from a tranquil period. Thus, this study adopts the SETAR value.

IV.3 Results and Discussion

The result of the threshold diagnostic studies indicated that the autoregressive threshold value was 0.461. This threshold parameter has significant macroeconomic implications for the economy. It implies that any value of MII above 0.461 flags off a warning signal that the economic condition is heading towards instability, with the attendant adverse effect of economic crisis. Beyond this threshold value, the economy is most likely to slide into a recession.

In-sample result of this study attested to this prediction. It revealed that the 2016-2017 economic recession was preceded with a warning signal in 2015q2, when the MII rose to 0.461. The threshold value is essential in determining when and how to switch over from traditional to unconventional economic policy stance. It is also important in designing an appropriate unconventional policy, when necessary, to avoid unintended consequences on the economy.

Perhaps, had this warning been noted and heeded with appropriate policy actions, the 2016-2017 economic recession might have been averted, or at least mitigated. The major implication of a prolong instability condition, beyond the threshold is that the efficacies of most of the conventional economic policies become weak. Consequently, normal economic policies may no longer produce the desired macroeconomic outcomes. To forestall the continuous worsening of existing economic conditions, monitoring the MII and the EWS is imperative in ensuring a stable macroeconomic condition.

V. Conclusion

From empirical results, it has been established that macroeconomic instability is inimical to growth and that the strength of empirical relationship has remained uncertain in Nigeria. This makes it difficult to have reliable planning, monitoring, and predicting macroeconomic instability. The distinctive implications include the inability to detect and diagnose symptoms of macroeconomic instability as early as possible; as well as determine the appropriate policy options, to address it. The use of multiplicity of proxies for this latent variable suffers the usual limitations of measurement error, associated with disaggregated variables across a range of indicators. This problem broadly underlines the significance of this paper.

Statistical algorithms and econometric techniques, including factor analysis and threshold autoregressive models, were employed. The results identified a mix of monetary and fiscal factors, as key drivers of macroeconomic instability in Nigeria. These were fluctuations in price level changes, volatility in the ratio of non-performing loans to total loans of deposit money banks (DMBs), variability of fiscal balance to GDP, and swings in foreign reserves to base money. In relative terms, inflation and the ratio of non-performing loans to total DMBs loans ranked very high in influencing macroeconomic instability in Nigeria. The

calculated values for the index of macroeconomic instability ranged between 0.316 and 0.859, with a mean value of 0.609. The instability threshold for Nigeria was 0.461. This should serve as a EWS beyond which unconventional policy options to mitigate and reverse the MII trend becomes eminent. The result also confirmed that GDP growth rate was adversely correlated (-0.58) with macroeconomic instability, confirming that macroeconomic instability has generally been associated with poor economic growth performance.

The policy implication is that there is need to monitor carefully the MII, as an early warning signal, to ensure that macroeconomic conditions remain stable, over time.

References

Ali, A. (2015). *The Impact of Macroeconomic Instability on Social Progress: An Empirical Analysis of Pakistan* (Doctoral Dissertation, National College of Business Administration and Economics (NCBAE), Lahore, Pakistan).

Ali, A., & Rehman, H. U. (2015). Macroeconomic Instability and Its Impact on Gross Domestic Product: An Empirical Analysis of Pakistan. *Pakistan Economic and Social Review*, 53(2), 285-316.

Azam, J. (1999). Institutions for Macroeconomic Stability in Africa. *Journal of African Economies*, 8(Suppl. 1), 6-29.

Azam, J. (2001). Inflation and Macroeconomic Instability in Madagascar. *African Development Review*, 13(2), 175-201.

Bai, J., & Perron, P. (1998). Estimating and Testing Linear Models with Multiple Structural Changes. *Econometrica*, 66(1), 47.

Bai, J., & Perron, P. (2003). Critical Values for Multiple Structural Change Tests. *The Econometrics Journal*, 6(1), 72-78.

Baker, D. (1998). *Getting Prices Right: The Debate over the Accuracy of the Consumer Price Index*. New York: M. E. Sharpe, Armonk.

Barro, R. J. (1991). Economic Growth in a Cross Section of Countries. The *Quarterly Journal of Economics*, 106(2), 407-443.

Beaumont-Smith, M., Murray, L., N'Cho-Oguie, C., & Blakley, D. (2003). The Effects of Macroeconomic Instability and Inflation on Sustainable Real Growth in South African Firms. *South African Journal of Economic and Management Sciences*, 6(4), 666-692.

Berg, A., Borensztein, E., & Pattillo, C. A. (2004). Assessing Early Warning Systems: How have they worked in Practice? *IMF Working Papers*, 04(52), 462-502.

Bleaney, M. F. (1996). Macroeconomic Stability, Investment and Growth in Developing Countries. *Journal of Development Economics*, 48(2), 461-477.

Caballero, R. J. (2007). Specificity and the Macroeconomics of Restructuring. Massachusetts, USA: MIT Press.

Cardenas, M., & Urrutia, M. (1995). Macroeconomic Instability and Social Progress. In R. Dornbusch & S. Edwards (Eds.), Reform, Recovery, and Growth: Latin America and the Middle East (pp. 79 - 114).

Cariolle, J., & Goujon, M. (2015). Measuring Macroeconomic Instability: A Critical Survey Illustrated with Exports Series. *Journal of Economic Surveys*, 29(1), 1-26.

Cervena, M. (2006). *The Measurement of Capital Flight and Its Impact on Long-term Economic Growth: Empirical Evidence from a Cross-Section of Countries* (Unpublished master's thesis). Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovakia.

Céspedes, L. P., & Velasco, A. (2012). *Macroeconomic Performance during Commodity Price Booms and Busts, NBER Working Paper No* (Paper No.18569). National Bureau of Economic Research.

Child, D. (1990). *The Essentials of Factor Analysis* (2nd ed.). London: Cassel Educational Limited.

Costello, A. B. & J. Osborne (2005). Best Practices in Exploratory Factor Analysis: Four Recommendations for Getting the Most from Your Analysis. *Practical Assessment Research & Evaluation*, 10(7).

Dabušinskas, A., Kulikov, D., & Randveer, M. (2012). *The Impact of Volatility on Economic Growth* (Working Paper No. 2012–7). Bank of Estonia.

Daniel, G. (2011). Whither Macroeconomic Stability in Europe? *Review of European Economic Policy*, 46(3), 122-123.

DeFerranti, D. M., & Ferreira, F. H. (2000). Securing our Future in a Global Economy. Washington, D.C. World Bank.

Dornbusch, R., & Edwards, S. (1990). Macroeconomic Populism. *Journal of Development Economics*, 32(2), 247-277.

Easterly, W. (2001a). Growth Implosions and Debt Explosions: Do Growth Slowdowns Cause Public Debt Crises? *Journal of Macroeconomics*, 1(1), 1-26.

Easterly, W. (2001b). *The Elusive Quest for Growth: Economists' Adventures and Misadventures in the Tropics*. Massachusetts, USA: MIT Press.

Easterly, W., & Kraay, A. (2000). Small States, Small Problems? Income, Growth, and Volatility in Small States. *World Development*, 28(11), 2013-2027.

Farhan, M., Sattar, A. Abrar Hussain Chaudhry, A.H. and Khalil, F., M., Sattar, M., & Chaudhry, A. H. (2012). Determinants of Non-Performing Loans: Perception of Nepali Bankers. E*conomic Journal of Development Issues*, 17(1-2), 128.

Fatima, G., Ahmed, A. M., & Rehman, W. U. (2011). Fiscal Deficit and Economic Growth: An Analysis of Pakistan's Economy. International Journal of Trade, *Economics and Finance*, 2(6), 501-504.

Field, A. (2000). *Discovering Statistics using SPSS for Windows*. CA, USA: Thousand Oaks, Sage Publications.

Fischer, S. (1993). The Role of Macroeconomic Factors in Growth. *Journal of Monetary Economics*, 32(3), 485-512.

Haghighi, H.K., Sameti, M. & Isfahani, R.D. (2012). The Effect of Macroeconomic Instability on Economic Growth in Iran. *Research in Applied Economics*, 4(3), 39-63.

Hansen, B. E. (1996). Inference When a Nuisance Parameter Is Not Identified Under the Null Hypothesis. *Econometrica*, 64(2), 413-430.

Hansen, B. E. (2000). Sample Splitting and Threshold Estimation. *Econometrica*, 68(3), 575-603.

Herrera, S. & Garcia, C. (1999). *User's Guide to an Early Warning System for Macroeconomic Vulnerability in Latin American Countries (Policy Research Working Paper No*. 2233). Washington D.C.: World Bank.

Hoggarth, G., & Sinclair, P. (2004). *On the Resolution of Banking Crises: Theory and Evidence*. *Working Paper No*. 229, Bank of England.

Hu, L. & Bentler, P. (1999). Cutoff Criteria for Fit Indices in Covariance Structure Analysis: Conventional Criteria versus New Alternatives. *Structural Equation Modeling*, 6(1), 1-55.

Ibe, J. G. (2002). Macroeconomic and Political Instabilities in Sub-Saharan Africa. *African Social Science Review*, 2(2), 24-74.

International Monetary Fund. (2000). Debt and Reserve Related Indicators of External Vulnerability. Retrieved from https://www.imf.org/external/np/pdr/debtres/

Iqbal, N., & Nawaz, S. (2010). Fiscal Decentralisation and Macroeconomic Stability: Theory and Evidence from Pakistan, (Paper No. 27184). *Munich Personal RePEc Archive* (MPRA).

Ishfaq, M. A., Guohui, W., Hasan, H., Ali, R., Rafiq, M. Y., & Rehman, R. (2016). Non-Performing Loans and Economic Growth, Scholars. *Journal of Economics, Business and Management*, 3(10), 584-586.

Ismihan, M. (2003). *The Role of Politics and Instability on Public Spending Dynamics and Macroeconomic Performance: Theory and Evidence from Turkey* (Doctoral Dissertation, Middle East Technical University (METU), Ankara, Turkey).

Ismihan, M., Metin-Ozcan, K., & Tansel, A. (2005). The Role of Macroeconomic Instability in Public and Private Capital Accumulation and Growth: The Case of Turkey 1963–1999. *Applied Economics*, 37(2), 239-251.

Jacks, D. S. (2013). *From Boom to Bust: A Typology of Real Commodity Prices in the Long-run*, NBER *(Working Paper No. 18874)*. National Bureau of Economic Research.

Jacobs, G., & Šlaus, I. (2010). Indicators of Economics Progress: The Power of Measurement and Human Welfare, The CADMUS Journal, 1(1), 53-113.

Jaramillo, L., & Sancak, C. (2007). Growth in the Dominican Republic and Haiti: Why has the Grass been Greener on One Side of Hispaniola? (*Working Paper*, WP/07/63) Washington, D.C.: International Monetary Fund, Western Hemisphere Dept.

Kaminsky, G. L. (1998). Currency and Banking Crises: A Composite Leading Indicator. (*International Finance Discussion Paper Series No*. 629). Washington: Board of Governors of the Federal Reserve.

Kharroubi, E. (2006). Illiquidity, Financial Development and the Growth-Volatility Relationship. *Working papers* 139. Banque de France.

Kolawole, B. O. (2013). Growth-Effects of Macroeconomic Stability Factors: Empirical Evidence from Nigeria. *Developing Country Studies*, 3(14), 47-55.

Kraay, A., & Ventura, J. (2007). Comparative Advantage and the Cross-Section of Business Cycles. *Journal of the European Economic Association*, 5(6), 1300-1333.

Lehtinen, A., & Kuorikoski, J. (2007). Computing the Perfect Model: Why Do Economists Shun Simulation? *Philosophy of Science*, 74(3), 304-329.

Maji, A., & Achegbulu, J. O. (2012). The Impact of Fiscal Deficits on Economic Growth in Nigeria. *International Business and Management*, 4(2), 127-132.

Mishra, S. K. (2016). *A Note on Construction of a Composite Index by Optimisation of Shapley Value Shares of the Constituent Variables*. Paper No. 72330. Munich Personal RePEc Archive (MPRA).

Morakinyo, A. E., & Sibanda, M. (2016). Non-Performing Loans and Economic Growth in Nigeria: A Dynamic Analysis. *SPOUDAI Journal of Economics and Business*, 66(4), 61-81.

Muthami, A. A. (2016). The Relationship between Non-Performing Loans and Economic Growth: A Case Study of Commercial Banks in Kenya. Unpublished Masters of Business Administration Dissertation Presented to the School of Business, University of Nairobi, Kenya

Ocampo, J. A. (2005). A Broad View of Macroeconomic Stability, DESA (*Working Paper* No. 1, ST/ESA/2005/DWP/1). United Nation's Department of Economics and Social Affairs.

Odhiambo, O. S., Momanyi ,G., Othuon, L. & Aila, F.O. (2013). The Relationship Between Fiscal Deficits and Economic Growth in Kenya: An Empirical Investigation. *Greener Journal of Social Sciences*, 3(6), 306-323.

Onis, Z. (1997). Democracy, Populism and Chronic Inflation in Turkey: The Post Liberalisation Experience. *Yapi Kredi Economic Review*, 8(1), 33- 50.

Ouliaris, S. (2017). Economic Models: Simulations of Reality, Finance and Development, International Monetary Fund (IMF), available at http://www.imf.org/external/pubs/ft/fandd/basics/models.htm.

Powell, A. (2015). *Commodity Prices: Over a Hundred Years of Booms and Busts*, Centre for Economic Policy Research Paper, 28 April, retrieved at http://voxeu.org/article/commodity-booms-bust-evidence-1900-2010.

Raddatz, C. (2007). Are External Shocks Responsible for the Instability of Output in Low-Income Countries? *Journal of Development Economics*, 84(1), 155-187.

Rajha, K. S. (2016). Determinants of Non-Performing Loans: Evidence from the Jordanian Banking Sector. *Journal of Finance and Bank Management*, 4(1), 125-136.

Ramey, G., & Ramey, V. (1995). Cross-Country Evidence on the Link Between Volatility and Growth. *The American Economic Review*, 84(5), 1138-1151.

Sahay, R., & Goyal, R. (2006). *Volatility and Growth in Latin America: An Episodic Approach. IMF Working Paper No*. 06/287. Washington D.C.: International Monetary Fund.

Sameti, M., Dallali Isfahani, R., & Karnameh Haghighi, H. (2012). Outcome of Macroeconomic Instability (A Case for Iran). *Research in Applied Economics*, 4(1), 33-48.

Sanchez-Robles, B. (1998). Macroeconomic Stability and Economic Growth: The Case of Spain. *Applied Economics Letters*, 5(9), 587-591.

Shahbaz, M. (2013). Linkages Between Inflation, Economic Growth and Terrorism in Pakistan. Economic Modelling, 32, 496-506.

Sirimaneetham, V., & Temple, J. R. (2009). Macroeconomic Stability and the Distribution of Growth Rates. *The World Bank Economic Review*, 23(3), 443-479.

Suhr, D. D. (2006). *Exploratory or Confirmatory Factor Analysis?* Paper Presented at Proceedings of the Annual Conference, San Francisco, CA, SAS Users Group International Conference (SUGI31), March, Paper, No. 200-31, University of Northern Colorado.

Supriyadi, A. (2014). *External Vulnerability Indicators: The Case of Indonesia*. Paper Presented at the Seventh Irving Fisher Committee Conference (IFC) on Central Bank Statistics Biennial Conference, 4 – 5 September, Basel.

Tong, H. & K. S. Lim (1980). Threshold Autoregression, Limit Cycles and Cyclical Data. *Journal of the Royal Statistical Society. Series B (Methodological)*, 42(3). 245 – 292.

UNCTAD. (2012). *Excessive Commodity Price Volatility: Macroeconomic Effects on Growth and Policy Options*. Contribution from the UNCTAD Secretariat to the G20 Commodity Markets Working Group, United Nations Conference on Trade and Development, 30 April.

Yu, P., & Phillips, P. C. (2014). *Threshold Regression with Endogeneity. Discussion Paper No*. 1966, Cowles Foundation for Research in Economics, Yale University, New Haven, Connecticut.

Appendices

Appendix I: Exploratory Factor Analysis

	Loadings F1	Communality	Uniqueness
FBG	0.635884	0.404348	0.595652
FBM	-0.550885	0.303474	0.696526
INF	0.556954	0.310197	0.689803
NPL	0.823160	0.677593	0.322407

Factor	Variance	Cumulative	Difference	Proportion	Cumulative
F1	1.695612	1.695612	---	1.000000	1.000000
Total	1.695612	1.695612		1.000000	

	Model	Independence	Saturated

Appendix II: EFA Goodness-of-fit Summary

	Model	Independence	Saturated
Parameters	8	4	10
Degrees-of-freedom	2	6	---
Parsimony ratio	0.333333	1.000000	---

Absolute Fit Indices

	Model	Independence	Saturated
Discrepancy	0.090303	0.933063	0.000000
Chi-square statistic	2.618792	27.05884	---
Chi-square probability	0.2700	0.0001	---
Bartlett chi-square statistic	2.362933	25.03720	---
Bartlett probability	0.3068	0.0003	---
Root mean sq. resid. (RMSR)	0.075199	0.421276	0.000000
Akaike criterion	-0.046040	0.501961	0.000000
Schwarz criterion	-0.139453	0.221722	0.000000
Hannan-Quinn criterion	-0.075924	0.412310	0.000000
Expected cross-validation (ECVI)	0.642027	1.208926	0.689655
Generalised fit index (GFI)	0.956092	0.652563	1.000000
Adjusted GFI	0.780459	-0.737185	---
Non-centrality parameter	0.618792	21.05884	---
Gamma Hat	0.959071	0.407775	---
McDonald Noncentralilty	0.989388	0.695528	---
Root MSE approximation	0.103290	0.347891	---

Incremental Fit Indices

	Model
Bollen Relative (RFI)	0.709656
Bentler-Bonnet Normed (NFI)	0.903219
Tucker-Lewis Non-Normed (NNFI)	0.911848
Bollen Incremental (IFI)	0.975306
Bentler Comparative (CFI)	0.970616

Appendix III: CFA Robustness Thresholds

Measure	Threshold
Chi-square/df (cmin/df)	< 3 good; < 5 sometimes permissible
p-value for the model	> .05
CFI	> .95 great; > .90 traditional; > .80 sometimes permissible
GFI	> .95
AGFI	> .80
SRMR	< .09
RMSEA	< .05 good; .05 - .10 moderate; > .10 bad
PCLOSE	> .05

Appendix IV: Principal Components Analysis

Eigenvalues: (Sum = 4, Average = 1)

Number	Value	Difference	Proportion	Cumulative Value	Cumulative Proportion
1	2.233376	1.403589	0.5583	2.233376	0.5583
2	0.829786	0.276712	0.2074	3.063162	0.7658
3	0.553074	0.169310	0.1383	3.616236	0.9041
4	0.383764	---	0.0959	4.000000	1.0000

Eigenvectors (loadings):

Variable	PC 1	PC 2	PC 3	PC 4
FBG	0.511041	-0.441163	0.523388	0.519883
FBM	-0.482412	0.459788	0.735138	0.124281
INF	0.442182	0.739976	-0.247431	0.442368
NPL	0.557307	0.215421	0.352726	-0.720130

Ordinary correlations:

	FBG	FBM	INF	NPL
FBG	1.000000			
FBM	-0.481316	1.000000		
INF	0.250432	-0.273594	1.000000	
NPL	0.515650	-0.409191	0.512124	1.000000

Appendix V: Summary of TAR Specifications and Threshold Values

Variable	Coefficient	Std. Error	t-Statistic	Prob.
	MII(-3) < 0.4606442 -- 22 obs			
MII(-5)	-6.93E-16	4.33E-15	-0.160249	0.8746
C	-8.57E-15	3.98E-15	-2.151999	0.0461
	0.4606442 <= MII(-3) -- 3 obs			
MII(-5)	2.34E-13	5.92E-14	3.952247	0.0010
C	-1.04E-13	2.70E-14	-3.850860	0.0013

Unofficial Dollarisation and Monetary Policy in Nigeria

Adamu, Y.*

Abstract

This paper examined the impact of dollarisation on monetary policy in Nigeria, using monthly data spanning 2002 to 2016. The paper adopted the conventional IMF proxy for dollarisation and traced its reactions to changing monetary policy stance. Using the vector autoregression (VAR) model and interbank rate as an indicator of monetary policy stance, the results showed that the size of dollarisation could influence the outcome of monetary policy, though the impact was small. This was evident from the output equations, that inflation did not respond in the first month and responded negatively in the second month. However, from the third to sixth month, it responded positively before it eventually returned to equilibrium. The overall impact of dollarisation on exchange rate is dependent on the degree of dollarisation. The conclusion from the results was that monetary policy could still be effective with the present level of dollarisation.

Keywords: Dollarisation, Monetary Policy, Vector Autoregression
JEL Classification Numbers: C51, E52, E58

I. Introduction

The central goal of monetary policy is to achieve price stability and ensure rapid economic growth, among others. Acknowledging the size, timing, direction, and persistence of monetary policy shocks on economic activities provides the monetary authority the vital information required to fine-tune policy initiatives (CBN, 2014). Dollarisation has become a source of worry for monetary policy because of its potential impact on the stability of the financial system. It has been established that if a substantial part of the financial system is officially or unofficially dollarised, it could create stability risks in the form of either liquidity risk or solvency risk or both.

By definition, 'dollarisation' refers to the holding by residents of a significant share of their assets in the form of foreign currency-denominated assets. It can be official and unofficial dollarisation. It is official when the foreign currency is

* *The author is a staff of the Research Department, Central Bank of Nigeria. The usual disclaimer applies.*

given legal tender status, which implies that the foreign currency is adopted as an official medium of exchange, as well as unit of account. Unofficial dollarization, on the other hand, represents a case in which a foreign currency is used alongside the domestic currency as means of exchange (Alvarez-Plata &Garcia-Herero, 2007).

The extent of dollarization and its impact on monetary policy have continued to generate debate in the literature. Circulation of a foreign currency, either as a means of payment or as a store of value, is bound to affect the conduct of monetary policy and, ultimately, the inflation outcome (Feige, 1997). In Nigeria, under section 16 of the Central Bank Act 2007, the power to fix and determine the exchange rate of the naira is exclusively vested in the Bank. By virtue of the Act, currency notes and coins issued by the Bank shall be legal tender in Nigeria at their face value for the payment of any amount. *Under section 20(5) of the Act, any person who refuses to accept the naira as a means of payment for any amount in Nigeria is guilty of an offense and liable to be prosecuted, and if found guilty shall be fined N50,000 or 6 months imprisonment.*

In addition, many circulars had been issued by CBN, the latest Circular was issued on April 17, 2015 with reference BSD/DIR/GEN/LAB/08/013 and titled Currency Substitution and Dollarisation of the Nigerian Economy. In the circular, the CBN condemned the development and reiterated that the naira remains the only legal tender. The Bank also warned the banks and general public that it was illegal to price or denominate the cost of any product or service (visible or invisible) in any foreign currency, other than naira. Also, no business offer or acceptance should be consummated in Nigeria in any other currency.

The content of the Circular indicated that unofficial dollarisation is a serious concern to the monetary authority, and makes the Nigerian economy vulnerable to external shocks. It has been adjudged in some quarters as a major factor largely explaining the depreciation of the domestic currency. Unofficial dollarisation, which is the focus of this paper, is a reaction of economic agents to a loss of value of a domestic currency, often resulting from persistent inflation, devaluation or currency confiscation (Feige, 2002). It could also be a result of an underground economy, since activities of this segment are often concealed, hence, the appetite to transact in foreign currency. The

preference for the use of a foreign currency gives consumers a hedge against domestic inflation and enables savers to retain the value of their savings. However, its effects can create distortions in the transmission mechanisms of the monetary policy. This study examines the extent to which these distortions could affect the efficacy of monetary policy in Nigeria. In other words, when economic agents choose to voluntarily substitute a foreign currency for domestic currency as a means of payment or choose to hold foreign rather than domestic currency-denominated assets as a store of value, what would be the impact on monetary policy?

The theoretical literature on monetary policy does not offer a clear answer as to how dollarisation may affect monetary policy. The common view among economists is that dollarisation makes monetary policy more complicated and less effective (Alvarez-Plata and Garcia-Herrero, 2007). Monetary policy effectiveness is important, since monetary policy instruments principally affect domestic currency assets and liabilities. Another common view is that dollarisation could result in a loss of seigniorage, which can be quite significant in economies with growing money demand.

In the light of the above, the main objective of this paper, therefore, is to examine the impact of distortions in monetary policy transmission mechanism caused by the dollarisation. In other words, the study investigated the extent to which dollarisation had impacted on monetary policy outcomes in Nigeria. The paper also examined how dollarisation affected inflation and, in particular, the pass-through effect from exchange rate to prices. The findings could be useful to the Bank in achieving its price stability objective.

The rest of the paper is structured as follows. Section 2 reviewed empirical literature while Section 3 examined the data and presented some developments. Section 4 focused on the methodology as well as explained the data used for the study. Section 5 presented the empirical results, while Section 6 drew policy implications and concluded the paper.

II. Literature Review

Literature has traditionally identified three consequences of dollarisation to include: reduced monetary policy autonomy, limited last-minute creditor

capacity, and the unfavorable mismatch of currencies resulting from unhedged borrowers when the national currency depreciates. Though these consequences are recognised by theory, existing empirical studies have produced mixed results as to whether or not they are relevant in practice. The concept of dollarisation has attracted controversial debates for some reasons, including its impact on inflation performance and economic vulnerability. The answer to whether and how dollarisation plays a role in influencing the outcome of monetary policy is an aspect that has remained relatively inadequate. To the best of my knowledge, only a few studies had empirically investigated this subject in details, and the results were mixed.

Hausmann et al., (1999) opined that under a circumstance where de-facto dollarisation became widespread, expansionary monetary policy could have pro-cyclical rather than counter-cyclical consequences. This implied that unofficial dollarisation would impede government efforts to employ inflationary finance to impose implicit taxes on domestic monetary assets. Inferring from this assertion, information on the extent of de-facto dollarisation would be a critical input into the monetary policy decision, since extensive unofficial dollarization was likely to make monetary policy less effective and active exchange rate intervention more dangerous. Levy (2006) noted that financially dollarised economies, tended to exhibit higher inflation rates, higher tendency to suffer from banking crises and slower and more impulsive output growth. De Nicoló et al., (2003) found similar results, which showed that financial instability was probably higher in dollar-dominated economies.

Honohan and Shi (2001) showed that greater dollarisation was associated with a greater pass-through from exchange rate changes to consumer prices, thereby potentially increasing nominal risk in the economy. Bordo et al., (2009) investigated the long-run evidence of the impact of foreign currency debt on growth and found that a higher share of foreign currency debt to total debt was associated with an increased risk of currency and debt crises, which themselves resulted in significant permanent output losses. Cheng and Wang (2011) contended that dollarisation was a form of neo-colonialism.

On the other side of the debate, Arteta (2003) found marginal evidence that significant levels of dollarisation increased the risk of bank crises or currency disruption. Currency disruption would probably not be greater in high-dollar

countries but instead be based on macroeconomic policies. Berg and Borensztein (2000) examined the experience of five dollarised countries, to find which monetary aggregates appear to have the closest connection to future inflation. The study found that a broader monetary aggregate that included foreign currency deposits was superior to one that did not. Rheinhart, Rogoff and Savastano (2003) found that partial dollarisation had a limited impact on the effectiveness of monetary policy, and that output fluctuations were quite similar in countries with different degrees and varieties of dollarisation.

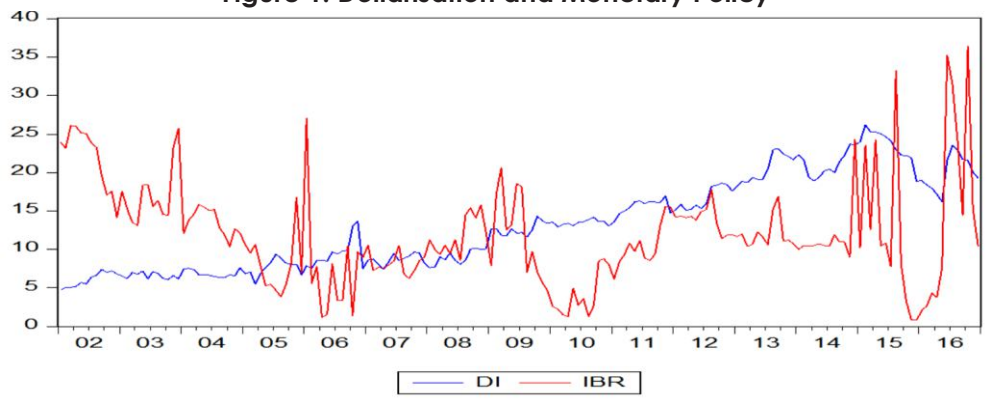
III. Dollarisation and Monetary Policy in Nigeria

A parallel circulation of a foreign currency is likely to affect the conduct of monetary policy and, ultimately, the inflation outcome. The index of dollarisation in Nigeria has, on the average, maintained, a smooth upward trend throughout the observed period. As shown in Figure 1, the index of dollarisation was 4.8 in January 2002, rose to 25.3 in March 2005 but declined to 19.3 in December 2006. The movement in the interbank rate was, however, not too smooth, as observed in the case of the dollarisation. The interbank rate was 23.9 per cent in January 2002. It declined to 14.1 per cent by December 2002 and rose to 25.7 per cent in December 2003. The interbank rate also declined to 12.1 per cent in January 2004 and further fell to 3.8 per cent in August 2005, but rose to 27.1 per cent in January 2006 before declining to 1.1 per cent in April 2006. The fluctuations continued throughout the observed period, peaking at 36.4 per cent in October 2016.

Dollarisation typically has been a reaction to economic instability and high inflation. Small amount of foreign currency holdings is supposed to lead to higher inflation, all things being equal. In January 2002, inflation stood at 18.6 per cent, while dollarisation was 4.8. Inflation fell in May 2002 to 10.2 per cent while the dollarisation index rose to 5.7. In July 2006, when inflation fell to 3.0 per cent, dollarisation index rose to 9.8. The inflation trend just like the interbank call rate did not show a regular pattern across the observed period. It was 4.1 per cent in September 2007 and rose to 15.1 per cent in December 2008, in response to rising global food and fuel prices and the loosening of monetary conditions. Prices also declined to 10.4 per cent in September 2009 and to 9.4

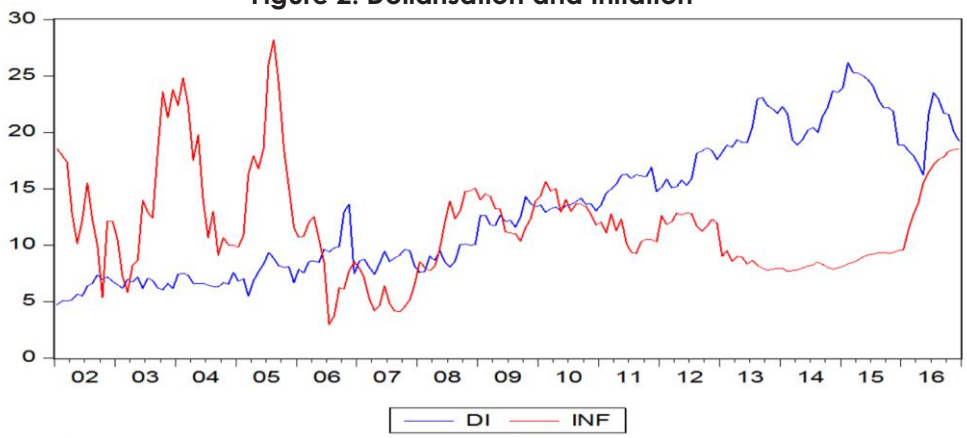
per cent in July 2011. The declining trend continued in November 2014 with a 7.9 per cent decrease, but later rose to 18.6 per cent in December 2016.

Figure 1: Dollarisation and Monetary Policy



However, the dollarisation index maintained an upward trend on average throughout the observed period with the lowest point of 4.8 in January 2002, and rose to a peak of 26.2 in February 2015

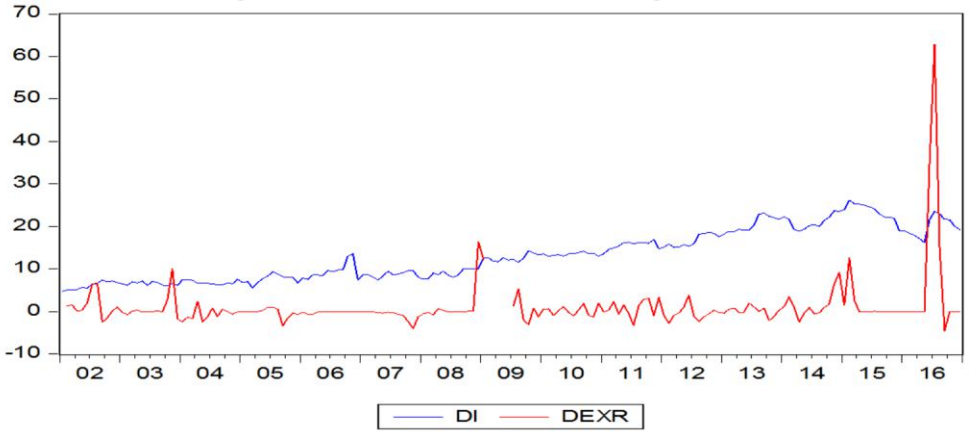
Figure 2: Dollarisation and Inflation



Source: Author

In Figure 3, the dollarisation showed a pattern of upward trend from January 2002 to February 2015 before it started declining. For the exchange rate, it appears there was no sign of trends. The observed behaviour of the exchange may be due to the exchange rate regime operating during the periods.

Figure 3: Dollarisation and Exchange Rate



IV. Methodology

IV.1 Data

The data employed were monthly data spanning 2002 to 2016. The variables of interest were the index of dollarisation, monetary policy rate- proxied by interbank rate, the naira-dollar exchange rate and inflation rate. The main source of data is the CBN statistical bulletin. The index of dollarisation was computed as the ratio of foreign currency supply to the broad money supply. Foreign currency deposit is the traditional proxy for the measurement of dollarisation in an economy. According to Feige (2002), the traditional dollorisation index woulx be an adequate proxy of unofficial dollarisation when, foreign currency holdings were of marginal importance or when the foreign currency in circulation and foreign currency deposit were highly complementary.

Most literature and institutions, like the IMF, used the traditional index to proxy the extent of foreign currency in an economy. The ideal proxy should include both the foreign currency deposit and the foreign currency in circulation. However, data on the latter are very difficult to obtain in Nigeria. For exchange rate, the official rate was employed as against the Bureau De-Change (BDC) where transactions were speculative in nature. The inflation variable was used as an indicator of the general price level, while the interbank call rate was employed to proxy monetary policy. The monetary policy rate (MPR) is an anchor rate, as well as the operating range or band of overnight interest rates in the money market. However, its lumpy nature did not readily capture the market dynamics, hence the use of the interbank call rate as a proxy for MPR.

In examining the properties of the data, unit root tests were conducted and the results indicated that all the variables were stationary at levels, except for the exchange rate variable which was stationary at first difference (Appendix 1).

IV.2 Descriptive Statistics

Table 1 was based on 174 observations (after adjustment), hence providing a more precise estimate of the parameters. The variables presented a positive mean for all series with interbank rate having a mean of 11.80 and standard deviation of 6.71. The dollarisation index (DI) showed a mean of 13.27 with a standard deviation of 6.02. The Jarque-Bera statistics confirms that the null hypothesis of the variables should not be rejected and that the variables are normally distributed. As shown in the table below: DI stands for index of dollarization, IBR-Inter Bank Rate, INF-Inflation Rate, and DEXR-Exchange Rate.

Table 1: Descriptive Statistics

	DI	IBR	INF	DEXR
Mean	13.26609	11.80460	11.66138	1.087989
Median	13.02049	10.68000	10.99500	-0.010000
Maximum	26.18879	36.42000	28.21000	62.81000
Minimum	5.057444	0.770000	3.000000	-4.500000
Std. Dev.	6.019655	6.713486	4.558580	6.075554
Skewness	0.410046	1.077628	1.020001	7.322641
Kurtosis	1.830140	4.728909	4.363961	68.04152
Jarque-Bera	14.79813	55.34836	43.65946	32225.40
Probability	0.000612	0.000000	0.000000	0.000000
Sum	2308.300	2054.000	2029.080	189.3100
Sum Sq. Dev.	6268.870	7797.266	3595.053	6385.838
Observations	174	174	174	174

IV.3 The Model

In order to capture the real-time effects of policy actions and avoid the freezing of innovations in some variables, the study used the vector autoregression (VAR) models which have the power to avert theoretical assumptions in modern monetary policy analysis. The dependence on the propagation of impulses through the error term also makes VAR models more reliable – the unexplained term is the source of shock to the system.

A major requirement for the estimation of a VAR model is the choice of an appropriate lag length. The Final Prediction Error (FPE), Schwarz Information Criterion (SC) and Hannan-Quinn Information Criterion, selected an optimal lag length of 3, which was employed in the study (Appendix 3). As part of the diagnostic test, a stability test was undertaken to ascertain the reliability of the VAR model using the autoregressive (AR) root stability test. The estimated VARs proved to be stable, since all roots indicated a modulus of less than one and lie inside the unit circle (Appendix 1).

IV.4 Model Specification

In a VAR model, each variable is expressed as a function of its own lags and the lags of other variables in the system. The general specification is as follows:

$$y_t = \delta + \Phi_1 y_{t-1} + \Phi_2 y_{t-2} + \cdots + \Phi_p y_{t-p} + \varepsilon_t$$

The specification for this model follows the general framework of the VAR which constituted four variables in this paper, namely: index of dollarization (DI), interbank interest rate (IBR), inflation rate (INF) and exchange rate changes (DEXR).

Where y_t represent the vector of the four endogeneous variables DI, IBR, DEXR, and INF. δ is the vector of equation specific constant while ε_t is the vector of error terms, or innovations (shocks) to the four variables. In matrix form the equations is stated as below:

$$AY_t = \begin{bmatrix} DiDi & DiIbr & Didexr & DiInf \\ IbrDi & IbrIbr & Ibrdexr & IbrInf \\ Dexr & DexrIbr & DexrDexr & DexrInf \\ InfDi & InfIbr & InfDexr & InfInf \end{bmatrix} \begin{bmatrix} Di \\ Ibr \\ dexr \\ Inf \end{bmatrix}$$

In terms of ordering, the index of dollarisation entered first because the central bank is expected to monetise its flows as it intervenes in the foreign exchange market. The interbank rate is next since the money market is expected to respond to increase in money stock. This also affects the exchange rate, which makes it come next in the model. Inflation entered last because it is expected to react to interest rate and exchange rate.

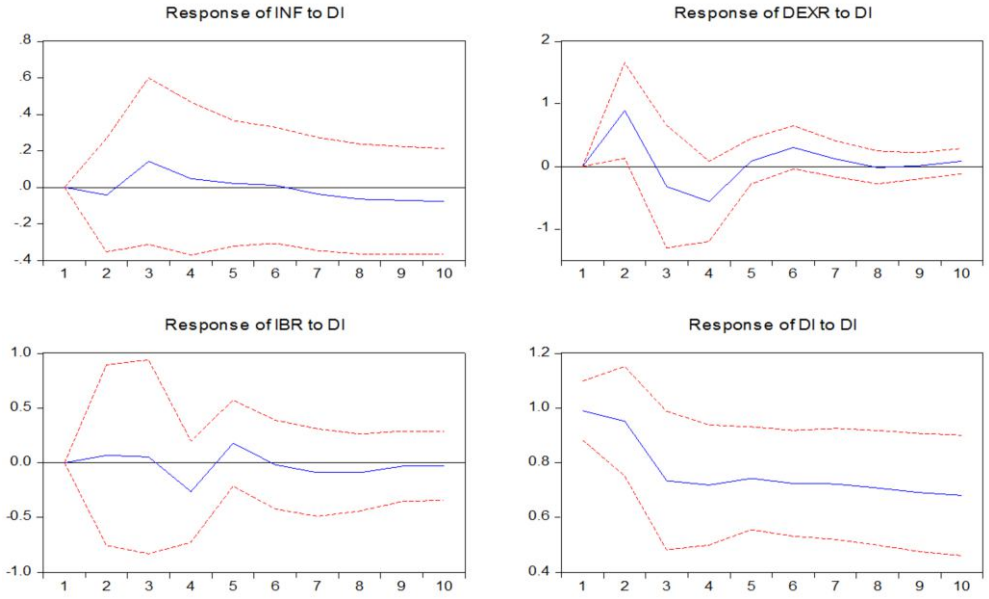
V. Analysis of Results

V.1 Impulse Response Analysis

Impulse response functions (IRF) are structured such that they trace the effects of any shock, represented by the error term of the concerned equation, on the future values of the dependent variable in that equation and those in the other equations. In this paper, the impulse response function was applied to identify the impact of dollarisation on monetary policy in Nigeria. From the results shown in Figure 4, IRF revealed that given a one standard deviation innovation, dollarisation does not affect the outcome of monetary policy contemporaneously. In the second month, inflation declined by 0.04 per cent, while interbank rate and exchange increased by 0.07, and 0.9 per cent, respectively.

However, in the third month, inflation turned positive increasing by 0.14 per cent. The interbank rate also increased in the third month by 0.05 per cent, while the exchange rate turned negative by 0.32 per cent. The sign on the response of the monetary policy in the fourth month was negative, which was reversed in the fifth month. From the fifth month to the tenth month, the sign of the monetary policy stays negative. The fourth month decline in the monetary policy rate is a sign of slow impact of increasing dollarisation on monetary policy because short term rates are expected to respond rapidly. In the case of prices, the increase in dollarisation resulted to an increase in inflation for the third month, which lasted until the sixth month before it reversed to decreasing trend up to the tenth month. For the exchange rate, aside the deprecation experienced in the second, third, and the fifth month, the other months were appreciations due to increasing dollarisation in the economy. In summary, the results suggested a small impact in terms of a reduction in the degree of dollarisation despite tight monetary policies.

Figure 4: Impulses of Dollarisation Graph



V.2 Variance Decomposition Analysis

The VAR system was estimated to isolate the variation of each endogenous variable that was due to shocks in each component. In doing this, the significance of each random shocks, relative to the others, was ascertained.

The forecast error variance decomposition (FEVD) analysis (in Table 1) revealed that shocks to index of dollarisation accounted for only 0.02 per cent of the variation in the growth of inflation at the first period and settles at 0.09 per cent by the end of the tenth month. Shocks to dollarisation generated 13.2 per cent variation in exchange rate in the first month, which gradually increased and settled at 22.0 per cent by the tenth month. This position was implied by the impulse response analysis where the real exchange rate changed significantly in response to an impulse from dollarisation. Moreover, the reaction of monetary policy rate to the index of dollarisation was marginal in the first month at about 0.38 per cent and rose slowly afterwards to 0.58 per cent by the tenth month. This is, however, contrary to a priori expectation. Lastly, the impact of an own shock to dollarisation was 86.4 and 77.4 per cent in the first month and tenth month, respectively.

Table 1: Forecast Error Variance Decomposition (FEVD) of Index of Dollarisation

		Decomposition of DI			
Period	**S.E.**	**INF**	**DEXR**	**IBR**	**DI**
1	1.937706	0.018421	13.16931	0.383683	86.42859
		-0.86133	-5.07672	-1.18586	-5.20356
2	2.858011	0.014111	16.56079	0.227999	83.1971
		-1.00704	-6.39668	-0.96056	-6.62822
3	3.439461	0.019404	20.13507	0.952784	78.89274
		-1.40431	-7.91117	-1.40195	-7.91487
4	3.806247	0.01837	21.41309	0.925329	77.64321
		-1.80297	-8.81279	-1.41453	-8.82057
5	4.065632	0.015504	21.34178	0.854729	77.78799
		-2.04681	-9.25841	-1.40465	-9.3414
6	4.255148	0.021744	21.59922	0.757814	77.62122
		-2.36204	-9.74493	-1.39969	-9.90176
7	4.389678	0.031489	21.9486	0.68418	77.33573
		-2.76745	-10.18	-1.46228	-10.4116
8	4.485103	0.045024	22.11069	0.626116	77.21817
		-3.22116	-10.5078	-1.56546	-10.8255
9	4.553871	0.064119	22.07307	0.57807	77.28474
		-3.70929	-10.7506	-1.701	-11.1604
10	4.604013	0.090531	21.95823	0.535623	77.41562
		-4.21726	-10.9349	-1.85514	-11.4426

VI. Policy Implications and Conclusion

VI.1 Policy Implications

I. From the findings, monetary policy could still be effective even with the current level of unofficial dollarisation in the Nigerian economy, since the impact was small.

ii. Furthermore, the results indicated that reaction of the index of dollarisation to changes in monetary policy stance was marginal, in terms of percentage. This development might be because the level of dollarisation that could have influenced

monetary policy was largely from the foreign currency in circulation rather than foreign currency deposit with domestic banks.

iii. The results may also suggest that monetary policy could still be effective in influencing domestic transactions in part because these have remained predominantly in domestic currency and dollarisation may reflect primarily asset substitution and foreign exchange in circulation.

iv. The study also showed that there was no regular pattern in the response of the exchange rate to monetary policy shocks.

VI.2 Conclusion

This paper examined the impact of dollarisation on monetary policy in Nigeria. The paper adopted the conventional IMF proxy for dollarisation and traced its reactions to changing monetary policy stance. Using the vector autoregression (VAR) model and interbank rate as an indicator of monetary policy stance, the results showed that the size of dollarisation could influence the outcome of monetary policy, though the impact was small. This was evident from the output equations, that inflation did not respond in the first month and responded negatively in the second month. However, from the third to sixth month, it responded positively before it eventually returned to equilibrium. The overall impact of dollarisation on exchange rate is dependent on the degree of dollarisation. The conclusion from the results was that monetary policy could still be effective with the present level of dollarisation.

References

Alvarez-Plata, P. & Garcia-Herrero, A. (2007). To Dollarise or De-dollarise: Consequences for Monetary Policy. *Paper Prepared for the Asian Development Bank.*

Arteta, C. (2003). Exchange Rate Regimes and Financial Dollarisation: Does Flexibility Reduces Bank Currency Mismatches? *International Finance* 0303005, EconWPA.

Berg, A. & Borensztein, E. (2000). The Choice of Exchange Rate Regime and Monetary Target in Highly Dollarised Economies. *Journal of Applied Economics*, III: 2, pp. 285-324.

Bordo, M., Meissner, C. & Stuckler, D. (2009). Foreign Currency Debt, Financial Crises and Economic Growth: A Long-run View. *NBER Working Paper*.

CBN(2014). Effects of Monetary Policy on Real Sector of the Nigerian Economy: A Disaggregated Analysis by Real Sector Division Research Department Central Bank of Nigeria. A "Festschrift" In Honour of Banji Stephen Adebusuyi.

CBN Circular BSD/DIR/GEN/LAB/08/013

Cheng, E., & Wang, C. (2011). The Possibility of Creating a Global Currency and the Path to its Realisation. WRPE, *Pluto Journals*

De Nicoló, G., Honohan, P. & Ize, A. (2003). Dollarisation of the Banking System: Good or Bad? *IMF Working Paper*, No. 146.

Feige, E. L. (1997). World Dollarisation, Monetary Aggregates and Underground Economies: Where is America's Currency? *METU Conference on Economics*, Ankara, Turkey, September 9-12.

Feige, E. L., Faulend, M. | & Šonje, V (2002). Currency Substitution, Unofficial Dollarisation and Estimates of Foreign Currency Held Abroad: The Case of Croatia in Mario Blejer and Marko Skreb (Ed). *Financial Policies in Emerging Markets*, MIT Press.

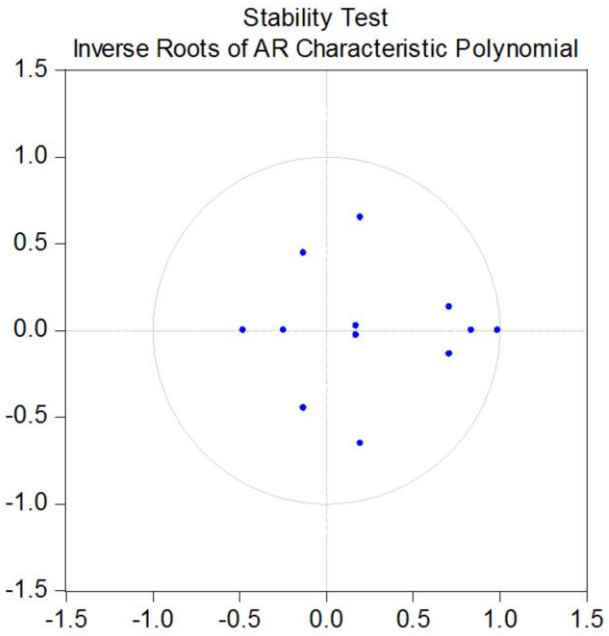
Hausmann, R., Gavin, M., Pages-Serra, C. & Stein, E. (1999). Financial Turmoil and the Choice of the Exchange Rate Regime. Inter-American Development Bank, *Working Paper* #400.

Honohan, P. & Shi, A. (2001). Deposit Dollarisation and the Financial Sector in Emerging Economies. *World Bank Policy Research Working Paper*, No. 2748.

Levy, Y. E. (2006). Financial Dollarisation: Evaluating the Consequences. *Economic Policy, CEPR, CES, MSH*, vol. 21(45), pp. 61-118.

Reinhart, C., Rogoff, K. & Savastano, M. (2003). Addicted to Dollars, , No. 10015, October.

Appendix



VAR Lag Order Selection Criteria
Endogenous variables: INF DEXR IBR DI
Exogenous variables: C
Sample: 2002M01 2016M12
Included observations: 158

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1978.142	NA	926246.4	25.09040	25.16794	25.12189
1	-1518.423	890.3425	3368.689	19.47370	19.86137*	19.63114
2	-1483.972	64.97638	2668.140	19.24015	19.93796	19.52354*
3	-1467.352	30.50432	2649.938*	19.23231*	20.24025	19.64165
4	-1456.602	19.18762	2837.260	19.29876	20.61684	19.83405
5	-1447.053	16.55899	3087.882	19.38042	21.00864	20.04166
6	-1431.229	26.64156*	3108.379	19.38264	21.32099	20.16983
7	-1417.534	22.36261	3220.011	19.41182	21.66031	20.32496
8	-1413.467	6.433958	3775.629	19.56288	22.12150	20.60197

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 06/23/17 Time: 14:52
Sample: 2002M01 2016M12
Included observations: 168

Dependent variable: INF

Excluded	Chi-sq	df	Prob.
DEXR	5.646203	3	0.1302
IBR	1.472770	3	0.6886
DI	2.031632	3	0.5659
All	8.541751	9	0.4806

Dependent variable: DEXR

Excluded	Chi-sq	df	Prob.
INF	4.554062	3	0.2075
IBR	4.857251	3	0.1826
DI	12.96441	3	0.0047
All	22.27325	9	0.0081

Dependent variable: IBR

Excluded	Chi-sq	df	Prob.
INF	0.432885	3	0.9334
DEXR	10.16938	3	0.0172
DI	0.311650	3	0.9578
All	12.22786	9	0.2008

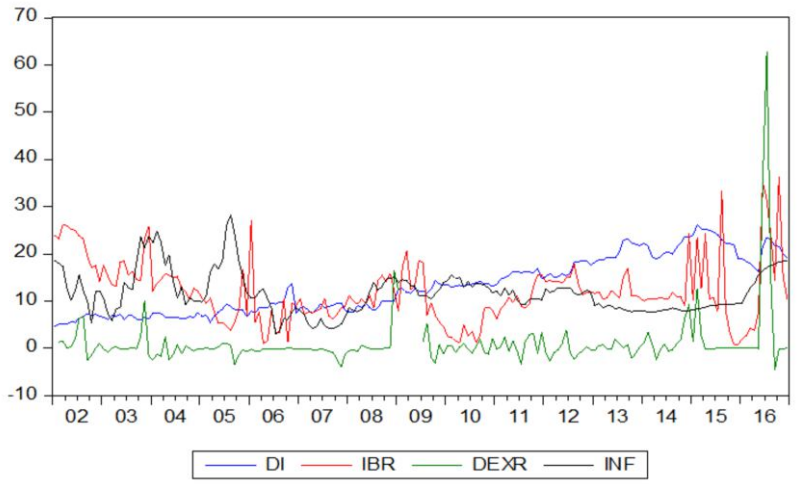
Dependent variable: DI

Excluded	Chi-sq	df	Prob.
INF	0.212180	3	0.9756
DEXR	1.656708	3	0.6466
IBR	3.618817	3	0.3057
All	7.268614	9	0.6092

Group unit root test: Summary
Series: DI, IBR, DEXR, INF
Date: 06/23/17 Time: 14:55
Sample: 2002M01 2016M12
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.56267	0.0591	4	703
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.43551	0.0000	4	703
ADF - Fisher Chi-square	57.3954	0.0000	4	703
PP - Fisher Chi-square	86.8449	0.0000	4	709

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality



Determinants of Nigeria's External Sector Competitiveness

O. Duke, M. Yakub, M. Nakorji, B. Gaiya, F. Isma'il, Z. Sani, S. Zimboh, T. Obiezue, O. Asuzu and V. Aliyu *

Abstract

The study investigated the determinants of Nigeria's external competitiveness, with a view to providing sound policy prescriptions on ways to improve competitiveness. The study employed an Autoregressive Distributed Lag (ARDL) model, using monthly data spanning 2008 to 2016 to determine the short- and long-run relationships among some selected macroeconomic variables. These included real effective exchange rate, exports, productivity, crude oil price, capital flow and consumer price index. The results from the short-run analysis revealed that productivity, proxied by government expenditure, and crude oil price were found to be the major determinants of external sector competitiveness in Nigeria, while CPI was significant in the long-run. However, Nigeria's exports and capital flows were not significant determinants of external competitiveness. The policy implication is that since the country has no control over crude oil price, the need to ensure prudence in government spending becomes imperative to boost productivity and trade. Also, the need to restructure government expenditure profile from recurrent to capital to guarantee infrastructural development is undisputable. This is because increased capital expenditure would enhance foreign investor confidence.

Keywords: External Competitiveness, Trade Performance, Economic Growth, REER, Price Level

JEL Classification Numbers: F1, F43, F31, E31

I. Introduction

In recent times, countries have shifted their policy focus towards improving competitiveness. This is against the backdrop that differences in factor endowment and technology prompted countries to trade with the rest of the world, in order to take advantage of today's globalised world. Competitiveness is the ability to realise central economic goals of growth in income and employment, favourable prices, exchange rate stability, and sustained rise in standards of living, without running into balance of payment

** The authors are staff of the External Sector Division, Research Department, Central Bank of Nigeria. The usual disclaimer applies.*

difficulties (Fagerberg, 1988; Cheptea et al., 2013). A country is said to be competitive when it has favourable terms of trade, high market share, low level of import penetration (ratio of domestic demand satisfied by import) and robust current account position. Other factors such as global demand patterns, economic diversification, productivity growth and prices, level of unemployment and real effective exchange rate (REER) are also important determinants of external competitiveness.

External competitiveness is of particular concern to Nigeria's policy makers, owing to the country's reliance on crude oil export and high import of goods and services. In this regard, the country's external competitiveness is measured in terms of trade performance and movement in REER. From 2000 to 2014, Nigeria witnessed robust current account position and favourable terms of trade, as a result, of high crude oil prices and active trade policy, aimed at improving non-oil exports. The goods account recorded a trade surplus of US$10.42 billion, US$19.67 billion and US$46.22 billion in 2000, 2004 and 2008, respectively. However, the effect of the 2008-2009 global financial crisis, combined with the negative oil price shocks, led to the drop in trade surplus to US$25.67 billion in 2009. This, however, increased to US$42.52 billion in 2013 as a result of the improvement in crude oil price. In 2015 and 2016, weak global demand and slump in crude oil prices resulted in trade deficits of US$5.03 billion and US$3.20 billion, respectively. Also, the annual average REER index, which was 97.4 in 2009, deteriorated to 89.8 and 69.5 in 2011 and 2014, respectively. The adverse impact of commodity price shock led to significant depreciation of the naira exchange rate and pushed domestic inflation higher than that of the major trading partners. Consequently, the REER index increased to 70.8 and 78.7 in 2015 and 2016, respectively, showing an improvement in competitiveness.

The recent deterioration in Nigeria's export proceeds, due to persistent decline in crude oil prices and dismal performance of non-oil export, exposed Nigeria's economy to external shocks. In reaction to this, various policies were redirected towards improving external competitiveness. Policies aimed at diversifying the export base and moving the economy away from oil exports, were promoted. In addition, reforms in the foreign exchange market were carried out by the Central Bank of Nigeria (CBN) to douse demand pressure, thereby reducing high import bills. Despite all these measures, there has not been a significant improvement in the country's level of external competitiveness.

This study, therefore, investigated the major drivers of external sector competitiveness, with a view to providing sound policy prescriptions on ways to improve competitiveness. Specifically, the study determined the component of trade performance (disaggregated into oil and non-oil exports) that drove Nigeria's external sector competitiveness and identified challenges undermining the sector.

Furtherance to the studies by Adeleye et al., (2015), Omojimite et al., (2010) and Obinwata et al., (2016), this study contributed to literature by disaggregating exports into oil and non-oil to identify the drivers of external sector competiveness in Nigeria.

The rest of the paper is structured as follows. Section 2 focused on conceptual, theoretical and empirical literature, while Section 3 provided stylised facts on Nigeria's externalcompetitiveness. Section 4 presented the methodology. Section 5 discussed the results and findings while conclusion and policy recommendations were presented in Section 6.

II. Literature Review

II.1 Conceptual Literature

It is well recognised that competitiveness depends not only on the evolution of relative prices and costs but also on a series of structural factors, such as technological innovation, research & development, and investment in physical and human capital (Agenor, 1997). Some well recognised and acceptable qualitative measures of competitiveness are highlighted below.

II.1.1 Global Competitiveness Index

The Global Competitiveness Index (GCI), established in 2004, is a yearly index published by the World Economic Forum. The GCI integrates the microeconomic and macroeconomic aspects of competitiveness, including structural factors, into a single index. It assesses the ability of countries to provide elevated levels of prosperity to their citizens. The index is made up of over 110 variables and considers 12 main determinants of competitiveness called pillars. These are institutions (public and private), appropriate infrastructure, stable macroeconomic framework, good health and primary

education, higher education and training, goods market efficiency, labour market efficiency, developed financial markets, technological readiness, market size, business sophistication and innovation. The 12 pillars are classified under three major headings, namely: basic requirements, which envelopes pillars 1 to 4; efficiency enhancers (pillars 5 to 10); and innovation and sophistication factor (pillars 11 to 12).

Nigeria was ranked 124 out of a total of 140 countries with a total score of 3.5 out of 7 in the GCI 2015-2016. This position marked a marginal improvement in performance over the previous period (2014-2015), where Nigeria got a score of 3.4 out of a total of 7, thus highlighting a slight improvement in competitiveness from a year earlier. The report also showed that Nigeria performed better under the efficiency enhancers, as indicated by a positive market size and labour market efficiency. Two areas that required improvement to enhance competitiveness were good health and primary education and infrastructure.

II.1.2 World Competitiveness Ranking

The World Competitiveness Ranking (WCR) is a leading annual report on the competitiveness of countries, published since 1989 by the International Management Development (IMD) Business School, Switzerland. The publication centres on overall performance, challenges, strengths and weaknesses, and competitiveness landscape. The WCI uses 340 criteria for evaluating factors that enhance doing business and social welfare. The criteria measure macroeconomic performance, governmental and private sector efficiency and infrastructure levels of 63 countries. Although not explicitly stated in the 2015/2016 abridged report, Nigeria is not competitive, as it falls below the top 60 competitive countries.

II.1.3 Doing Business Index

The Doing Business Index (DBI) is an annual publication of the World Bank established in 2003. The publication analyses the business environment, measures cost of business regulations to firms, and considers regulations that enhance and constrain business activities in 190 countries. The report ranks countries according to the average score they achieve in respect of eleven

(11) areas in the life cycle of a business. These include starting a business, getting electricity, getting credit, dealing with construction permits, registering property, protecting minority investors, paying taxes, trading across borders, resolving insolvency, enforcing contracts and market labour regulation.

The data set covers 8 economies in South Asia, 20 in the Middle East and North Africa, 25 in Eastern Europe and Central Asia, 25 in East Asia and the Pacific, 32 in Latin America and the Caribbean, 32 OECD high-income economies and 48 in Sub-Saharan Africa. These indicators were used to evaluate the consequences of economic reforms that had worked, where and why. The 2016 DBI report ranked Nigeria 170 out of 190 countries. With respect to the ease of doing business ranking, overall regulation in Nigeria also ranked 170 out of 190 countries.

II.I.4 Competitiveness Industrial Performance Index

The United Nations Industrial Development Organisation (UNIDO) developed the Competitiveness Industrial Performance Index (CIP index) in 1990. It estimates or determines the ability of countries to produce and export manufactured goods, competitively. Industrial competitiveness is assessed and benchmarked through CIP index, building on a meso-concept of competitiveness, which assigns particular emphasis to countries' manufacturing development (UNIDO, 2014). The CIP index is constructed from four (4) indices. The first two indicators provide information about industrial capacity, while the other two reflect technological complexity and industrial upgrading of a country. These indicators are industrial capacity, manufactured export capacity, industrialisation intensity and export quality. The key structural variables consider the following drivers: skills, technological effort, royalty and technical payment abroad and modern technology. Using the 2014 CIP index, Nigeria improved in competitiveness, rising eleven (11) places above the position in 2013 to the 83rd position out of a total of 142 countries. Nigeria was thus classified among the lower-middle competitive countries with Lebanon, Algeria, Cote d'Ivoire, Jamaica, Cameroon, Kenya and Paraguay.

II.1.5 Logistics Performance Index

The Logistic Performance Index (LPI) measures the performance of 160 countries on the efficiency of international supply chains as published by the World Bank, once in two years. The first publication was released in 2007. It is an average of specific country scores in six key dimensions, namely: efficiency of customs clearance process, quality of trade and transport-related infrastructure, ease of arranging competitively-priced shipments, competence and quality of logistics services, ability to track and trace consignments, and timeliness of shipments in reaching destination. Thus, the LPI tracks how efficiently countries can ship their products to other countries. Based on the 2016 report, high-income countries dominated the top 10. Nigeria was ranked 90 out of 160 with an LPI of 3.6 out of a total score of 5.0, as against 75th position with an LPI score of 2.8 in 2014. This revealed that Nigeria's competitiveness declined compared to other African countries that improved significantly from their positions in 2014, such as Algeria, Burkina Faso, Democratic Republic of Congo, Egypt, Gabon, Ghana, Kenya, Mali, Namibia, South Africa, Togo and Zambia.

II.2 External Competitiveness

The notion of competitiveness amongst nations, not only lacks a universally acceptable definition but also, lacks a broad consensus on its appropriate measurements. Some definitions focused on external balances and assumed that exports and imports could not achieve long-run equilibrium, even in a flexible exchange rate regime. Other scholars combined the concept of external balance with domestic performance to arrive at definitions that emphasised the importance of a country's ability to produce goods and services that meet international standards. The European Commission (2001) defined competitiveness as the ability of an economy to provide its population with high standards of living and rates of employment on a sustainable basis. Porter (1990) viewed competitiveness in terms of national productivity. In the same vein, Krugman (1994) defined competitiveness as the ability of a country to improve its living standards through increased productivity.

External competitiveness is usually determined by price and non-price factors. Price factors are quantifiable measures, while the non-price factors are

structural in nature. Measures of non-price competitiveness include level of infrastructural development, tax system and administration, regulatory environment and other support services that enhance market enlargement (Leichter et. al. 2010). The most common price measure is changes in the REER, which take into account both cost/prices of goods and services, and movements in the nominal effective exchange rate of the domestic economy, relative to that of its trading partners.

The REER is nominal effective exchange rate (a measure of the value of a currency against a measured average of several foreign currencies) divided by a price deflator or index of costs (IMF, 2017). The prices of these baskets are expressed in the same currency, using the nominal exchange rate of each trading partner. The price of each trading partner's basket is weighted by its shares in imports, exports, or total trade. The REER is the nominal effective exchange rate (NEER) adjusted by relative consumer prices. The REER can be calculated in two ways – the direct and indirect methods. Using the direct method, it is symbolically represented as:

$$REER = NEER * \frac{\prod_i^n (P^*) w^i}{P} \quad (1)$$

where $NEER$= nominal effective exchange rate; P= is domestic price proxied by CPI

$\prod_i^n (P^*)\, w^i$= The weighted average CPI of major trading partners

From Equation 1, an increase in the REER index signifies an improvement in competitiveness while a decline indicates loss of trade competitiveness, relative to its trading partners[1]. The REER index serves as an important indicator of assessing a country's international competitiveness, and identifies the underlying factors that drive trade flows and incentives to allocate resources between tradable and non-tradable sectors.

Another price factor that determines external competitiveness is productivity growth and prices. Productivity growth, measured by gross domestic product (GDP), refers to the capacity of a country to produce goods and services in a period, relative to another. It can be expressed either in nominal or real terms.

[1] *A rise in the REER signifies improved competitiveness resulting from the depreciation of currency. This depreciation makes exports more attractive, and imports unattractive.*

Economic growth is driven by better economic resources, increased labour force, creation of superior technology and specialisation. The principal cause of a country's economic growth is reflected in the technological advancement, improvement in quality and level of literacy and increase in the capital stock. Prices, measured by consumer price index (CPI) are the general price level, based on the cost of a typical basket of consumer goods and services in an economy. It measures changes in the purchasing power of a currency and the rate of inflation.

External competitiveness can also be measured in terms of trade performance. This is measured mainly in terms of export growth and market share. Export growth is the increase in the export of goods and services, in one period, relative to another. Export growth is derived thus:

$$Export\ growth = \frac{X_t - X_{t-1}}{X_{t-1}} \quad (2)$$

Export share, also known as market share, refers to a country's export performance in relation to world total export, over a specified period of time (World Bank, 2010). It is expressed as follows:

$$Export\ share = \frac{country's\ export_t}{world\ total\ export_t} \quad (3)$$

Market share determines the relative competitiveness of a country's export of goods and services. An increase in market share indicates improvement in competitiveness.

II.3 Theoretical Literature

II.3.1 Classical Theories of International Trade and Competitiveness

Classical theories of international trade have their foundation from the works of Smith (1776) and Ricardo (1951). Smith based his argument of free trade on the concepts of specialisation and absolute advantage. According to him, each country can gain a competitive advantage by focusing on producing goods in which it holds absolute advantage. The country exports goods produced at the lowest costs and imports those produced at highest costs. Assumptions

underpinning this theory include factor immobility, no barriers to trade, equality of import and export, labour as the dominant factor of production, and constant returns to scale. With the advent of capitalism and its attendant complexities, new issues on exchange between nations emerged. Ricardo's concept of comparative advantage opposed that of the absolute advantage. According to his theory, the opportunity cost of productive capacities between countries should be the focal consideration for efficiency in trade. It is more beneficial for a country to specialise in the production and export of goods that can be produced at a lower opportunity cost. The theory built on the assumptions of the absolute advantage theory.

Another notable contribution to the classical theory of international trade and competitiveness was Hecksher-Ohlin's (1933) factor endowment theory. The basic assumption of the theory is that, two countries, which engage in trade, are identical except for the differences in factor endowments of labour or capital. According to the theory, a country specialises in producing and exporting commodities which require relatively intensive use of those factors of production that are locally abundant (Frăsineanu, 2008). Watson (2003) held that the classical trade theory is hinged on the notion that the cause for international trade could be relayed to the quantitative and qualitative differentials in the distribution of factors of production.

II.3.2 Neo-Classical Theories of International Trade and Competitiveness

Amongst the neo-classical theories of international trade, Porter's (1990) theory of competitive advantage relates more to the macroeconomy. The theory negates the classical theories proposition and opines that a nation's competitiveness is closely tied to the ability of its industries to innovate and grow. He makes the inferences that the nature and sources of competitive advantage differ amongst industries. The theory asserts that increased global competition prompts nations to improve their competitive advantage. Porter identified four determinants of competitive advantage, namely; factor conditions, domestic demand, firm structure, and related and supporting industries (Mohammed, 2014).

II.4 Empirical Literature

Studies on the determinants of external competitiveness had been carried out in different climes, using different methodologies that yielded different findings. Manfort (2008) used VAR methodology to assess trade performance and competitiveness of the Chilean economy, using quarterly data from 1990 to 2006. Trade performance (proxied by trade flows) was modeled as a function of real income and relative prices. Export was to depend on global demand, proxied by the trade shares of Chile's major trading partners, and external competitiveness, measured by REER. Import was captured as a function of domestic demand proxied by private consumption for imports of consumer goods and internal competitiveness. The findings showed high and significant elasticities of both export and import to external and domestic demands, while REER was insignificant. He concluded that trade liberalisation contributed immensely to increased trade performance and external sector competitiveness in Chile.

Agenor (1997) examined the competitiveness and external trade performance of the French manufacturing sector, using quarterly data, spanning 1982 to 1994. Vector error correction model (VECM) was employed to determine the short- and long-run determinants of external trade performance. The empirical analysis focused on the dynamics of relative prices, and domestic and foreign demand on trade flows. The manufacturing trade ratio, captured by ratio of export over import of manufactured goods, was modeled as a function of real GDP, unit labour cost, G-6 real GDP and index of non-price competitiveness. The findings revealed that the overall competitiveness of the French manufacturing sector improved in the 1980s through the early 1990s. This improvement, however, did not necessarily occur in sectors with the highest potential for expansion.

Orszaghova et al., (2013) evaluated developments in the external competitiveness of the EU candidate countries for the period 1999 to 2011. They assessed competitiveness, using both price and non-price measures and considered both short- and long-run indicators of export performance, domestic prices, production costs, institutions and structural issues. The paper

also utilised comparative advantage index developed by Balassa (1965), concentration index called Herfindahl-Hirschman Index (HHI)[2] and international specialisation index by Lafay (1992). In terms of price/cost measures, REER, inflation and labour costs were used for the analysis. The paper showed that REER indices, of the EU candidate countries, appreciated during pre-global financial crisis periods and depreciated, considerably at the on-set of the crisis, for the countries with flexible exchange rate regime. The countries reviewed also experienced increase in wages during the period. However, the overall growth rates of wages outperformed the growth of labour productivity, signifying loss of competiveness.

The non-price indicators used both trade and structural indices. For the trade related indicators, the paper assumed that specialisation affected growth and export performance of a country. Their findings indicated that most of the member countries had diversified their exports both in terms of trading partners and products, and were, thus, less vulnerable to external shocks. Using static and dynamic methods in analysing trade structure of the member countries, the findings revealed increase in trade flows over the period. The structural indicators used were production, educational and technological intensities. Intra-industry trade (IIT) was used as an important determinant of trade performance, measured by Grubel-Lloyd (1975) index, which revealed increased share in IIT within the EU countries. Measuring the long-run indicator of competitiveness, member countries recorded remarkable increase in FDI.

Gutierrez (2007) evaluated the export performance and external competitiveness of the Macedonian economy, using REER-based indicator. The macroeconomic balance, the purchasing power parity (PPP) and behavioural equilibrium exchange rate (BEER) approaches were estimated to determine the competitiveness of the country. Findings showed deterioration of REER, which signified improved competitiveness in Macedonia, relative to her major trading partners. Mahvash (2008) investigated the structural competitiveness of oil-exporting African countries, relative to other major oil-endowed developing nations, using annual data spanning 1970 to 2006. The paper utilised gravity model to determine the level at which institutional arrangements affected the performance of non-oil exports in oil-exporting

[2] *The HHI was developed independently by two economists A.O. Hirschman (in 1945) and O.C. Herfindahl (in 1950).*

economies. The results revealed that oil-rich African nations lagged behind other oil-endowed countries in relation to global market share, investment climate and diversification. The performance of non-oil export was weak, due to poor infrastructure and quality of institutions. Using Mozambique's data, Vitek (2009) examined the external price competitiveness, utilising indicators, such as REER and terms of trade. The author used macroeconomic balance, equilibrium real exchange rate and external sustainability approaches. The results showed an over-valuation of Mozambican metical, indicating loss of international price competitiveness, compared with the country's major trading partners.

Brixiova et al. (2013) examined competitiveness for Egypt, Morocco and Tunisia based on annual data spanning 1980 to 2009. The authors modelled REER, productivity, terms of trade, net foreign assets and openness, utilising dynamic ordinary least squares (DOLS) and autoregressive distributed lag (ARDL) approaches. The finding indicated real exchange rate misalignment in Egypt, while Morrocco and Tunisia were closer to the underlying fundamentals. The countries were confronted with severe structural factors, which hindered their external competitiveness.

A study by the Reserve Bank of Zimbabwe (2015) examined the impact of REER on Zimbabwe's external competitiveness, using macroeconomic balance approach. The result revealed an overvalued REER, signifying loss of the country's external competitiveness. Similarly, Cham (2016) examined the external competiveness of the Gambian economy, using macroeconomic balance, purchasing power parity (PPP), equilibrium real exchange rate, and external sustainability approaches. The author applied Generalised Method of Moments (GMM) and VECM for the estimation. The findings from all the approaches indicated real appreciation of the Gambian dalasi, reflecting loss in external competitiveness. The survey based indicators of doing business also indicated that the country was lagging behind its competitors.

Alege and Okodua (2014) empirically examined the external competitiveness of the Nigerian economy and economic growth, using annual data for the period 1980 to 2012. The variables used were real GDP growth, export performance, measured by the ratio of country's export to world export, and REER, as a proxy for international competitiveness. The authors employed structural VAR approach to model the relationship between external

competitiveness and output dynamics. The findings showed the existence of a positive relationship between real output and REER and a negative relationship between REER and export performance. Adeleye et al., (2015) examined the impact of international trade on economic growth in Nigeria. Using co-integration and error correction modelling techniques, they revealed that export contributed significantly to economic growth in Nigeria, both in the short- and long-run. They also indicated that the balance of trade constituted minimally to export growth. Using a descriptive approach, Obinwata et al., (2016) investigated trends in exchange rate and export performance in Nigeria between 1970 and 2015. The results emphasised the impact of exchange rate volatility on export demand in the country. It further revealed that exchange rate volatility greatly affected export performance in Nigeria, despite policy pronouncements issued at the time, especially, volume of export demand.

Eboreime and Umoru (2016) examined Nigeria's export competitiveness, utilising annual data for the period 1980 to 2012. The ARDL method was used to model total export, as a function of exchange rate, export price and foreign income. The result indicated strong competitiveness of Nigeria's export in Canada, Japan and United States, influenced by foreign income and exchange rate. However, the country's export is less-competitive in the United Kingdom. Using descriptive analysis, Owuru and Farayibi, (2016) assessed exchange rate trends and export performance in Nigeria, during 1970 to 2015. The authors noted exchange rate volatility effect on export performance with greater emphasis on the volume of export demand. Kemi (2014) empirically investigated the impact of REER on terms of trade and economic growth, using annual data spanning 1980 to 2012. Findings from vector error correction model revealed that real exchange rate positively and significantly affected terms of trade and output in Nigeria.

Though the above-mentioned studies contributed to knowledge, they failed to take into cognisance a disaggregated approach of the export variable, the peculiarity of economies whose GDP or productivity is driven largely by government expenditure and their consideration of annual data, which are unable to efficiently capture some trade dynamics within a specific year. This study, therefore, addresses these concerns.

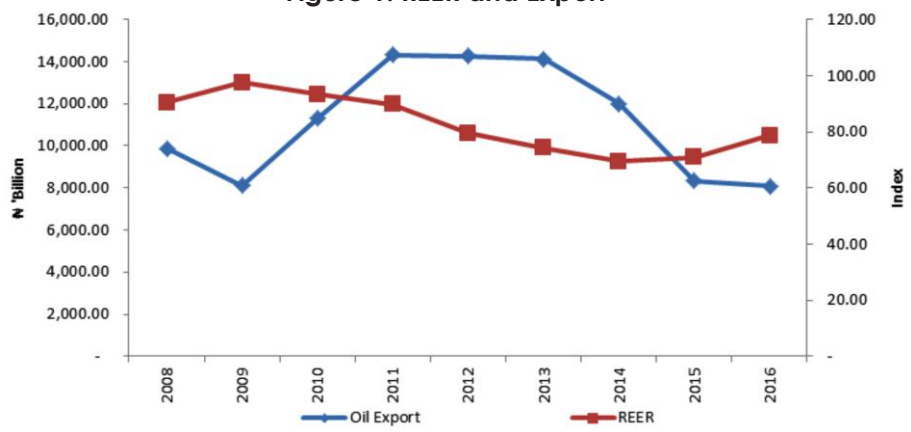
III. An Overview of Nigeria's External Competitiveness

Measuring the competitiveness of a country generally requires an assessment of the overall dynamism of the economy, including productivity and performance of exporting firms in the global market place Leichter, et al., (2010). Like other economies, Nigeria's external competitiveness is indicated by the REER. Also explained in relation to external competitiveness are export performance, productivity growth, prices and capital flows. This section highlighted the trends in these variables in relation to external sector competitiveness over the years.

III.1 Export Performance

From 1981 to 2016, Nigeria's export has been predominantly oil. Proceeds from exports fluctuated over time following significant events in the world and the Nigerian economy such as the Gulf war, oil price fluctuations, and export diversification drive of the Nigerian government as well as decline in receipts from agricultural and manufactured export products. By 2016, oil and non-oil export declined, significantly to 8,093.41 billion and 675.91 billion, respectively,, due to the collapse in oil prices and decline in receipts from agricultural and manufactured export products.

Figure 1: REER and Export



Source: Central Bank of Nigeria

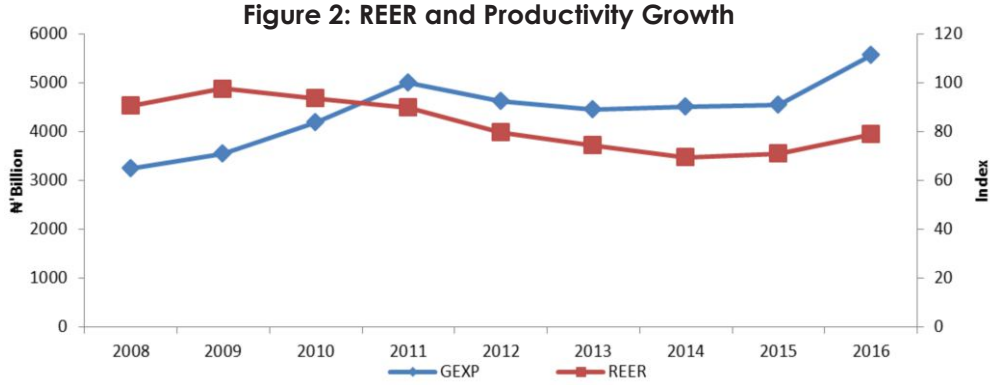
Nigeria's REER stood at 90.3 in 2008 and increased in 2009 to 97.4 signifying an improvement in competitiveness. In 2010, Nigeria became less competitive as

the REER declined to 93.4. This trend was sustained through 2014, recording 69.5 points. Nigeria's trade performance, however, improved in 2015 and 2016 to 70.8 and 78.7. In economic literature, based on the computation of the REER, an increase in the quantity of export is expected to increase revenue and the level of reserves. This could lead to an appreciation of the currency and to a loss in competitiveness as a result of increasing foreign exchange. This implies the existence of a negative relationship between exports and the REER. However, the data on the Nigerian economy as shown below revealed otherwise between 2008 and 2009, and 2014 and 2016, as a decrease in exports (oil and non-oil) led to a decrease in the REER, that is, a loss in trade competitiveness.

III.2 Productivity Growth (Government Expenditure)

In this study, productivity was proxied by government expenditure. Government expenditure in Nigeria increased from 3,240.82 billion in 2008 to 4,989.82 billion, 4,512.72 billion, and 5,562.96 billion in 2011, 2014, and 2016, respectively. This rise was as a result of the presidential elections and the decision of the fiscal authorities to drive the economy out of the recession that began in the first quarter of 2016.

Figure 2: REER and Productivity Growth



Source: Central Bank of Nigeria

The theoretical impact of government expenditure on REER is ambiguous Bakardzhieva et al., (2010). As shown below, a positive relationship was established between government expenditure and REER from 2011 to 2016, thus implying that an increase in government expenditure led to improved competitiveness.

III.3 Consumer Price Index (CPI)

An analysis of Nigeria's CPI between 2008 and 2016 showed a mixed trend. In 2008, it stood at 11.5, but increased to 12.6 and 13.8 in 2009 and 2010, respectively, owing to instability in the macroeconomic environment. In 2016, inflation rose to 15.63 due to the global commodity price shock. The REER tended to act independently of the CPI until 2012, where a positive relationship was highlighted. Hence, an increase in domestic prices led to improved trade competitiveness in Nigeria.

Figure 3: REER and Consumer Price Index (CPI)

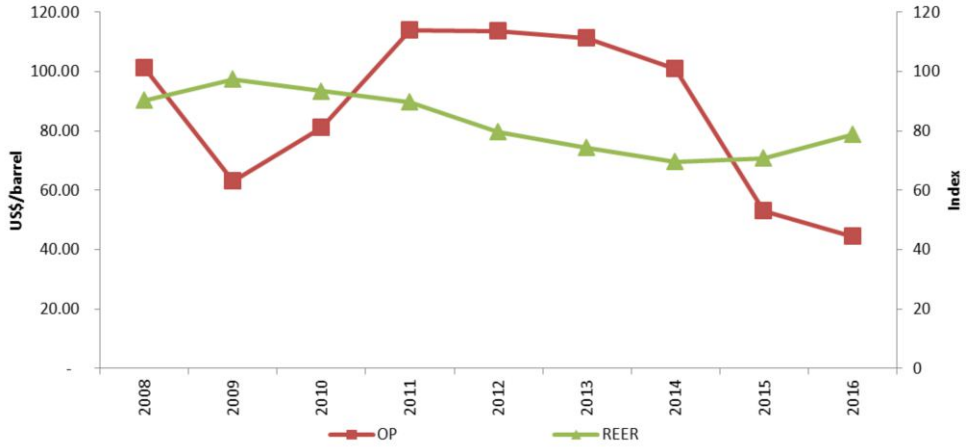
Source: Central Bank of Nigeria

III.4 Oil Price (OP)

The international price of crude oil, which was at about US$101.17 per barrel in 2008, experienced a huge decline of about 37.7 per cent to US$63.1 per barrel in 2009. This slump in crude oil price was attributed to the global financial crises that began in 2008. Crude oil price, however, rose in the following year to an average of US$81.0 and US$114.06 per barrel in 2010 and 2011, respectively. It then began a descent to US$113.52 and US$100.80 per barrel in 2012 and 2014. The most recent slump in prices was as a result of the glut in the market and the increase in supply of shale oil by the US government. Crude oil price further declined to an average of US$44.5 per barrel in 2016.

An increase in oil price, as Nigeria's major export product, is expected to lead to an increase in external competitiveness as exhibited in the figure below. The fall in oil prices between 2008/2009 and 2014/2016, led to a rise in competitiveness as occasioned by the increase in the REER. The rise in the international price of crude oil between 2009 and 2011, however, declined competitiveness slightly by 7.6 points.

Figure 4: REER and Oil Price



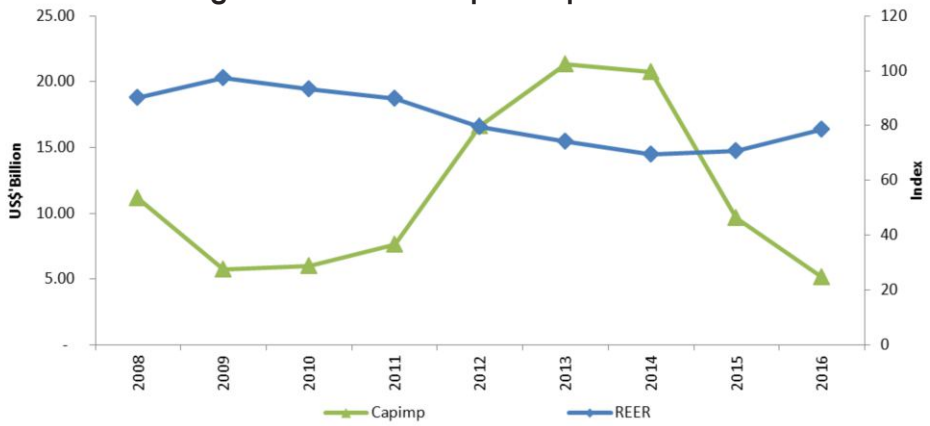
Source: Central Bank of Nigeria

III.5 Capital Flows (Capital Importation)

Nigeria recorded declining flows into the economy between 2008 and 2010. This could be attributed to the global financial crisis that engulfed world economies. This improved between 2011 and 2013 recording about US$21.34 billion in 2013. The Nigerian economy became slightly unattractive in 2014, as characterised by the decline in flows to about US$20.75 in 2014. This trend was sustained as a result of further pressures on the economy, such as the exchange rate crises and other macroeconomic challenges. Capital flows declined to US$9.64 and US$5.12 in 2015 and 2016, respectively.

Figure 5 reveals a negative relationship between capital importation and REER, which is as expected as increased foreign currency inflows cause currency appreciation and increased prices of exported goods. It shows that an inflow of foreign currency makes Nigeria less competitive.

Figure 5: REER and Capital Importation



Source: Central Bank of Nigeria

IV. Methodology

IV.1 Data and Variables

The study utilised monthly data from 2008 to 2016. The set of variables included real effective exchange rate (REER) (proxy for external sector competitiveness), export performance (proxy for trade performance) disaggregated into oil export (OE) and non-oil export (NOE), oil price (OP), capital importation (CIMP), which served as a proxy for capital flows, consumer price index (CPI) and government expenditure (GEXP), a proxy for domestic productivity. REER was used as a measure of competitiveness as it has been the most widely used in literature in recent years (Vitek, 2009 and Bakardzhieva, et al., 2010).

Government expenditure was used as a proxy for domestic productivity for two main reasons – the unavailability of monthly GDP data and the fact that government expenditure represents the largest component of Nigeria's GDP using the expenditure approach. Some studies included government expenditure as one of the control variables in the determination of capital flows and competitiveness (Bakardzhieva, et al.,2010; Tashu, 2015; Khomo and Aziakpono, 2015).

All data employed in the analysis, except the average price of crude oil (the Bonny light), were sourced from the Statistical Database of the Central Bank of Nigeria. Crude oil data was sourced from the Thomson Reuters platform. The

research works of Tashu (2015), Khomo and Aziakpono (2015) and Reserve Bank of Zimbabwe (2015) also considered these variables in the determination of external sector competitiveness. This study employed the auto-regressive distributed lag (ARDL) model.

IV.2 Model Specification

ARDL models are among the most popular classes of models for estimating short and long-run relationships among integrated economic variables. The ARDL is preferred to other methods, such as Engel and Granger (1987), Johansen (1988, 1991), Johansen-Juselius (1990) and Phillips and Hansen (1990), because it allows for a more flexible procedure that can be applied even when the variables are of different orders of integration (Pesaran and Pesaran 1997). Thus, the approach avoids problems resulting from analysis using non-stationary time series data and also enables sufficient number of lags to capture the data-generating process in a general-to-specific modelling framework (Laurenceson and Chai 2003). Also, both the short- and long-run coefficients of the model are estimated, simultaneously.

The models, representing the relationship between the dependent and independent variables, were presented in the Equations 4 and 5. Equation 4 captured the effect of oil export on competitiveness, while Equation 5 reflected the effect of non-oil export on competitiveness.

$$REER_t = \beta_0 + \sum \beta_1 OE_t + \sum \beta_2 GEXP_t + \sum \beta_3 OP_t + \sum \beta_4 CIMP_t + \sum \beta_5 CPI_t + \varepsilon_t \quad (4)$$

$$REER_t = \beta_0 + \sum \beta_1 NOE_t + \sum \beta_2 GEXP_t + \sum \beta_3 OP_t + \sum \beta_4 CIMP_t + \sum \beta_5 CPI_t + \varepsilon_t \quad (5)$$

The ARDL relates the dependent variable to its lagged values and the lag values of all the independent variables in the model. Accordingly, the ARDL representation of Equations 4 and 5, in a conditional or unrestricted error correction model (ECM), were presented in the following forms:

$$\Delta REER_t = \beta_0 + \beta_1 \mathrm{REER}_{t-1} + \beta_2 OE_{t-1} + \beta_3 \mathrm{GEXP}_{t-1} + \beta_4 OP_{t-1} + \beta_5 CIMP_{t-1} + \beta_6 CPI_{t-1} + \sum_{i=1}^{n} \psi_i \Delta\Gamma_{it-1} + \varepsilon_t \quad (6)$$

$$\Delta REER_t = \beta_0 + \beta_1 \mathrm{REER}_{t-1} + \beta_2 NOE_{t-1} + \beta_3 \mathrm{GEXP}_{t-1} + \beta_4 OP_{t-1} + \beta_5 CIMP_{t-1} + \beta_6 CPI_{t-1} + \sum_{i=1}^{n} \psi_i \Delta\Gamma_{it-1} + \varepsilon_t \quad (7)$$

Where $REER$ was the dependent variable and $OE, NOE, GEXP, OP, CIMP$ and CPI were the independent variables. Γ was a vector of the lag difference of all the variables in the model. The coefficients β_1 to β_5 were the long-run estimates and the ψ_i stood for short-run estimates. The error-term, ε_t , was expected to be serially independent. β_0 represented the constant term, while Δ stood for the difference operator.

The reliability of Equations 6 and 7 was judged by the strength of its estimates and diagnostics, which were conducted using tests for serial correlation, normality and heteroscedasticity. The long-run relationship among specified variables is established on the basis of an F-statistic (Wald test), relative to the two critical (lower and upper bounds) values introduced by Pesaran et al. (2001) for the co-integration test. Where the F-statistic lies above the upper bound, a long-run relationship is established and where the F-statistic lies below the lower bound, no long-run relationship exists. However, inference on the long-run relationship is inconclusive in the event that the F-statistic falls within the bounds (Pesaran et al., 2001).

Once long-run co-integration is established, an error correction specification of the models is required for the speed of adjustments to the long-run equilibrium. To this extent we estimated two models along with an error correction term, which was derived from the original long- run equation as follows:

$$\Delta REER_t = \beta_1 \mathrm{REER}_{t-1} + \beta_2 OE_{t-1} + \beta_3 GEXP_{t-1} + \beta_4 OP_{t-1} + \beta_5 CIMP_{t-1} + \beta_6 CPI_{t-1} + \sum_{i=1}^{n} \psi_i \Delta\Gamma_{t-1} + ect_{(-1)} + \varepsilon_t \quad (8)$$

$$\Delta REER_t = \beta_1 \mathrm{REER}_{t-1} + \beta_2 NOE_{t-1} + \beta_3 GEXP_{t-1} + \beta_4 OP_{t-1} + \beta_5 CIMP_{t-1} + \beta_6 CPI_{t-1} + \sum_{i=1}^{n} \psi_i \Delta\Gamma_{t-1} + ect_{(-1)} + \varepsilon_t \quad (9)$$

In Equations 8 and 9, ect must be negative and statistically significant for there to be short-run adjustment to long-run equilibria. The parsimonious model is then tested for fitness and normalised for short- and long-run elasticities. The expected sign of the variables are $\beta_2 > 0, \beta_3 > 0, \beta_4 < 0, \beta_5 < 0$ *and* $\beta_6 < 0$.

IV.3 Pre-Estimation Analysis

IV.3.1 Summary Statistics

Summary statistics presented in Table 1 showed that the REER index averaged 82.86 during the review period and spread between 60.89 and 100.23, suggesting volatility during the review period. Total oil and non-oil exports averaged 929,918.80 and 64,517.29, respectively. Further analysis revealed that REER, GEXP, CIMP and OP appeared to be normal as given by the Jarque-Bera statistic. Skewness revealed that all the variables, except REER, OE and OP were positively skewed. In terms of kurtosis, REER, OE, NOE, OP and CPI were platykurtic, while CIMP and GEXP were leptokurtic, that is, CIMP and GEXP tend to be characterised by a few outliers.

Table 1: Summary Statistics

Statistics	REER	OE	NOE	OP	CIMP	CPI	GEXP
Mean	82.8625	929918.8	64517.3	86.8035	962.1208	136.1341	367236.0
Maximum	100.2300	1575626.0	126011.7	138.7400	3029.848	213.5600	823673.6
Minimum	60.8900	376055.6	20053.91	30.6600	101.8309	79.0600	75646.5
St. deviation	11.1918	261691.4	19527.74	28.8816	667.8115	35.9788	142518.0
Kurtosis	1.6198	2.3895	2.9602	1.7135	3.5852	2.1793	3.8634
Skewness	-0.1004	-0.0823	0.1412	-0.2811	1.12589	0.2936	0.6225
Jarque Bera	8.7543[b]	1.8881	0.3661	8.8706[b]	24.3576[a]	4.5831	10.3300[a]

Note: a, and b denote 1% and 5% levels of statistical significance, respectively.

Source: Author's computation using e-views

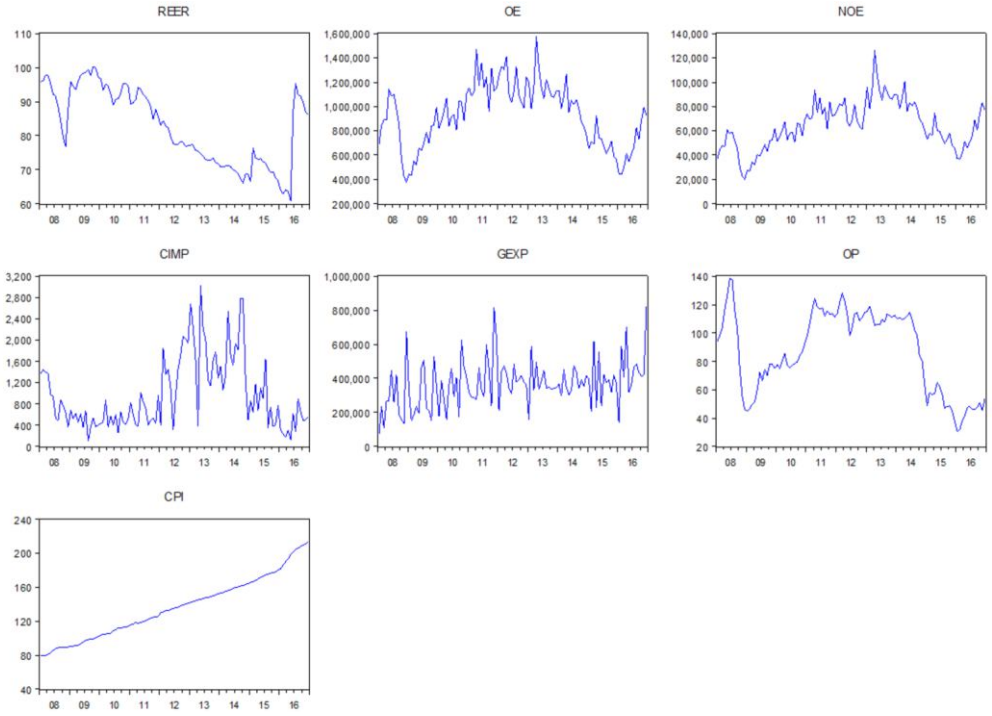
The above details highlighted distinctive characteristics in the data and thus we subjected the data to various tests of stationarity.

IV.3.2 Graphical Presentation

The graphical presentation of the data in levels was shown in Figure 6. It showed that the element of domestic prices (CPI) exhibited a linear distinct upward and deterministic trend in the pattern. REER was downward sloping but showed

a minor upward break around 2016M06, which could be as a result of the shift to a more flexible exchange rate regime. OP also exhibited elements of minor breaks, which could be attributed to crude oil price shocks in 2009M01. Another episode of crude oil price shocks was experienced in 2015M01. An inspection of the graphs revealed that all the variables except GEXP were likely to be non-stationary.

Figure 6: Graphical Presentation of the Variables



Source: Author's computation using e-views

IV.4 Unit Root Tests

Results of the unit root test rejected the nulls of unit root for REER, OE, NOE, OP and CPI, indicating that CIMP and GEXP were stationary, that is I(0), while REER, OE, NOE, OP and CPI were non-stationary and integrated of I(1). Due to the various orders of integration, the ARDL method was considered appropriate in estimating the equations. Furthermore, the Bounds testing approach was accommodative to such statistical properties and was encouraged to be used with the ARDL method (Narayan and Narayan, 2003).

Table 2: Augmented Dickey Fuller (ADF) Unit Root Test

Variable	Level	First Difference	I(d)
REER	-1.8987	-8.7570[a]	I(1)
OE	-2.2723	-7.6707[a]	I(1)
NOE	-2.4301	-13.6438[a]	I(1)
OP	-1.3228	-6.3050[a]	I(1)
CIMP	-3.2276[b]		I(0)
CPI	0.1066	-4.5878[a]	I(1)
GEXP	-11.4252[a]		I(0)
Note: a, and b denote 1% and 5% levels of statistical significance, respectively.			

Source: Author's computation using e-views

Table 3: Phillips-Perron (PP) Unit Root Test

Variable	Level	First Difference	I(d)
REER	-1.8987	-8.6502[a]	I(1)
OE	-3.0821	-14.0826[a]	I(1)
NOE	-3.4199[b]		I(0)
OP	-1.8772	-6.1805[a]	I(1)
CIMP	-4.4085[a]		I(0)
CPI	1.4084	-7.1101[a]	I(1)
GEXP	-11.4622[a]		I(0)
Note: a, and b denote 1% and 5% levels of statistical significance, respectively.			

Source: Author's computation using e-views

The Schwartz Information Criteria (SIC) was used in determining the best model, because of its parsimony. Also included were two fixed regressors (constant and trend) based on the results of the unit root tests. Equations 10 and 11, revealed a parsimonious ARDL with five (5) independent variables each having $ARDL(p, q_1, q_2, q_3, q_4, q_5,)$ where p, q1, q2, q3, q4, and q5 represent the lag lengths of the ARDL model.

The parsimonious models used in the determination of the co-integration of the variables was given as:

$$ARDL(p, q_1, q_2, q_3, q_4, q_5) = ARDL(1,1,0,0,0,0) \quad (10)$$

$$ARDL(p, q_1, q_2, q_3, q_4, q_5) = ARDL(1,0,0,1,0,0) \quad (11)$$

IV.5 Bounds Test

The bounds test was used to determine the joint significance of all the variables in the model. The F-statistic of 3.81 and 4.64 were significant at 5% level, necessitating the failure to reject the null hypothesis of joint insignificance. Consequently, when compared with the critical values provided by Pesaran et al. (2001), the F-statistic lied above the upper critical bound in both models. Therefore, the null hypothesis of no level effect was rejected thus a long-run relationship amongst the variables was established.

Table 4: ARDL Bounds Test for Equation10

Test Statistic	Value	K
F-statistic	3.8060	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.49	3.38
5%	2.81	3.76
2.50%	3.11	4.13
1%	3.50	4.63

Source: Author's computation using e-views

Table 5: ARDL Bounds Test for Equation 11

Test Statistic	Value	K
F-statistic	4.6449	5
Critical Value Bounds		
Significance	I0 Bound	I1 Bound
10%	2.49	3.38
5%	2.81	3.76
2.50%	3.11	4.13
1%	3.50	4.63

Source: Author's computation using e-views

The short-run ARDL model was computed with the first differenced series as shown in Equation 12:

$$\Delta y_t = \hat{\theta}\varepsilon_{t-1} + \sum_{i=1}^{N} \delta_i \Delta y_{t-1} + \sum_{j=0}^{N} \gamma_1 \Delta X_{t-j} + \varepsilon_t \quad (12)$$

where $\hat{\theta}\varepsilon_{t-1}$ was the adjustment factor

V. Results and Findings

V.1 Interpretation of Results

The results of Equations 10 and 11 were presented in Tables 6 and 7, respectively. The results showed that crude oil price and government expenditure were significant in the determination of external competitiveness in the short-run, while only CPI was significant in the long-run. The sign and size revealed that a 1.0 per cent increase in crude oil price was expected to raise REER by 0.2 per cent (in Equation 10) and 0.1 per cent (in Equation 11), which showed improvement of Nigeria's competitiveness. Also, a 1.0 per cent increase in government expenditure would lead to 0.01 per cent increase in REER; hence improvement of competitiveness in the short-run for both models.

The result implied that in the short-run, as oil price rises, Nigeria's competitiveness improved because an increase in capital inflow enhances government revenue, reduces government deficits and the need to borrow. This lessens the crowding-out effect and improves available credit to the private sector. Furthermore, the improved government revenue would also be used in providing more infrastructure and creating a better business environment that would attract foreign investors. For domestic prices, a 1.0 per cent increase would raise REER by 5.4 and 2.7 per cent in Equations 10 and 11, respectively. Hence, improving competitiveness in the long-run. This trend is not as expected and this could be as a result of an increased depreciation in the naira, which could be said to have dampened the effect of the rise in domestic prices. This increase in domestic CPI given the depreciation in the naira would thus improve competitiveness.

The trend component of technology was included in the estimation. Based on the results, the variable exhibited a significant negative relationship with competitiveness. This implied that, due to the structure of the Nigerian economy, the level of technology did not impact positively on competitiveness; thus emphasising limited value-addition in terms of exports. This is strengthened by the large average share of oil exports in total exports during the period 2008 to 2016, which was as high as 93.5 per cent. Where technology is said to impact on the non-oil sector, the ratio of the share of oil exports in total exports, would have declined, significantly over time.

Table 6: Model 1 – Long-Run and Short-Run Estimation of Determinants of External Sector Competitiveness for Nigeria

Long-Run Estimates							
	$\log\mathbf{OE}$	$\log\boldsymbol{GEXP}$	$\mathrm{Log}\mathbf{OP}$	$\log\boldsymbol{CIMP}$	$\mathrm{Log}\boldsymbol{CPI}$	**TREND**	
$\mathbf{log}\boldsymbol{REER} =$	-0.9253	0.0611	0.3519	0.0267	5.3839[c]	-0.0476[c]	
$\mathbf{SER} =$	(0.8032)	(0.1011)	(0.5013)	(0.0709)	(3.1399)	(0.0254)	
$\mathbf{T-stat} =$	[-1.1521]	[0.6039]	[0.7020]	[0.3770]	[1.7147]	[-1.8729]	
Short-Run Estimates							
	$\Delta\log\mathbf{OE}$	$\Delta\log\boldsymbol{GEXP}$	$\Delta\log\mathbf{OP}$	$\Delta\log\boldsymbol{CIMP}$	$\Delta\log\boldsymbol{CPI}$	$\mathbf{C}$	$\mathbf{E(-1)}$
$\Delta\mathbf{log}\boldsymbol{REER} =$	-0.0185	0.0130[c]	0.1584[a]	0.0088	-0.4499	-1.1689[a]	-0.1289[a]
$\mathbf{SER} =$	(0.0305)	(0.0071)	(0.0491)	(0.0064)	(0.5988)	(0.2232)	(0.0245)
$\mathbf{T-stat} =$	[-0.6080]	[1.8219]	[3.2288]	[1.3821]	[-0.7511]	[-5.2329]	[-5.2542]
$\mathbf{R^2 = 0.9100; F-stat = 123.8739^a; Durbin\ Watson = 1.96}$							
$\mathbf{LInearity\ [Ramsey\ Reset\ test\ (F-stat)] = 1.7938}$							
$\mathbf{Serial\ Correlation\ [Ljung\ Box\ (Q-stat)] = 4.5843}$							
$\mathbf{Heteroskedasticity\ [ARCH-LM\ (F-stat)] = 1.7078}$							
$\mathbf{Normality\ [Jarque-Bera] = 2069.841^a}$							
Note: a, b and c represents 1%, 5% and 10% levels of statistical significance.							

Source: Author's computation using e-views

The values of exports for both oil and non-oil, and capital importation were found to be insignificant; thus, they had no effect on external competitiveness. This is rather puzzling considering the fact that oil export is a dominant component of international trade in Nigeria. The insignificance of the non-oil export was expected because of its dismal contribution to Nigeria's total export due to poor infrastructure and quality of institution, as noted by Mahvash (2008). The performance of the non-oil sector in oil-exporting African countries is insignificant, due to the impact of "the Dutch Disease", where revenues are not used prudently to reduce oil dependence.

The error correction term of the two models exhibited an appropriate statistics. The coefficients of the adjustment factor suggested that about 0.1 per cent of any disequilibrium between external competitiveness and its determinants, with respect to oil export, would be corrected within seven (7) months and that of non-oil export would be within four (4) months.

Table 7: Model 2 – Long-Run and Short-Run Estimation of Determinants of External Sector Competitiveness for Nigeria

Long-Run Estimates							
	log**NOE**	log$GEXP$	Log**OP**	log$CIMP$	logCPI	**TREND**	
log$REER$ =	-0.0417	0.0291	-0.2416	0.0312	2.6628[b]	-0.0266[a]	
SER =	(0.1817)	(0.0588)	(0.1476)	(0.0427)	(1.1783)	(0.0099)	
T − stat =	[-0.2298]	[0.4954]	[-1.6368]	[0.7309]	[2.2599]	[-2.6968]	
Short-Run Estimates							
	Δlog**NOE**	Δlog$GEXP$	Δlog**OP**	Δlog$CIMP$	ΔlogCPI	**C**	**E(−1)**
Δlog$REER$ =	0.0414	0.0135[c]	0.0944[b]	0.0094	-0.4135	-1.2811[a]	-0.2073[a]
SER =	(0.0287)	(0.0073)	(0.0472)	(0.0065)	(0.6062)	(0.2621)	(0.0423)
T − stat =	[1.4437]	[1.8635]	[1.9979]	[1.4606]	[-0.6821]	[-4.8881]	[-4.9046]
$R^2 = 0.9107$; F − stat = 124.8813[a]; Durbin Watson = 1.74							
LInearity [Ramsey Reset test (F − stat)] = 1.8141							
Serial Correlation [Ljung Box (Q − stat)] = 5.7261							
Heteroskedasticity [ARCH − LM (F − stat)] = 5.8793							
Normality [Jarque − Bera] = 2587.900[a]							
Note: a, b and c represents 1%, 5% and 10% levels of statistical significance.							

Source: Author's computation using e-views

Source: Author's computation using e-views

V.2 Post-Estimation Diagnostics

The adjusted R-squared (91.0%) of the post-estimation diagnostics revealed that the overall goodness of fit of the models was satisfactory. The joint significance of the explanatory variables was statistically significant at the 1.0 per cent level, for both models as measured by the F-statistic. The Durbin-Watson statistics for both models was approximately 2, indicating the non-existence of serial correlation. The results of the Ljung box and the ARCH-LM tests showed evidence of no serial correlation and constant variance, which further supported the correctness of the models. However, the residuals exhibited some evidence of non-normality, which could be attributed to the inclusion of both I(0) and I(1) models in the estimation. This factor had, however, been taken care of by the use of the ARDL model.

VI. Conclusion and Policy Recommendations

The study investigated empirically the determinants of Nigeria's external competitiveness, using the ARDL Bounds test approach with monthly time series data for the period 2008 to 2016. The results revealed that government expenditure and crude oil price were major determinants of Nigeria's external

competitiveness in the short-run; while only CPI was significant in the long-run. This implied that in the short-run, as oil price increased foreign exchange earnings would improve, thus reducing government deficits. The possibility that CPI would improve Nigeria's external sector competitiveness in the long-run may be attributable to positive real interest rates recorded in the later part of the review period. From Figure 8, positive real interest rates were recorded for the period 2012M12 and 2016M1, which might have triggered increased foreign investments into the economy. In addition, the improved earnings could be used to reduce infrastructural deficit, enhance business environment and promote competitiveness. The combined effect of shock of all the variables were corrected within seven (7) and four (4) months of its occurrence for oil and non-oil exports, respectively.

The following recommendations are proffered:

1. Since oil price improves competitiveness in Nigeria, in the short-run, government should ensure optimal production of crude oil by promoting stability in the oil-producing areas, as well as fast tracking the passage of the Petroleum Industry Bill. Furthermore, government should maximise its potentials, by resuscitating the existing refineries, and building modular refineries, in order to limit the importation of refined oil;

2. Government should fast-track efforts in restructuring expenditure profile from recurrent to capital to guarantee infrastructural development, improve standard of living, create employment and stimulate domestic production. This derives from the result of the model, which showed that government expenditure contributes significantly to external sector development. The more the investment in human and physical capital development, the better the inflow into the economy and, by extension, improved competitiveness of the external sector. In terms of infrastructural development, Nwankwo (2017) reported an infrastructural deficit of US$25 billion per annum for the next seven years. Therefore, in order to achieve infrastructural balance, a concerted effort, to intensify government revenue drive, is required. As at end-2016, there were about US$14 trillion global investment funds invested in

negative-yielding bonds (Ocheho, 2017) from which the government could attract for investment purposes. Also, efficiency in tax administration and broadening the tax base should be pursued vigorously.

3. Since CPI improved competitiveness in the long-run, the monetary authority should ensure policy actions that assure low and stable prices in the economy. This should be done in collaboration with the fiscal authorities.

4. Since government expenditure improves competitiveness in the short-run, there is the need for assured and diverse revenue sources to sufficiently take care of these expenditures. Therefore, government should intensify efforts at technological advancement in the productive sector of the economy to optimise productivity and specialisation. Technological advancement in the manufacturing sector ensures meeting of domestic demand and exports that lead to improvement of the country's competitiveness. Also, emphasis should be on value-chain approach to agriculture and value addition in solid minerals development, so as to meet domestic demand that reduce import bills and enhance foreign exchange inflow through non-oil exports. In addition, government should ensure improvement in human capital development that would guarantee optimum productivity.

5. Also, in the short-run, government should ensure prudence in its spending and channel its resources to priority sectors of the economy, as it improves competitiveness. Strategies for ensuring ease of its expenditure and bureaucratic bottlenecks that are detrimental to the genuine expenditure and business should be eliminated.

References

Adeleye, J.O., Adeteye O. S. & Adewuyi, M. O (2015). Impact of International Trade on Economic Growth in Nigeria (1988-2012), *International Journal of Financial Research*, Vol. 6, No. 3, pp. 163-172.

Agenor, P. R. (1997). Competitiveness and External Trade Performance of the French Manufacturing Industry. *Springer*, Vol. 133, Issue 1, pp. 103-133.

Alege, P.O. & Okodua, H. (2014). International Competitiveness and Growth of the Nigerian Economy: A Structural VAR-Based Perspective. Macrothink Institute, Research in Applied Economics. Vol. 6, No. 4, February 2014, pp. 53 – 57.

Bakardzhieva, D., Naceur, S. B. & Kamar, B. (2010). The Impact of Capital and Foreign Exchange Flows on the Competitiveness of Developing Countries. *IMF Working Paper WP/10/154, July 2010*.

Balassa, B. (1965). Trade Liberalisation and Revealed Comparative Advantage. Manchester School of Economics and Social Studies, Vol. 33, pp. 99-123.

Brixiova, Z., Egert, B., & Amor Essid, T. H. (2013). The Real Exchange Rate and External Competitiveness in Egypt, Morocco and Tunisia. African Development Bank Group *Working Paper Series*. No. 187, pp. 1-26.

Cham, T. (2016). An Assessment of External Price Competitiveness for the Gambia. *Journal of Applied Economics and Finance*. Vol.3, No.4, pp. 207.

Cheptea, A., Fontagné, L., Emlinger, C., Orefice, G., Pindyuk, O. & Stehrer, R. (2013). EU External Competitiveness: Recent Developments (Doctoral Dissertation, Commission of the European Communities).

Eboreime, O. F. & Umoru, D. (2016). An Econometric Estimation of Nigeria's Export Competitiveness in the Global Market. *European Scientific Journal*, Vol.12, No.7, pp. 39.

Engle, R. F. & Granger, C. W, J. (1987). Co-Integration and Error Correction: Representation, Estimation and Testing Econometrica. Vol. 55, No. 2, pp 251-276.

European Commission, 2001. *European Competitiveness Report 2001*. DG for Enterprise & Industry, Brussels.

Fagerberg, J. (1988). International Competitiveness. *The Economic Journal*, 98, 355-374.

Frăsineanu, P. L. (2008). The Porter's Theory of Competitive Advantage http://Feaa.Ucv.Ro/Annals/V7_2008/0036v7-030.Pdf

Gutierrez, E. (2007). Export Performance and External Competitiveness in the Former Yugoslav Republic of Macedonia. *South-Eastern Europe Journal of Economics, No. 2*.

IMF (2017) Via the IMF Help Link at http://datahelp.imf.org/knowledgebase/articles/537472-what-is-real-effective-exchange-rate-reer

Johansen, S. (1988). Statistical Analysis of Co-integration Vectors. *Journal of Economic Dynamics and Countrol*. Vol. 12, Issue 2-3, pp. 231-254.

Johansen, S. (1991). Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models. Econometrica. Vol. 59, No. 6, pp 1551-1580.

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. Vol. 52, Issue 2, pp. 169.

Kemi, A. (2014). Real Exchange Rate, Terms of Trade and Economic Growth in Nigeria (1980 – 2012). Journal of Economic Theory. Vol. 8, Issue 2, pp. 19-23.

Khomo, M. M. & Aziakpono, M. J. (2015). The Behaviour of the Real Effective Exchange Rate of South Africa: Is there a Misalignment? Economic Research Southern Africa (ERSA) Working Paper 644 pp. 1-23

Krugman, P. (1994). Competitiveness, a Dangerous Obsession. Journal of Foreign Affairs. Vol. 73, No. 2, pp. 28-44.

Lafay, G. (1992). The Measurement of Revealed Comparative Advantage, in Dagenais, M. G. and Muet, P. A. (eds). *International Trade Modelling*, London: Chapman and Hall.

Laurenceson, J. & Chai, J. C. H. (2003). Financial Reforms and Economic Development in China. Cheltenham, UK, Edward Elgar. Pp. 1-28

Leichter, J., Mocci, C. & Pozzuoli, S. (2010). *Measuring External Competitiveness*: An Overview. *Italian Ministry of Economy and Finance Working Papers*. No. 2, pp. 1-55.

Mahvash, S. Q. (2008). Africa's Oil Abundance and External Competitiveness: Do Institutions Matter? IMF Working Paper, No. 08, Vol. 172.

Manfort, B. (2008). Chile: Trade Performance, Trade Liberalisation, and Competitiveness. IMF Working Paper, Vol. 08, No. 128.

Mohammed A. (2014). Theories of International Trade, Lecture Notes No.5. Sprott School Of Business, Carleton University.

Narayan, P. & Narayan, S. (2003). Savings Behaviour in Fiji: An Empirical Assessment using the ARDL Approach to Co-integration. *Department of Economics Discussion Papers, Monash University*. No 03/02.

Nwankwo, A. (2017). Fiscal Space and Debt Management in Times of Recession and Exchange Rate Crisis, Paper Presented at the CBN Executive Seminar held at Golden Tulip Hotel, Festac Town, Lagos State, between September 11-13.

Obinwata, I. B., Owuru, J. E. & Farayibi, A. O. (2016). Exchange Rate Trends and Export Performance in Nigeria: A Descriptive Approach. Centre for Allied Research and Economic Development, Ibadan.

Ocheho, S. (2017). Managing Recession and Exchange Rate Crisis: Operators Perspective, a Paper Presented at the CBN Executive Seminar held at Golden Tulip Hotel, Festac Town, Lagos State, Between September 11-13, 2017.

Omojimite, B. U. & Godwin, A. (2010). The Impact of Exchange Rate Reforms on Trade Performance in Nigeria. *Journal of Social Sciences*, 23(1): 53-62.

Orszaghova, L., Savelin L. & Schudel, W. (2013). External Competitiveness of EU Candidate Countries. European Central Bank, Occasional Paper Series No. 141.

Owuru, J. E. & Farayibi, A. O. (2016). Exchange Rate Trends and Export Performance in Nigeria: A Descriptive Approach. Available online at https://mpra.ub.uni-muenchen.de/74158/MPRA paper No. 74158.

Pesaran, M. H., Shin, Y. & Smith, R. J. (1999). Pooled Mean Group Estimator of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association*. Vol 94, pp. 621-634.

Pesaran, M. H., Shin, Y. & Smith, R. J. (2001). Bounds Testing Approaches to the Analysis of Level Relationships. Journal of Applied Econometrics. Vol. 16, pp. 289-326.

Pesaran. M. H. & Pesaran, B. (1997). Working with Micro-fit 4.0: Interactive Econometric Analysis. Oxford University Press.

Phillips, P. C. B. & Hansen, B. E. (1990). Statistical Inference in Instrumental Variables Regression with I(1) Processes. *Review of Economic Studies. Volume* 57, Pp. 99-125.

Porter M.E. (1990). The Competitive Advantage of Nations. *Harvard Business Review*. March-April 1990, https://hbr.org/1990/03/the-competitive-advantage-of-nations

Reserve Bank of Zimbabwe (2015). Assessing the Impact of the Real Effective Exchange Rate on Competitiveness in Zimbabwe. *Central Bank of Zimbabwe, RBZ Working Paper Series, No. 1.*

Ricardo, D. (1951). The Works and Correspondence of David Ricardo. 11 Vols. {Sraffa ed].

Smith, A. (1776). An Enquiry into the Nature and Causes of the Wealth of Nations. Vol. 1.

Tashu, M. (2015). Drivers of Peru's Equilibrium Real Exchange Rate: Is the Nuevo Sol a Commodity Currency? IMF Working Paper WP/15/26, February 2015.

UNIDO (2014). United Nations Industrial Development Organisation Competitiveness Industrial Performance Report 2014.

Vitek, F. (2009). An Assessment of External Price Competitiveness for Mozambique. IMF Working Paper, Vol. 09, No.165.

Watson, M. (2003). The Politics of Inflation Management *The Political Quarterly* Vol. 74, Issue 3, pp. 285.

World Bank (2010). World Bank Development Indicators. April. Retrieved from https://openknowledge.worldbnk.org./handle/ 10986/4373

SUBMISSION OF MANUSCRIPT TO CBN ECONOMIC AND FINANCIAL REVIEW

1. Three (3) hardcopies and a softcopy of the original manuscript should be addressed to the:

Editor-in-Chief
CBN Economic and Financial Review
Research Department
Central Bank of Nigeria
P.M.B.0187, Garki, Abuja

The softcopy of the papers can also be submitted via email as electronic document, preferably Microsoft word document to either of the following email address:
RSDPublications@cbn.gov.ng

The article should not be more than 20 pages on A4 size paper and should be typed double-spaced with a margin of 1.5 inches on all sides. The manuscript must be accompanied with a letter of submission written in English. Submission of a paper is assumed to imply that its contents represent original and unpublished work and is not under consideration elsewhere for publication. Normally, the review process is expected to take not more than three months. There is neither a submission charge nor page fee. A return address (postal/email) should be indicated.

2. Papers may be accepted or returned for specified revisions. A paper is expected to be published approximately six months from the date of acceptance.

3. Comments on published article/notes and reviews of up to 2,000 words will also be considered for publication. Notes deal with relevant topics not meeting full length articles. Reviews may be about articles published recently by this journal or elsewhere. A copy of the review/comments should be sent to the articles' author for clarification of any points or misunderstandings.

4. All submitted manuscripts are referred to an Editorial Board comprising of an in-house editorial committee and external referees. All comments by the referees will be sent to the author(s) together with a decision of the Editorial Board.

5. The purpose and scope of the article should be clearly stated in an abstract summarising the article's essential points. The abstract should be typed on a separate page and should be between 80-100 words in length. In addition, the JEL classification code (s) as well as keywords should be clearly indicated on the abstract page.

6. The author's institutional affiliation and necessary background information on the article should appear at the foot of the first page. Footnote to the text should be listed at the end, followed by the list of references

7. References for quotations or statements should be in parentheses in the text, not as notes. E.g. Hess (1906:20) or Cagan (1958) or Majer (1975:35). Where more than three authors are involved, cite senior author and use et al., E.G. Johnson et al. (1988).

8. Citations listed under the reference sections must begin on a new page. All entries must be typed double-spaced, listed alphabetically by last name of senior author and chronologically for two or more articles by the same author. The typed layout must conform to the following examples:

Nnanna, O. J. (2003). Promoting Savings and Investment Culture for National Development. CBN Economic and Financial Review, 41(3), 1-10.

Oresotu, F. O., & Mordi, C. (1992). The Demand for Money Function in Nigeria: An Empirical Investigation. CBN Economic and Financial Review, 30(1), 32-69.

Croxton, F. E., Cowden, F. E., & Klein, S. (1968). Applied General Statistics. London: Sir Isaac Pitman and Sons.

9. All tabular materials should be separated from the text in a series of tables numbered consecutively in Arabic numerals preferably in Microsoft Excel. Each table should be typed double-spaced and identified by a short descriptive at the top. Notes for table should be at the bottom of each table, before the source, and marked by lower case superscript letters. Appropriately placed tables should be indicated in the text.

10. Diagrams, graphs, charts, etc. must be separated from the text and clearly drawn in black ink on a white paper with all axes clearly positioned. They should be submitted in a form suitable for reproduction without redrawing, preferably in camera-ready artwork.

11. Where mathematical equations and formulae are used, they should be typed clearly. Notations, exponents, etc, which are simple to reproduce should be used. The equations should be numbered consecutively in Arabic numerals. The full mathematical workings necessary for justifying each step of the argument should accompany all the articles of a mathematical nature. This is meant to assist the reviewers and will not be published.