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Economic Downturn and Credit Risk: Empirical Evidence from the Nigerian Banking Sector

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Abstract

This paper investigates the impact of the economic downturn on the credit risk of the Nigerian banking sector using quarterly data for the period 2007 – 2016. The study employs ARDL (Autoregressive Distributed Lag) approach to cointegration. The study also conducted causality test using the Modified Wald (MWALD) test proposed by Toda and Yamamoto (1995) to determine the direction of causality among the variables. The results provide empirical support for the existence of a long-run relationship between the credit risk of Nigerian banks and macroeconomic variables, namely GDP growth, interest rate, inflation and foreign exchange rate. Most importantly the study finds greater causality power of interest rate, inflation and foreign exchange rate over the credit risk of Nigerian banks during the study period. The findings of the study have important implications for the impacts of the macroeconomic factors on the quality of the risk assets of the banks. One practical implication for Nigerian banks; is the integration and assessment of the potential impacts of the macro economic environments into the evaluation and assessment mechanism of the quality of their risk asset portfolio. Similarly, in order to mitigate another round of banking crisis and therefore a financial system instability in the country, the government and the monetary authority should therefore, work to harmonize the government's fiscal policies and the monetary policies with a view to reducing the interest rate, inflation and exchange rates in order to reduce the negative impacts of volatile macroeconomic environment on the risk assets of the banking sector.

JEL Classification codes: E44, E51, G01, G21.

Keywords: Economic downturn, Credit risk, ARDL Bounds testing

Introduction

Economic growth and recession are two sides of the economic life of nations. Nations usually have achievement and sustenance of economic growth to create economic well-being for their citizens, as important components of their primary macroeconomic objectives. However, economic downturns have become inevitable phases of national

indeed global economic histories. The Great Depression of the 1930s and the Global financial crisis of 2007-2009 are common examples of global economic crises. There have also been transnational and national recessions such as the 1997-98 financial crises that swept through the "Tiger economies" of the South-East Asia countries. Other examples are the recessions in the early 1980s, 1990s and the "Great Recession" of 2008-2009 in the UK. Similarly, Nigeria has also experienced an economic recession in the 1980s and currently going through what has been referred to as the 2016 recession.

While financial crises have occurred in the past in many countries of the world, for various reasons, the common reasons have always been associated with shocks in the macroeconomic environment resulting from the economic downturn. Financial crisis resulting from the weakness of the financial system usually provides catalytic support for the shocks from the macroeconomic environment to trigger financial system instability. The banking sector is a key segment of the financial system. Crisis in the banking sector is usually preceded by an abnormal rise in the level of non-performing loans in banks. Non-performing loans define the level of credit risk banks are exposed to. The ratio of non-performing loans to the total loans has been used to define the credit risk in financial institutions (Joint Forum¹, 2015; Louzis, Vouldis & Metaxas, 2012). This has become one of the measures of the degree of risk inherent in, and the stability or otherwise of a bank.

Similarly, many studies (Cobham, 1997; Muell bauer & Murphy, 1997) have argued that recessions and financial crises appear inevitable after a relatively long period of economic growth. This is because, the boom-bust cycles are usually characterized by over-consumption boom and subsequent retail slump (Salerno, 2012). The banking industry as a critical sector of the economy always bears the negative impacts of the economic downturns. This is because, banking crises often occur as economy slumps into recession consequent upon a prolonged boom that was sustained by credit expansion and capital inflows (Kaminsky & Reinhart, 1999). This has been aptly described by Eichengreen and Mitchener (2003) as a case of "credit boom went wrong".

The Nigerian economy slipped into recession after two consecutive quarterly contractions in the economy. The first contraction of -0.3 percent was recorded in the first quarter of 2016 while the second contraction of -2.06 percent was recorded in the second quarter of the year (NBS, 2016). The volume of crude oil export (the main revenue earning source for the country), according to the Central Bank of Nigeria (CBN), reduced due to the militancy activities in the Niger Delta area of the country. The sharp decline in the crude oil export coupled with a crash in the crude oil prices in the international crude oil markets sent ripples through the entire economy with dire consequences on the financial

¹ The Joint Forum was established in 1996 under the aegis of the Basel Committee on Banking Supervision (BCBS), the International Organization of Securities Commissions (IOSCO) and the International Association of Insurance Supervisors (IAIS) to deal with issues common to/across the banking, securities and insurance sectors, including the regulation of financial conglomerates

sector. The income earned from the oil exports in 2014 for example, was USD78.053 billion which drastically declined to USD27.788 billion in 2016 (OPEC, 2017). Similarly, the average price of the Nigerian Bonny light crude oil in the international crude oil market was as high as USD112.23 per barrel as at the second quarter of 2014 but fell to USD46.44 per barrel as at the second quarter of 2016 (NNPC, 2016).

The history of an economic recession in Nigeria has always been intertwined with the dynamics of the international crude oil market. For example, the collapse of the crude oil prices and crude oil glut in the international crude oil market led to the 1980s recession in the country. The country witnessed a period of the economic boom between 2009 and 2014. The period witnessed economic growth during which the country recorded an average of 6.5 GDP growth rate. However, revenue from oil export declined in 2015 and by the first quarter of 2016, the Nigerian economy contracted. Consequent upon the continuing contraction of the economy into the second quarter of 2016, the country was declared to be in recession. Coincidentally, financial soundness indicators of the banking industry indicate an increasing trend in non-performing loans during the period 2015-2016 (CBN, 2016). Consequently this study, therefore, seeks to investigate the relationship between the ongoing economic recession and the rising trend in the credit risk of the Nigerian banks. The relationship between the credit risk of Nigeria banks and the macroeconomic variables represented by GDP growth rate, inflation, interest rate, and foreign exchange rate are shown in the charts in Figures 1 and 2.

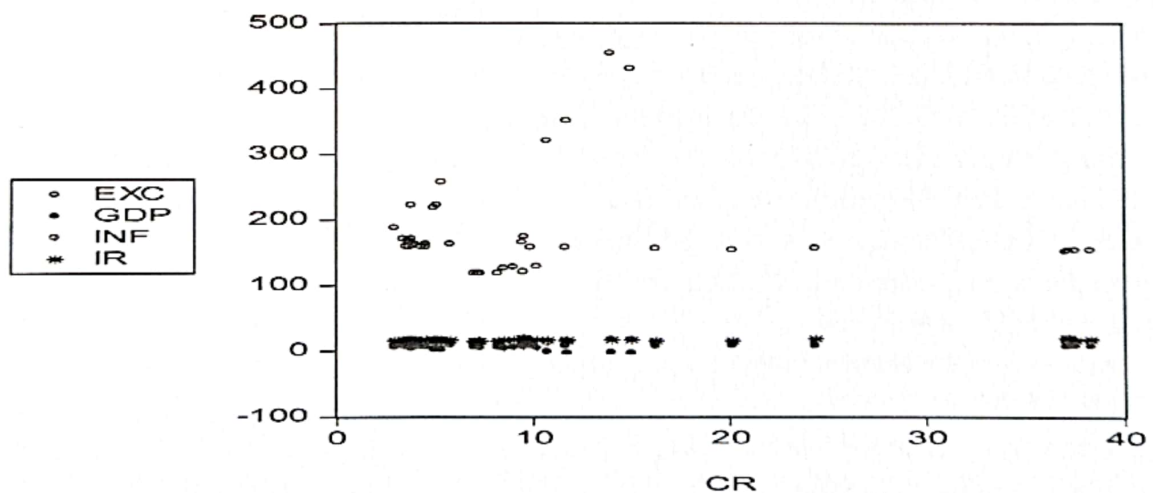


Figure 1. Scatter graph of credit risk (CR) of Nigerian banks and GDP, INF,IR and EXC

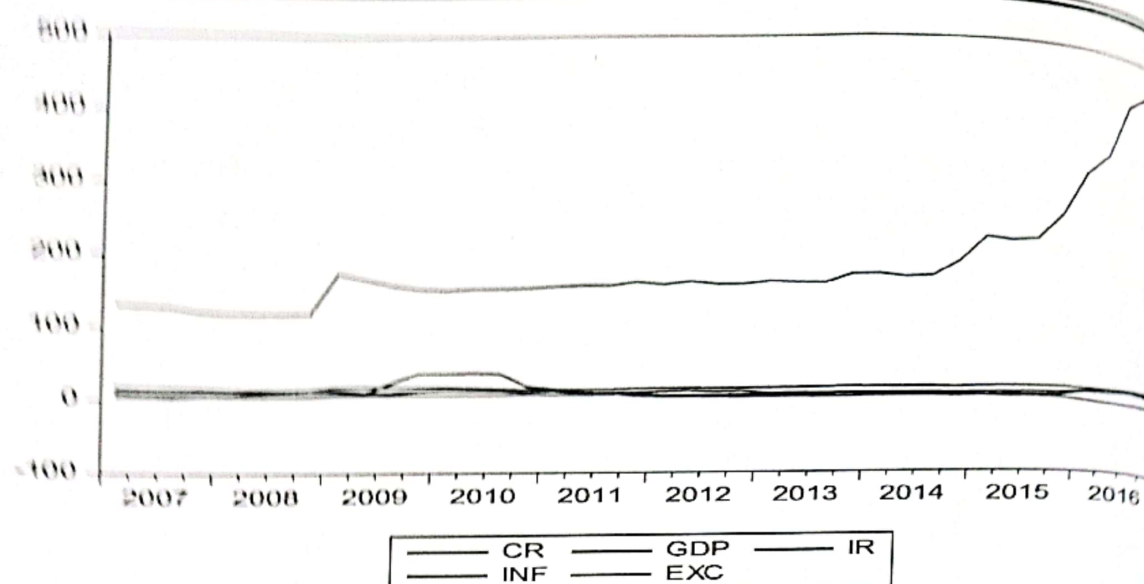


Figure 2. Graph of credit risk (CR) of Nigerian banks and GDP, INF, IR and EXC.

Figures 1 and 2 show consistent relationship between the credit risk of Nigerian banks and the macroeconomic environment determined by economic growth rate, inflation and interest rates. Figure 1 also shows a high volatility in the foreign exchange rate.

From Figure 2 however, credit risk of Nigeria banks experienced great shock from the macroeconomic environment during the periods of 2009-2010 and 2015-2016. For example, the increase of foreign exchange rate from N119: USD1.00 in the fourth quarter of 2008 to N173.32: USD1.00 and continued to N154.58: USD1.00 in the last quarter of 2010, significantly led to the increase in the rate of non-performing loans of Nigeria banks during the period of 2009-2010. Similarly, the economic downturn as reflected by the decline in the GDP growth rate from 7.4% in the last quarter of 2007 to 5.8% and 5.2% in the first and second quarters of 2008 respectively, precipitated the increase in the rates of non-performing loans of the banks from 7% in the third quarter of 2008 to 9.6% in the first quarter of 2009 and continued to 38.3% in the second quarter of 2010. Furthermore, the contraction of the economy to -0.4% in the first quarter of 2016 with upward movement in the rates of inflation, interest and foreign exchange significantly affected the non-performing loans of Nigeria banks to go up from 5.3% in the last quarter of 2015 to 14% in the last quarter of 2016.

The study contributes to the literature by further expanding the understanding of the interdependence of the macroeconomic environment and the financial system stability applying the Staple theory of economic growth. This study also makes a significant contribution by establishing the long run relationship between the credit risk of the Nigerian banks and economic growth, interest rate, inflation and exchange pressure using the robust ARDL bounds testing approach to co-integration. It also provides useful

information to bank management in formulating appropriate credit risk management policies that can minimize the vulnerability of their banks to the shocks from the macroeconomic environment. For policy and governmental authorities, the study points out the need to rigorously pursue monetary and fiscal policies to stimulate growth, combat inflation, moderate interest rate movements and ensure stability in the foreign exchange market.

The paper is organized as follow. Section two presents the theoretical underpinning and review of the literature, while section three discusses the data and methodology. Section four presents results of the analysis and findings, and section five conclude the study.

Literature review

Volatilities in macroeconomic variables usually create shock in the economic environment which often and usually precipitate banking crisis (Kaminsky & Reinhart, 1999). For example, shocks, such as asustained decline in real GDP growth, increase in foreign interest rates, high inflation could create shock within the domestic economy, impair the ability of borrowers to service their debts and thereby accentuate non-performing loans. If appropriate actions are not taken on time, it can lead to the credit crunch, increased bankruptcies and financial crisis. For example, studies abound in the literature supporting the export-led growth hypothesis (Innis, 1954; Krueger, 1961; Bhagwati, 1988; Altima, 2003; Parida & Sahoo, 2007). The credit risk of the Nigerian banks is therefore investigated from the perspective of the downturn in the Nigeria's economic activities brought about by the crisis being experienced in the nation's monolithic export (crude oil) under the Staple theory of economic growth.

The Staple theory of economic growth was pioneered by Harold Innis (1954) and further developed by Melville H. Watkins (1963) and Morris Altman (2003). The fundamental concept of the Staple theory is that staple exports are the leading sector of the economy and set the pace for economic growth. Another fundamental assumption of the Staple theory of economic growth is that in absence of staple exports, a country or region would be significantly poor in terms of per capita GDP (Altma, 2003). Altman emphasizes the fundamental importance of the linkage; staple exports have with a larger economy and therefore, the growth process of the country. The Staple theory, therefore, posits a positive causal relationship between staple exports and real per capita GDP of the country. Watkins (1963) also underscores the "Central concept" of the Staple theory which explains the importance of the linkage and the spread effects of the export sector on the domestic economy and society. The Staple theory, therefore, assumes the spread effect of export activities on the domestic economy and living standard of the people (Watkins, 1963). Therefore, the health of the banking sector depends largely on the performance of the domestic economy which is also a function of the performance of the staple export (crude oil export in Nigeria's case).

Similarly, the linkage between economic fragility and credit risk of banks is explained by Fisher (1932). Fisher argues that business cycle begins with new discovery which leads to new investment opportunities. This brings about economic growth which in turn encourages credit expansion and speculation in anticipation of higher returns. Money supply to the economy increases and this raises the general price level. Higher price level has the effect of fuelling greater optimism and reduces the real value of debt and thereby further encourages additional borrowing. The trend continues until the point of over-indebtedness is reached and the banks become reluctant to refinance performing mature credits. This creates panic in the economy, creating credit crunch, dampening investment which eventually can impair the ability of businesses to service their debts and thereby resulting in loan defaults and triggering banking crises. Shuarick and Taylor (2010) find in their study that excessive growth of credit is an important predictor of future financial instability. Shuarick and Taylor (2010) then, conclude that critical information about macroeconomic and financial stability would be missed if policymakers chose to ignore the behaviour of aggregate credit. Barras (2009) also argues that fluctuations are natural consequences of long-run economic growth which produces a dynamic in which growth and instability are inextricably intertwined. Barras further states that loan losses do not emerge suddenly, they usually have long gestation period

Saurina and Jimenez (2000) also presented some theories that explain the association of economic boom to bank crisis. Competition among banks and between banks during boom becomes intense and the margin between loans and deposits is narrowed. To compensate for reduced profitability, bank managers might increase loan growth at the expense of the future quality of their credit. Another theory that explains this phenomenon is the risk-based capital requirement (Vanden Henvel, 2002). The theory predicts that during the boom periods, when banks show strong balance sheets and capital buffer, they tend to over-lend. It would then get to a point when the loan portfolio has eroded much of the capital buffer; at that point, a monetary shock may trigger a decline in banks' profit, tight capital ratio and tightening of credit policy. Bank losses during the downturn preceded by a period of excessive credit growth are usually very large and such losses can destabilize the banking sector which in turn can further exacerbate a crisis in the real economy (BCBS, 2010).

Gavin and Hausmann (1996) argue that macroeconomic developments contribute to financial crises in many ways. According to Gavin and Hausmann (1996), "lending booms tend to take place during periods of economic expansion, when borrowers are transiently very profitable and, therefore, liquid" (p. 14). The study concludes that during the boom period, loan problems are not visible, but an adverse macroeconomic shock will impair the ability of borrowers to meet their financial commitments to the banks leading to loan defaults. Loan defaults, on the other hand, create nonperforming loans and heighten the credit risk for the banks. Gavin and Hausmann (1996) further argue that in most of the major banking crises, macroeconomic shocks have always been among the factors.

In a study conducted to investigate macroeconomic and bank-specific determinants of the nonperforming loan in Greece, Louzis, Vouldis and Metaxas (2012) argue that economic boom is usually characterized by low non-performing loans, because firms and households generate sufficient revenues and income to service their debts. As the boom continues they argue, banks extend credit to low-quality and high risk debtors, and when a recession sets in, the non-performing loans increase. The study by Jimenez and Saurina (2006) also concludes that banks' lending mistakes are more pervasive during good times than in the midst of recession, whereas, during recession, when banks are flooded with non performing loans, high specific provisions and tighter capital buffer, banks suddenly become conservative and adopt very stringent credit policies, mistakes become much lower.

It is observed from the literature that empirical studies on the causes of non-performing loans in Nigerian banks remain very scanty. Among the few studies on the non-performing loans of the Nigerian banks, is Akinlo and Emmanuel (2014) which examine the factors that determine the non-performing loans in Nigerian banks. Their study employs Johansen Juselius cointegration method using annual data of a number of macroeconomic variables over the period 1981-2011. Their study concludes that increase in real GDP tends to reduce the rate of non-performing loans. The study also finds that exchange rate, credit to private sector and lending rate tend to increase non-performing loans in Nigerian banks.

Agu and Okoli (2013) investigate the causes of non-performing loans in Nigerian banks. The authors employ a VAR method on quarterly time series data for the period 1993-2011. Findings from the study suggest that interest rate is the major factor that causes non-performing loans in Nigerian banks.

In view of the prevailing economic downturn in Nigeria, the present study has further expanded the scope of literature by empirically investigating the effects of the current economic crisis on the credit risk of the Nigerian banks. This study employs a current macroeconomic time series data (2007-2016) on a quarterly basis. Unlike the previous studies in the area of the credit risk of the Nigerian banks, the present study employs a more robust ARDL approach to cointegration introduced by Pesaran and Shin (1998) and Pesaran et al. (2001) and the Modified Wald (MWALD) causality test introduced by Toda and Yamamoto (1995).

Methodology

This study employs time series macroeconomic variables for the period 2007-2016. The data are employed are quarterly data set. The macroeconomic variables are GDP growth rate, the prime lending rate used to represent interest rate, inflation and nominal exchange rate. The variables are regressed on credit risk of the banks. Credit risk as the dependent variable is measured in this study as the proportion of the total non-performing loans to the total loans of the Nigerian banks. The data were collected from the CBN's (Central Bank of Nigeria) Quarterly Economic Reports.

Unit root tests

Unit root tests are conducted to ensure that none of the variables is I(2) and above. Though unit root tests are not requirements for the bound testing it is, however, necessary to clarify that no variable with a second order integration I(2) is included in the model. The inclusion of an I(2) variable in the ARDL model will produce meaningless results (Abu, 2017; Raji, et al., 2014; Shahbaz, et al., 2011; Solarin, et al., 2011). This study has employed Augmented Dickey-Fuller (ADF) test and compared it with the Phillips-Perron (PP) test to ensure the robustness of the data used.

The Model

This study uses the Autoregressive Distributed Lag (ARDL) approach to cointegration otherwise called bounds testing method. ARDL is an efficient method commonly used to investigate cointegration. ARDL is therefore used in this study to examine the existence of the long-run relationship between the credit risk of Nigerian banks and the selected macroeconomic variables namely, real GDP growth, interest rate, inflation and exchange rate.

The analytical model for the study is given as:

$$CR_t = \alpha_0 + \alpha_1 GDP_t + \alpha_2 IR_t + \alpha_3 INF_t + \alpha_4 EXC_t + \epsilon_t \dots \dots \dots (1)$$

CR represents the credit risk of the banks which is defined as the ratio of the total non-performing loans over the total loans while the GDP indicates the growth rate of the GDP. IR represents interest rate. Prime lending rates have been used as a proxy for interest lending rates. INF is the head on inflation rate, while EXC stands for the exchange of the domestic currency against the US dollar. The rate of exchange used in this study is the Bureau de Change (BDC) rates. This is because the Bureau de Change rates became the reference rates for the foreign exchange market for the most part of the study period.

The general ARDL model is also given as:

$$Y_t = \mu + \sum_{i=1}^p \alpha_i Y_{t-i} + \sum_{i=0}^p \beta_i X_{t-i} + \epsilon_t \dots \dots \dots (2)$$

Therefore, the parameterized equation (2) is given as:

$$\begin{aligned} \Delta CR_t = & \alpha_0 + \sum_{i=1}^p \alpha_1 \Delta CR_{t-i} + \sum_{i=0}^p \alpha_2 \Delta GDP_{t-i} + \sum_{i=0}^p \alpha_3 \Delta IR_{t-i} + \sum_{i=0}^p \alpha_4 \Delta INF_{t-i} \\ & + \sum_{i=0}^p \alpha_5 \Delta EXC_{t-i} + \beta_1 CR_{t-1} + \beta_2 GDP_{t-1} + \beta_3 IR_{t-1} + \beta_4 INF_{t-1} \\ & + \beta_5 EXC_{t-1} + \varepsilon_{1t} \dots \dots \dots (3) \end{aligned}$$

$\alpha_0, \alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ and $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are Parameters. Δ stands for the first difference operator while ε_{1t} is the error term.

ARDL bound testing calculates F-test to determine the joint cointegration of the dependent variable on one period lagged level of the explanatory variables (Narayan, 2005). The Null hypothesis is ($H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$). There are two critical values for the bounds testing, the lower bound which is appropriate when all the series are $I(0)$ and the upper bound critical values when all the series are $I(1)$, thereby giving the range of all possible classifications of the series into $I(0)$ and $I(1)$ (Pesaran et al., 2001). The calculated F-Statistic is compared with lower and upper critical values. The null hypothesis of no cointegration would be rejected if the calculated F-Statistic is greater than the upper bound critical values. However, if the calculated F-Statistic is less than the lower bound critical values, the hypothesis of no cointegration cannot be rejected. This means that there is no long-run relationship between the variables. If on the other hand, the calculated F-Statistic falls between the lower and upper bound critical values the result would be inconclusive.

Unlike other traditional approaches to cointegration, such as Engle-Granger (1987) test and Johansen and Juselius (1990) method, ARDL bounds testing approach is particularly suitable for the series that are a mixture of $I(0)$ and $I(1)$. ARDL bounds testing approach can be very efficient for small samples and widely used by researchers (Farhani, et al., 2014; Wolde-Rufael, 2005). It also has an advantage over the traditional approaches to cointegration by making a selection of different optimum lags possible to be assigned to the variables of the model (Raji, et al., 2014). Furthermore, ARDL presents another advantage over the conventional cointegration techniques by using reduced form equation to simultaneously estimate the long run and short run parameters as against the conventional cointegration techniques that use system equations to estimate long-term relationships (Abu, 2017).

According to Yamada (1998), the basic idea of Toda-Yamamoto approach to causality test is to artificially augment the correct VAR order k by the maximal order of integration, $d_{\max}$. Once, this is done, a $(k + d_{\max})$ th order of VAR is estimated. Therefore, the appropriate lag length k for the VAR model is selected using the Lag Length Criteria.

Empirical results

Results of the unit root tests are presented in Table 1 and Table 2. Though, to present variables for unit root is not a requirement in bounds testing approach, it is however desirable to ensure that none of the variables is I(2) and above. (Ahu, 2017; Kaly, 2014; Shahbaz, et al., 2011; Solarin, et al., 2011).

Table 1: Unit root tests (ADF and PP Statistics) in levels

Variable	Model type	ADF Statistics	Critical Value	PP Statistics	Critical Value
CR	Constant	-2.198245	-2.941145	-1.904652	-2.941145
GDPG	Constant	0.340857	-2.938987	0.371407	-2.938987
IR	Constant	-4.24865***	-2.945842	-2.729909	-2.938987
INF	Constant	-1.351580	-2.938987	-1.351580	-2.938987
EXC	Constant	4.285226***	-2.938987	5.282655***	-2.938987

Note: Critical value is at 5%. *** indicate CV at 1% level of significance.

The Bounds testing results are presented in Table 3. The Table presents the results obtained for the F-statistics computed and the critical values provided in Pesaran et al. (2001). The results indicate joint cointegration of economic growth (GDP), interest rate (IR), inflation (INF) and exchange rate (EXC) with the credit risk (CR) of the Nigerian banks. This implies that these variables jointly have an along-run relationship with non-performing loans of the Nigerian banks.

Table 2: Unit root tests (ADF and PP Statistics) in first differences.

Variable	Model type	ADF Statistics	Critical Value	PP Statistics	Critical Value
CR	Constant	-3.980912***	-2.941145	-	-2.941145
GDP	Constant	-6.332842***	-3.533083	-	-2.941145
IR	Constant	-	-	-	-2.941145
INF	Constant	-5.341397***	-2.941145	-	-2.941145
EXC	Constant	-3.848715*	-2.941145	-	-2.941145

Note: Critical value is at 5%. *, ** and *** indicate CV at 10%, 5% and 1% level of significance respectively.

In Table 3, when CR is the dependent variable; the bound testing result shows the F-Statistic to be 12.875 which is greater than 5.06, the upper critical value at 1% significance level.

Table 3: The Bounds testing result

F-Statistics	Bounds		Bounds		Bounds	
	critical Value		critical Value		critical Value	
	@ 10%		@ 5%		@ 1%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	2.45	3.52	2.86	4.01	3.74	5.06

$$F_{CR}(CR|GDP,IR,INF,EXC)=12.875***$$

$$F_{GDP}(GDP|CR,IR,INF,EXC)=4.168**$$

$$F_{IR}(IR|CR,GDP,INF,EXC)=4.847**$$

$$F_{INF}(INF|CR,GDP,IR,EXC)=4.572**$$

$$F_{EXC}(EXC|CR,GDP,IR,INF)=6.210**$$

Note: *** represent 1% significance levels.

The long-run coefficients

The influence of the individual variable on the credit risk of the Nigerian banks is indicated by the significance level indicated by the p-value of the variables and the direction of the relationship is shown by the signs of their long-run coefficients. Table 4 shows the long-run coefficients and their significance levels.

Table 4: Long-run coefficients - Dependent variable is CR

GDP	-1.750190 (1.332610) [-1.313355]
IR	12.781990*** (2.454839) [5.206855]
INF	1.494343*** (0.466488) [3.203389]
EXC	-0.092724* (0.047904) [-1.935638]
C	-192.970726*** (32.303661) [-5.973649]

Note: *,** and *** represent 10%, 5% and 1% levels of significance. Parenthesis () represents std error while the bracket [] represents t-statistic.

The results reported in Table 4 shows that interest rate has positive coefficient and significantly related to the credit risk of the banks at 1% level. The implication of this that interest rate is found to be a major determinant of loan defaults in the Nigerian banking system during the period. This result shows that increase (decrease) in interest rate raises (lower) the incidence of non-performing loans in the Nigerian banks. This suggests that with the steady rise in interest rates consequent upon the prevailing galloping inflation, in the country, it should be expected that non-performing loans of the Nigerian banks will be on the increase. The finding of the study of a positive and significant relationship between the credit risk of the Nigerian banks and interest rate confirms the findings of earlier studies (see Akinlo & Emmanuel, 2014; Demirguc-Kunt & Detragiache, 1998; Gavin & Hausmann, 1998).

Similarly, the long-run coefficient of inflation has the expected positive sign and also significant. The result shows that inflation has a direct relationship with the credit risk of the Nigerian banks. It implies that increase in the rate of inflation with the corresponding increase in interest tends to increase the debt burden of borrowers which could suggest the incidence of the credit risk of the banks going up. This result supports the finding of Demirguc-Kunt and Detragiache (1998) of a positive and significant relationship between credit risk of banks and inflation.

The long-run coefficient of the foreign exchange rate shows a negative sign and significant. The implication of this is that the exchange rate of the local currency to the US dollar has an inverse relationship with the credit risk of the banks. If the nominal exchange rate of a country's domestic currency rises against other currencies, it means that in real term, the value of the domestic currency has depreciated. The impact on the economy particularly the banking sector depends on the structure of the economy or the business of the majority of the bank borrowers. The impact of the changes in the exchange rate of the domestic currency vis-à-vis other international currencies particularly the US Dollars would depend on whether the economy is a net exporter or importer of goods and services. A country in which large proportion of her industries are export-oriented stand to benefit more if the nominal exchange rate of the domestic currency rises. This implies the price of the local exports become relatively cheaper for the foreign importers of such goods. This all things being equal, leads to increase exports and foreign earnings by the country. The ability of firms to service their loans would be buoyed. The ultimate impact is to reduce the credit risk of the banks. This explains the inverse relationship between credit risk of the banks and the exchange rate. The reverse is also true if the exchange rate goes down indicating exchange rate appreciation. This result supports the findings of Kaminsky and Reinhart (1999). A critical look at the Nigeria economy shows a heavy reliance on one major export, crude oil. The relatively long period of high prices of crude oil in the international oil market before its crash in 2015-2016 could explain the inverse relationship between the credit risk of the banks and the foreign exchange volatility. It is also instructive to note that economic activities in Nigeria depend largely on government spending. This means that whatever happens in the banking sector depend largely on government earnings from crude oil exports. The non-significance of the p-value of the

economic growth could be due to the long period of growth of the economy and the short period of the economic contraction contained within the study period. The impact of the contraction may take some time before its full effects are observable on the credit risk of the banking system

Diagnostic tests

The fitness and the stability of the model specification are determined by the diagnostic tests using Breusch-Godfrey serial correlation LM tests and ARCH for heteroscedasticity test. The results are presented in Table 5. The result shows that the models are free from the problems of serial correlation and heteroscedasticity.

Table 5: Diagnostic tests

Test statistic	LM test
Serial correlation	CHSQ(1) 0.4221 [0.4850]
Heteroscedasticity	CHSQ(1) 0.8859 [0.8897]

The P-values are presented in parenthesis []

The stability of the model is confirmed by the results of the Recursive estimates showing CUSUM test in Figure 1 and CUSUM of Squares in Figure 2. The results show that the model is stable.

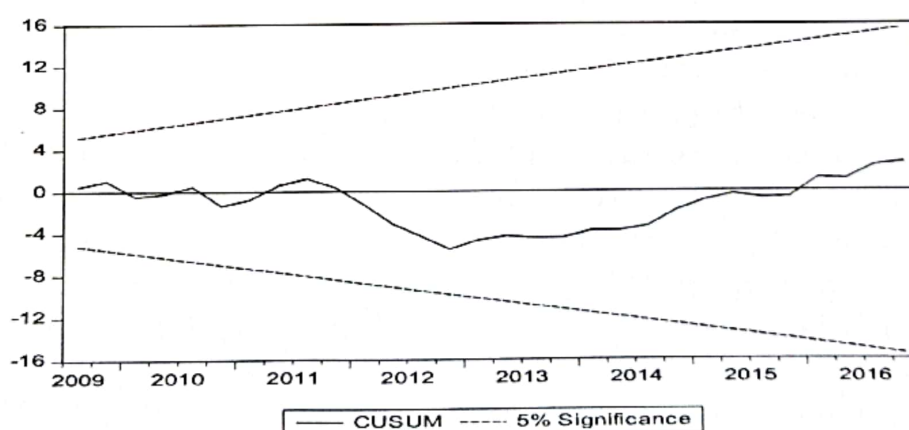


Figure 3: CUSUM tests

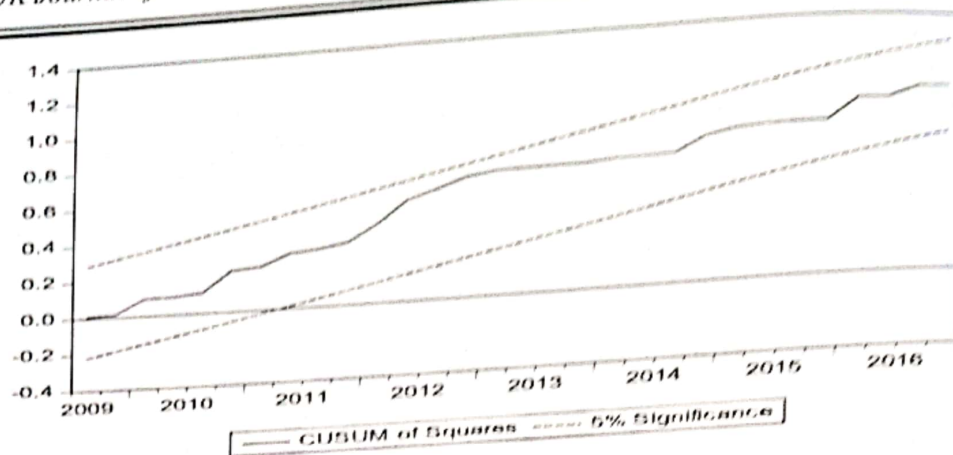


Figure 4: CUSUM of Squares

In order to conduct Toda-Yamamoto causality test, the order of integration (d_{max}) of the series was determined as $d=1$. The optimal lag 5 was also determined by the agreement of three of the lag length selection criteria, AIC (Akaike Information Criterion), HQ (Hanna Quinn) and FPE (Final Prediction Error) information criteria. With the appropriate optimum lag and order of integration determined, a VAR model was estimated with $(k+d_{max})$. The results of the tests presented in Table 6 shows the directions of the causality between the variables. The results indicate bi-directional causality from the credit risk of the banks to the interest rate as well as from interest rate to credit risk. This implies that the credit risk in Nigerian banks has been caused by high-interest regimes. On the other hand, this suggests that the high-interest rates in the country also result from high credit risk environment. The results show further that, there is a unidirectional causality running from both inflation and exchange rate to the credit risk of the banks. Bi-directional causality is also observed between interest rate and inflation. However, the result shows a unidirectional causality running from economic growth and exchange rate to interest rate. These suggest that as interest rate exact pressure on the credit risk of the banks, credit risk, economic conditions, inflationary trend and exchange fluctuation have all been the causes of the rising interest rate regime in the country. The results of the causality tests affirm the staple theory of export-led growth in an economy. The crisis in the crude oil export induced contraction of the economy. This Granger causes an increase in interest rate and then inflation. These macroeconomic variables, interest rate, inflation and exchange rate, on the other hand, put pressure on the ability of borrowers to service their debts and thereby precipitating rising non-performing loans, which subsequently created a high level of credit risk in the banking sector.

Table 6: Granger non-causality tests

Variable	CR	GDPG	LR	INF	EXC
CR	-	4.165	21.010***	6.153	0.534
GDPG	5.932	-	36.937***	9.776**	1.197
IR	25.603***	1.663	-	16.296***	2.953
INF	7.738*	4.831	33.821***	-	1.385
EXC	22.933***	2.846	39.981***	8.772*	-

Note: *, ** and *** represent significance level at 10%, 5% and 1% respectively.

Conclusion and recommendations

This paper investigates the existence of the long-run relationship between credit risk of the Nigerian banks and the downturn in the Nigerian economy which is characterized by the contraction of the real GDP growth, high interest, inflation and domestic currency exchange rates. This study employs an ARDL bounds testing approach to cointegration to investigate the long-run relationship between these variables. The study also conducted causality test using the Toda-Yamamoto procedure to determine the direction of the causality among these variables. This study concludes from the results of the tests conducted that GDP growth rate, interest rate, inflation and exchange rates are the main determinants of the credit risk of the Nigerian banks. Most importantly the study finds the greater causal power of interest rate, inflation and exchange rate over the credit risk of the banks. The decline in the government revenue accompanied by a persistent rise in interest rate and inflation no doubt, have serious implications for the quality of the banks' risk assets and the financial system stability. Similarly, in order to mitigate another round of banking crisis and therefore a financial system instability in the country, the government and the monetary authority should therefore, work to harmonize the government's fiscal policies and the monetary policies with a view to reducing the interest rate, inflation and exchange rates to reduce the negative impacts of volatile macroeconomic environment on the risk assets of the banking sector.

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