ABSTRACT

This paper investigated the extent, to which monetary policy influences the possibility of bank distress in Nigeria, and whether monetary policy adjustments have complimentary short- and long-run effects on banking industry stability, using time series data from 1989 to 2018. The study employed the Z-Score to measure the probability of banking system distress, hence, overall stability of the banking system, with the inclusion of institutional and macroeconomic indicators, as control variables. Findings from the study showed that, MPR, a measure of monetary policy, had mixed results: it was negative and significant in the long run (inter-temporal OLS) model, suggesting that, raising policy rate reduces the likelihood of banking system distress. However, MPR coefficient was positive and significant in the short run (ECM) differenced equation, which suggests that, a higher regime of MPR beyond a threshold distorts banking system stability due to elevated risk-taking behaviours of economic agents that may cause higher NPLs accumulation. The extent of economic openness showed mixed results, suggesting that openness to external environment can be a blessing or curse. In this regard, the study recommends the need for monetary authorities to develop effective framework for the conduct of monetary policy in Nigeria to support the banking system development, as well as for policy makers to urgently undertake economic and institutional reforms to generate a non-declining contribution of monetary policy instruments to the development of an inclusive financial system in Nigeria.

Keywords: Monetary policy, bank distress, z-score, economic openness, financial system

JEL Classification: E44, E52, G21,

1.0 INTRODUCTION

Monetary policy stance have potential impacts on the perception or tolerance of banks toward risks that can invariably weaken the stability of financial systems (Borio and Zhu, 2008; Wu, Jeon, Chen, and Wang 2015). Researchers like Bernanke, Gertler and Gilchrist (1996); Smith, (2002); Mohan (2009); Maddaloni and Peydro, (2011) traced the genesis of the 2007/2008 global financial crisis to the excessively loose monetary policy during the 2002-04 period in the United States (US). The prominence of low interest rates encouraged the search for higher yields, and consequently, created large global imbalances, amidst periods of lax lending standards, excessive leverage and under-pricing.
of risk, led to a crisis that quickly spread to global financial markets. This occurrence emphasized the linkage between monetary policy stance and risk taking by economic agents, especially players in the financial markets. The aftermath of the crisis led to collapse of some prominent banks in the US and severe write-down in book value of top banks across Europe. Following from the crisis, there has been a tremendous effort devoted to researches and analysis of the monetary policy and risk taking nexus in global economies, including researchers in developing nations.

The impact of monetary policy on economic phenomena is often felt through the wealth-effects transmission mechanism. An expansionary monetary policy, for example, causes a rise in asset prices, thereby prompting a rise in consumers’ financial wealth (De Nicolò, Dell’Ariccia, Laeven, and Valencia, 2010). Consequently, this increases the lifetime resources of consumers, and thus, spurs their consumption. With this, it is obvious that, either easing or tightening of monetary policy stance, can induce greater risk taking by banks through a search for yield or its effects on leveraging or asset prices, which may increase the probability of bank distress and the collapse of the overall banking system.

The risk-taking transmission mechanism of monetary policy denotes the effect of monetary policy rate dynamics on risk perceptions or risk-tolerance (Borio and Zhu, 2008). Stiglitz and Greenwald (2003), Rajan (2005), Dell Ariccia and Marquez (2006), Diamond and Rajan (2006) and Adrian and Shin (2008) hypothesized that expansionary monetary policy has the tendency to influence higher risk-taking behaviour for banks. Accordingly, prolonged low levels of interest rates could lead to higher riskiness of portfolios and mis-pricing of assets in the extension of credits/project funding (Borio and Zhu, 2008; Adrian and Shin, 2008). Consequently, low interest rates might play an important role in influencing the risk-taking behaviour of financial intermediaries.

On the other hand, Kane (1989); Hellman et al. (2000); and Smith (2002) argued that contractionary monetary policy also provides incentives for banks to take higher risk. Accordingly, contractionary monetary policy stance spurs the attractiveness of risky assets due to higher opportunity cost of holding cash buffers. In line, Huey and Li, (2016), further stressed that higher interest rates shrinks the net worth of banks prompting them to ‘gamble for resurrections’ that can ultimately cause failure of financial institutions.

The role that institutions and good governance play in stimulating economic growth has been established in both economic and political literature (North, 1990; Murphy, et al., 1993; Mauro, 1995; Fosu, et al., 2006). Institutional factors, like enforcement of property rights, corruption, adherence to rule of law, extent of voice and accountability, effectiveness of government, regulatory quality, political stability and absence of violence/terrorism have been found to constitute drag on economic growth path, and by extension, explain the probability of default of a country's banking system.

While the literature is a budding one, the recent experience from global financial crisis has helped to intensify empirical studies on the monetary policy-banks’ risk and distress
nexus. However, while many scholarship contentions have been ongoing as well as theoretical appeal on this connection, the direct link from monetary policy to bank risk taking, and consequent banking system distress, is yet to be fully established in Nigeria. In view of the above, this paper focuses on the banking system distress in response to monetary policy conditions of Nigeria, with macroeconomic and institutional factors as control variables. Specifically, this study examines the impact of monetary policy stance on banks’ risks in Nigeria. Specifically, the study sets out to empirically analyse how monetary policy influence overall banking system default in Nigeria and investigates the nexus among banking system distress, macroeconomic and institutional factors.

The finding of this study is thus expected to lend support to the existing responsibilities of banking regulators and supervisors in the realm of macro-prudential supervision. The study is also expected to provide evidences upon which bank regulators could formulate policies on bank supervision and their risk taking in a bid to stem the tides of banking system distress.

The rest of this study is ordered as follows. Section two presents stylised facts on banking industry, as well as the review of relevant theoretical and empirical issues on monetary policy and banks’ risk-taking nexus. Section three describes the methodology which comprises the key features of the dataset, theoretical framework and model specification, while Section four discusses results of the empirical analysis, as well as policy implications, and section five concludes the paper.

2.0 STYLISED FACTS ON BANKING INDUSTRY
2.1 Overview of the Nigerian Banking Industry

Globally, financial systems perform vital roles in the economic development and growth. The effectiveness and efficiency in the discharge of these functions, particularly, the financial intermediating role between the deficit and surplus unit of the economy is largely dependent on the level of the financial system development. It is to ensure its soundness that the sector appears to be the most regulated and controlled by the government and its agencies.

The average Capital to Total Risk-Weighted Asset Ratio (CAR) of 15.26% in 2018, indicates that the overall DMBs has barely achieved the minimum regulatory capital set for internationally active banks, and well above the 10% threshold for National banks. The CAR stood at 14.78% and 10.23% in 2016 and 2017, respectively. Though, Basel III stipulates that a tier 1 and tier 2 capital of a bank must be at least 8% of its Risk-Weighted Assets. The recapitalisation requirement continues to be high at ₦704.88 billion as at end-2018, compared to ₦1.57trillion required in 2017. The pressure points for the above outcome stem from deteriorating Asset Quality of DMBs due to rising NPL/Total Loan Ratio that astronomically increased from 4.88% in 2015 to 12.8%, 14.84% and 11.7% in 2016, 2017 and 2018, respectively, which remain well above the regulatory NPL threshold of 5%. The NPL/Total Loan Ratio remains high for MFBs at 13% in 2017 to
11.20% in 2018, which is remarkably above the regulatory threshold of 5%, although the liquidity ratio of DMBs, MFBs and PMBs remain highly satisfactory. However, ROA and ROE for MFBs recorded decline in growth rate from 4.50% and 18.90% to 4.22% and 18.19% in 2017 and 2018, respectively. This will undermine the continued stability of MFBs.

This growth in the NPL figure remains a pressure point for the stability of the domestic banking system. The rising NPL level, coupled with the increases in successful fraud cases in the financial system, continue to elicit increases in loan loss provisioning, on the back of huge exposure to oil and gas subsector as crude oil prices moderated to low levels at the international oil market, and with the entrenchment of unyielding macroeconomic distortions, the probability of banking system default is relatively high and ever material in scope.

2.2 Trend Analysis
The trend of the MPR and banking industry z-score from 1995 to 2018 is shown in Figure 1. A cursory look at the chart indicates an inverse relationship between the two variables for almost the entire period from 1995 to 2018. A further analysis shows that there is a positive correlation between MPR and the z-score between 1996 and 2004, implying that the probability of default of the country’s banking system increases with MPR during the period. An intuitive explanation to this is that as MPR increases, the rate of lending increases and thus raises the default probability by the borrowers. However, there is a negative correlation between MPR and banking industry z-score from 2005 to 2018. At the onset of this period, low MPR tempted banks to engage in risky businesses to boost their interest income. Thus, banks engaged in risky businesses, for example, by giving out merging loans to customers to buy shares, giving huge credit facilities to oil and gas businesses, among others.

Figure 1: Monetary Policy Rate and Banking Industry Z-Score

| Both MPR and Bank Z-Score have positive correlation coefficient of 0.30 |
| Both MPR and Bank Z-Score have a correlation coefficient of -0.61 |
| Both MPR and Bank Z-Score have slightly positive correlation coefficient of -0.19 |
The adverse effect of the non-performing loans on the overall banking industry probability of default is evident in Figure 2. Both the NPL and z-score moved in the same direction from 2010 to 2015, showing a proportional effect of non-performing loan on the likelihood of default risk in the banking industry. However, beyond year 2015, there is more than proportionate effect of the non-performing loans on the banking industry default probability. This is further supported by the upsurge in the proportion of non-performing loan in the total banking credit from 4.87 percent in 2015 to 12.8 percent in 2016 and further to 14.84 percent and 11.7 percent in 2017 and 2018, respectively. This is a serious concern for the banking system stability since z-score could serve as a proxy for it.

Figure 2: Non-Performing Loans and Banking Industry Z-Score

Source: Graphed by Authors but underlying data obtained from IMF
The effect of the non-performing loans is further seen in the value of the return on asset (ROA) in the banking industry. Figure 3 shows that there is an inverse relationship between NPL and ROA. While it is evident that the major assets of the banking industry are loans, the higher value of the NPL has further reduced the returns on those assets over time. For instance, the ROA dropped from 3.91% in 2010 to 0.48% in 2017, while NPL worsened from N1.1 trillion to N2.36 trillion over the same period.

**Figure 3: Non-Performing Loans and Banking Industry Z-Score**

As expected, there is an inverse relationship between non-performing loans and profit before tax in the banking industry. For instance, profit before tax dropped from N607 billion in 2010 to N150 billion in 2017 in the face of increasing non-performing loans in the industry.

**Figure 4: Industry Plot of Non-Performing Loans and Profit Before Tax**
The banking industry vulnerability to the shock in NPLs rise is further reflected in the capital to risk asset ratio as the inverse relationship between the two banking metrics is evident in Figure 4. A rise in NPL increases the loan provisioning by banks and hence erodes the banks’ capital.

Figure 5: Non-Performing Loans and Capital Adequacy Ratio in the Banking Industry
2.3 Monetary Policy and Banks’ Risk-Taking Nexus: Theoretical and Empirical Evidence

In the literature, it is mostly believed that there is a negative relationship between monetary policy rate and risk-taking tendency of banks (Dell’Ariccia and Marquez, 2006; Delis and Kouretas, 2011). It has been suggested that expansionary policy encourages the risk taking ability of banks. This is supported historically since the most severe financial crisis, the Great Depression, took place during a sustained period of exceptionally easing monetary conditions (Nicolo, et al., 2010).

There are different ways in which monetary policy influence banks’ risk. One of the ways is through “search for yield” (Rajan, 2005; Nicolo, et al., 2010). A fall in the expected returns of interest rate risk may induce the taking of a higher interest rate risk. They may increase their exposure to risk through engagement in risky investments in pursuit of higher profits (Weistroffer, 2013; Genay and Podjasek, 2014). In the short run, banks may benefit from lower provisioning for loan loss due to reduced likelihood of default on outstanding loans arising from low interest rates for lenders. In the medium term, banks could lower their lending standard procedures due to low interest rates thereby deteriorating the loan portfolio quality, and thus raising credit risk. However, Bikker and Vervliet (2017) found that no clear evidence is found that U.S. banks increase their risk exposure in a search for yield. In another view, financial institutions with long-term commitments (such as insurance companies and pension funds) need to match the yield they promised on their liabilities with what they obtain on their assets (Rajan, 2005; Nicolo, et al., 2010). Optimal decisions are taken by banks based on the diverse microeconomic problems they are faced with, which relates mostly to informational asymmetry, as well as the macroeconomic and regulatory environment (Delis and Karavias, 2014). During the period of high interest rates, they can boost their revenue base by investing in riskless assets. When interest rates are low, these institutions are constrained to invest in riskier assets to maintain the matching of the yield on their liabilities. However, a financial institution may renege on or review its long term commitment if it continues to invest in safe assets in the wake of prolonged period of low yield. Thus, shifting to riskier assets with higher yields may increase its chance of fulfilling its long term commitments.

Another channel is through credit risk. The low interest rate environment can exert effect on the exposure of banks to credit risk in two opposing ways. On the one hand, low interest rates might lower the probability of default on outstanding loans, and hence, lessens provisions for non-performing loans. On the other hand, lending standards of the banks might be relaxed through the reduction in the quality of loan portfolio, which leads to higher credit losses in the medium run. This was observed for Spanish and Bolivian banks by Jimenez et al. (2014) and Ioannidou, et al. (2009), respectively. Maddaloni and Peydró (2011) found that, in the case of Europe and the US, low short-term interest rates soften lending standards for both firms and households. Dell’Ariccia and Marquez (2006) found that low interest rates reduce adverse selection problems and thereby may
decrease bank screening, increasing the probability of granting loans to more risky debtors. Delis and Kouretas (2011) contributed to the existing literature by considering the period 2001-2008 and note that the lower the interest rates, the riskier the loan portfolios.

The influence of monetary policy on risk taking behaviour of banks could also be explained via moral hazard problem exhibited by economic agents, especially the banks. It is theoretically known that a typical economic agent react to information and thus the risk taking tendency of banks could be stimulated by the level of information exposure given by the monetary authority. Economic agents are expected to be more responsive and reactive to unanticipated monetary policy, thus providing more room for disruptive consequences. A higher degree of predictability of monetary authority about future decision can give a reasonable level of market certainty and thus give banks incentives to take on more risks since they are almost sure of what move the central bank will take. Consequently, agents’ perception that the monetary authority will exhibit expansionary policy during unfavourable economic outcomes could reduce the tendency of large downside risks, thereby producing insurance effect (Altunbas, 2010). Hence, Papadamou, et al, (2014) opined that a higher degree of monetary policy transparency allows monetary authority to better manage anticipations and attenuate market volatility. However, in line with earlier position, Cao and Illing (2015) suggested that the transparency of monetary policy may also enable economic agents to predict interest rates more accurately. This allows banks to redistribute budgets that were previously related to forecasting towards risk-taking activities (Delis and Kouretas, 2011).

Furthermore, monetary policy would have impact on banks’ risk-taking through its influence on the adverse selection problem. Expansionary monetary policy may reduce banks’ motivation to screen and supervise loan applicants (Dell’Ariccia and Marquez, 2006). It may also cause alteration in the projected cash flow of more risky customers and less risky ones to a disproportionate degree, causing the number of the former to be more than that of the latter in banks’ borrower pool and endangering financial stability in the long run (Blommestein, et al., 2011). However, an expansionary monetary policy may also produce conflicting effects. It may increase banks’ franchise value by raising their profits, thus easing the moral hazard problem and leading to taking less risk. A lower interest rate can also reduce the default risk of borrowers since it tends to reduce their cost of financing and increase their output.

Altunbas, et al. (2010) also identified habit formation as a channel through which monetary policy could influence banks risk taking. According to Campbell and Cochrane (1999), habit formation can justify why consumers’ reported sense of well-being often seems more linked to recent changes in consumption than to the absolute level of consumption. According to the study, investors are likely to avoid taking more risks during economic expansions since their current consumption is increased compared to absolute values. Thus, expansionary monetary policy, through increased economic activity, reduces the degree of investors’ risk aversion. This also supports the findings of Duffee,
that a negative relationship exists between variations in interest rates and credit spreads.

Monetary policy may also cause banks to adjust their leverage, thereby affecting the risk pricing as well as the degree of banks’ risk-taking (Chen et al., 2017). A fall in the interest rate of safe assets reduces the opportunity cost of holding reserves, which is a component of banks’ deposits, thus raising banks’ demand for higher leverage.

Finally, the impact of policy rates on bank risk-taking tendency can be explained through the concept of financial accelerator since a rise in the worth of collateral reduces borrowing constraints (Bernanke et al., 1996). This is basically through the impact of interest rates on banks’ asset valuations, incomes, cash flows and measured risk. A change in aggregate economic activity causes a change in economic agents’ net worth since they have positive influence on each other. As a result of asymmetric information, external finance premium has negative correlation with economic agents’ net worth (Coric, 2011). With this, the procyclical behaviour of economic agents’ net worth over business cycles implies countercyclical behaviour of the external finance premium. The negative relationship between output changes and the external finance premium thus makes borrowing more expensive during contractionary than during the expansionary phase. Therefore, a decrease in the policy rate increases the values of asset and collateral, which in turn can adjust banks’ estimates of default probabilities, loss given default and unpredictability (Altunbas, 2010).

Looking at the empirical evidence of the relationship, existing literature suggests that monetary policy has mixed effects on banks risk-taking behaviour. There are studies, though few that have examined the role of monetary policy in the risk taking behavior in Nigerian banks. For example, Gambacorta (2009); De Nicolò et al. (2010); Gaggl and Valderrama (2010); Angeloni et al. (2010); Delis and Kouretas (2011); Maddaloni and Peydró (2011) argue that banks’ risk-taking increases when the central bank reduces policy interest rates or keeps interest rate too low for too long. Conversely, the studies of De Graeve, et al. (2008) and Buch, et al. (2011) suggest that risk-taking decreases in response to the fall of monetary policy rates.

Using a proprietary micro-dataset on loan defaults, Huey and Li (2016) investigates the risk-taking channel of monetary policy via a second-stage panel fixed effects regression, but found a limited evidence of the risk-taking channel of monetary policy in Malaysia. They however attributed in part the limited evidence pre-emptive monetary policy stance and the implementation of policies from a broader toolkit in leaning against financial imbalances in Malaysia.

Jimenez et al. (2014) analysed the impact of the overnight monetary policy rate on risk-taking by banks and found that a lower overnight interest rate induces banks to engage in higher risk-taking in their lending. They also found that a lower overnight interest rate induces lowly capitalized banks to grant more unhealthy credit applications to ex ante
riskier firms than highly capitalized banks. Chen et al. (2017) also investigated the relationship between monetary policy and banks’ risk-taking employing data from roughly 1000 commercial banks doing business in emerging economies. They found that expansionary monetary policy gives banks incentives to engage in more risky business activities, which is in line with the bank risk-taking channel of monetary policy transmission.

Altunbas et al. (2010) used a comprehensive database of quarterly balance sheet information and risk measures for over 600 listed banks operating in the European Union and the United States, mainly 16 countries. The study analyses the link between unusually prolonged low interest rates and bank risk. The results suggest that low levels of short-term interest rates over an extended period of time contributed to an increase in bank risk. This is interpreted as the combination of two effects: in the short run, a rise in policy rates reduces the risk of outstanding loans; over time, the higher level of policy rates stimulate hazardous lending behavior, leading to more risk.

Abbate and Thaler (2014) built a general-equilibrium model where low levels of the risk free rates affect banks’ revenues and funding costs, thereby inducing them to extend credit to riskier borrowers. Based on their findings, a lower risk-free rate decreases the return on loans and therefore the benefits of a safe investment, conditional on repayment. Expansionary monetary policy reduces the cost of funding, and deposits, thus increasing the resources available to the bank’s owner and the incentive to adopt a safe investment strategy. Their results also suggest that a shock in the fall in the nominal risk-free interest rate causes a decrease in both banks’ loan revenues and the cost of bank funding, causing a persistent rise in bank asset risk.

Another paper, Angeloni et al. (2015) also supported the existing evidence linking monetary policy and bank riskiness through a risk taking channel: lowering policy rates raises bank riskiness especially on the funding side. Their results highlight a new channel arising from the endogenous formation of risk. The higher the investment project risk, the more likely bank runs materializes. This threatens bank funding and investment through increased volatility, and hampers output potential in the long run.

The proposition of the bank risk-taking channel of monetary policy transmission is also supported by the findings of Wu et al. (2015). Using the bank-level panel data from over 1000 banks in 33 emerging economies, they found that banks’ riskiness increases when there is expansionary monetary policy. It is also found that bank risk-taking tendency during expansionary monetary policy is prominent in small and less liquid banks, and in jurisdictions with a stronger deposit insurance scheme and a fixed exchange rate regime. Their findings also include the notion that the nexus between monetary policy and bank risk is weakened in more concentrated banking markets and when monetary policy is transparent.

Delis and Kouretas (2011) used approximately 18,000 annual observations on euro area banks and presents empirical evidence that low interest rates gives incentives to banks
to take risk more. According to the authors, the distributional effects of interest rates on bank risk-taking due to individual bank characteristics reveal that the impact of interest rates on risk assets is diminished for banks with higher equity capital and is amplified for banks with higher off-balance sheet items.

The relationship between excessive bank risk taking and monetary policy is further investigated by Agur and Demertzis (2012). They suggest that banks’ moral hazard dampens the ability to contain the build-up of risk, as it amplifies their levering activities. They conclude that the correlation between banks’ assets matters for the impact of monetary policy, which implies that regulations aimed at containing common exposures in the financial system interact with monetary transmission.

Dell’Ariccia et al. (2016) presented evidence of a risk-taking channel of monetary policy for the U.S. banking system using confidential data on banks’ internal ratings on loans to businesses. The study found that ex-ante risk taking by banks (measured by the risk rating of new loans) is negatively associated with increases in short-term interest rates. This relationship is however, more noticeable in jurisdictions that are less in sync with the nationwide business cycle and less prominent for banks with relatively low capital or during financial distress episodes.

Moreover, Jimenez, et al. (2014) explored how the relationship between the policy rate and risk taking tendency of banks changes with bank capitalization. They found that the least capitalized banks react the most to changes in the policy rate, taking less risk when monetary policy is tightened and more when it is eased. This suggests that the nexus between interest rates and bank-taking risk is likely to depend on country circumstances.

Rajan and Zingales (2003), for example, argued that financial sector reform may be an important strategy to raise the size of domestic savings channeled through the formal financial system, improve financial intermediation efficiency, as well as directly or indirectly enhance the resilience of the macroeconomic environment. To the author, financial inclusion of vast majority of previously unbanked persons through the process of reforms raises the volume of available credit that supports entrepreneurship, investment and human development.

3.0 METHODOLOGY
Theoretical literature has identified a number of channels through which monetary policy affects the overall probability of default of the banking system. For instance, Nicole, et al. (2010) and Raja, (2015) showed that monetary policy affects bank risks via the search for yield channel, while Ioannidou, et al. (2009); Maddaloni and Peydró, (2011) and Jimenez, et al. (2014) argued in support of the credit risk channel through which monetary policy affects bank risks. Chen, et al. (2010); Papadaman, et al. (2014) and Cao and Illing, (2015) provided support for moral hazards channel, Dell’Ariccia and

To measure bank-wide risk in this study, we employed the Z-Score metrics due to its vast usage in the financial sector, exciting intuitions as well as methodology of its derivation. The Z-Score was first developed by NYU Professor Edward Altman. The methodology was built for credit risk analysts and lenders to provide a more efficient financial valuation and assessment tool. Credit professionals use risk mitigation in debt portfolios and by lenders for loan extension. It adopts multiple variables to gauge the financial well-being and credit worthiness of a borrower, hence one of the reasons for its wide usage. The Z score relies on actual financial information deduced from the operating performance of the business enterprise. It evades conflicts of interest, biases of subjective assessments, as well as brand and large company bias. The Z Score does not employ any theoretical assumptions or market inputs outside of the company’s financial statements. This gives users of the Z-Score a coherent view and understanding of a company’s true financial health.

The intuition of the Z-Score has been extended to investigating the risk of default of a country's banking system, calculated as a weighted average of the z-scores of a country's individual banks (the weights are based on the individual banks' total assets). The overall degree of solvency in banking is calculated by the Z-Score. It is constructed through the return on asset ratio (ROA) augmented by the equity-to-asset ratio (EA) all divided by a measure of variability in returns, the standard deviation of ROA is often employed. The rationale is that lower capital base is usually accompanied by higher likelihood of bankruptcy. In addition, increase in returns variability also raises the probability of bankruptcy. In a cross-sectional setting, the standard approach to estimate the Z-Score for an individual bank (or a set of banks) is as follows:

In notation, Z-Score is given by:

$$ Z = \frac{EA - \mu(ROA)}{\sigma(ROA)} $$

(1)

Where: EA is the equity-to-asset ratio; $\mu(ROA)$ is the expected value of return on asset, and $\sigma(ROA)$ is the standard deviation of ROA.

Accordingly, we have Equation (1), which shows that the probability of banking system default, measured by the Z-Score is a function of the dynamics in monetary policy (MP) environment.

$$ Risk_{it} = f(Monetary\ Policy\ Variable) $$

(2)
Hence, our basic equation becomes:

\[ Risk_t = \theta_0 + \theta_1 MP_t + \epsilon_t \quad \text{----------------------------------------(3)} \]

In line, studies have demonstrated that macroeconomic factors significantly influence performance of the banking system. Therefore, unique effects of macroeconomic factors are endogenously incorporated in developing the general framework for this study.

Let \( M \) represents constellation of all possible macroeconomic factors, including extent of resource dependence, real GDP, trade openness, inflation, unemployment, private credit, which influences the dynamics of the banking system in Nigeria

\[ M_t = \varphi_i(Natres, Rgd, TOpen, inf, unempl, PriCredit) \quad \text{... ... ... ... (4)} \]

Thus, Equation (3) can be expanded by including macroeconomic variables, \( M \). The functional expression for the macroeconomic factors is presented in Equation (4).

Hence, Equation (3) is modified to become Equation (5)

\[ Risk_t = \theta_0 + \theta_1 MP_t + \sum_{i=1}^{I} \varphi_i M_t + \epsilon_t \quad \text{----------------------------------------(5)} \]

Again, the important role that institutional quality and good governance play in stimulating economic growth, and by extension probability of banking system distress, has been accepted in both economic and political literatures (see North, 1990; Hall and Jones, 1999; Acemoglu, Johnson and Robinson, 2004; Rodrik, Subramanian and Trebbi, 2004; Fosu, Bates and Hoeffler, 2006; Rodrik, 2007). Hence, Equation (5) is further modified by employing the use of institutional variables to capture governance stability cum policy environment, and this is specified as Equation (6).

\[ Risk_t = \theta_0 + \theta_1 MP_t + \sum_{i=1}^{I} \varphi_i M_t + \sum_{j=1}^{J} \omega_j Inst_t + \epsilon_t \quad \text{----------------------------------------(6)} \]

Where: \( \sum_{j=1}^{J} \omega_j Inst_t \) represents institutional variables, including voice and accountability, political stability and absence of violence/terrorism, government effectiveness, regulatory quality, rule of law and corruption (Worldwide Governance Indicators, WGI).

Therefore, Equation (6) becomes the fundamental equation for this study, which forms the underlying framework on which estimation and discussion are based.

We employed monetary policy rate as indicators to gauge the CBN’s monetary policy stance following the common practice in previous literature (Wu et al., 2015). We also included secondary school enrolment rate as proxy to capture the literacy level in Nigeria.
amongst financial experts. It measures extent of understanding of policy thrust of the monetary authorities through sensitization, moral suasion and prudential guidelines.

The study employed two variants of data models vis-à-vis; OLS (long run inter-temporal model), and using the error correction modelling framework, a short-run analysis, for robustness checks. Time series data employed for the study ranges from 1989 to 2018, and obtained from established sources, including World Bank’s World Development Indicators.

4.0 EMPIRICAL ANALYSIS
We performed analysis using the Ordinary Least Square (OLS) due to its BLUE characteristics and for the fact that, it reveals the steady-state equation among the data employed. Also, we adopted the Error Correction Modelling (ECM) approach to understand the nature of the short-run dynamics in the banking system, as it relates to the speed of adjustments in the long-run from any possible short-run upheavals. Findings from the models would be analyzed and compared with intuitive relevance from policy implication ascertained.

4.1 Descriptive statistics
Table 1 describes the variables employed in this study in terms of their statistical characteristics. The average monetary policy rate over the period under review is 13.81% and it range from 6% to 26%. Also, the official exchange rate has an average value of N117.99/US$ during the period with the minimum and maximum value of N125.81/US$ and N375.60/US$, respectively.

Table 1: Descriptive Statistics

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<th>Maximum</th>
<th>Minimum</th>
<th>Std. Dev.</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Jarque-Bera</th>
<th>Prob.</th>
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<td>3.02</td>
<td>0.21</td>
<td>0.9</td>
</tr>
<tr>
<td>OPEN</td>
<td>51.86</td>
<td>57.69</td>
<td>81.81</td>
<td>7.84</td>
<td>19.34</td>
<td>-0.78</td>
<td>2.79</td>
<td>3</td>
<td>0.22</td>
</tr>
<tr>
<td>PCGDP</td>
<td>15.11</td>
<td>13.22</td>
<td>38.35</td>
<td>8.69</td>
<td>6.61</td>
<td>2.35</td>
<td>8.21</td>
<td>59.48</td>
<td>0</td>
</tr>
<tr>
<td>UNEMP</td>
<td>4.71</td>
<td>4.4</td>
<td>8.87</td>
<td>3.7</td>
<td>1.13</td>
<td>2.39</td>
<td>8.38</td>
<td>62.68</td>
<td>0</td>
</tr>
<tr>
<td>SSE</td>
<td>37.21</td>
<td>32.17</td>
<td>72.97</td>
<td>23.54</td>
<td>15.62</td>
<td>0.95</td>
<td>2.62</td>
<td>4.57</td>
<td>0.1</td>
</tr>
<tr>
<td>RULE</td>
<td>-1.18</td>
<td>-1.15</td>
<td>-0.96</td>
<td>-1.43</td>
<td>0.13</td>
<td>-0.33</td>
<td>2</td>
<td>1.75</td>
<td>0.42</td>
</tr>
<tr>
<td>REGQ</td>
<td>-0.89</td>
<td>-0.91</td>
<td>-0.66</td>
<td>-1.35</td>
<td>0.17</td>
<td>-0.94</td>
<td>3.66</td>
<td>4.79</td>
<td>0.09</td>
</tr>
<tr>
<td>PINST</td>
<td>-1.53</td>
<td>-1.63</td>
<td>-0.59</td>
<td>-2.21</td>
<td>0.51</td>
<td>0.67</td>
<td>2.29</td>
<td>2.77</td>
<td>0.25</td>
</tr>
<tr>
<td>Z-SCORE</td>
<td>14.26</td>
<td>14.41</td>
<td>20.41</td>
<td>7.21</td>
<td>3.54</td>
<td>-0.18</td>
<td>2.8</td>
<td>0.17</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Source: Authors’ Computation.
4.2 Unit Root Test
In Figure 2, the plotted variables appear non-stationary and unit root tests are conducted on the employed variables. The results of the unit root test conducted are shown in Table 2. The test is conducted to ascertain the stationarity of the variables. Based on the two tests, Philips-Peron (P-P TEST) and Augmented Dickey-Fuller tests (ADF TEST), all the variables are integrated of order 1. This calls for the adoption of the ECM.

Table 2: Unit Root Test

<table>
<thead>
<tr>
<th>UNIT ROOT TEST</th>
<th>P-P TEST</th>
<th>ADF TEST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Z Score</td>
<td>-2.1547 I(1)</td>
<td>-3.5878 I(1)</td>
</tr>
<tr>
<td>RGDP</td>
<td>-3.0145 I (1)</td>
<td>-3.0794 I (1)</td>
</tr>
<tr>
<td>MPR</td>
<td>-3.3552 I (1)</td>
<td>-7.5106 I (1)</td>
</tr>
<tr>
<td>EXRv</td>
<td>-1.5948 I (1)</td>
<td>-1.7813 I (1)</td>
</tr>
<tr>
<td>NRR</td>
<td>-3.766 I (1)</td>
<td>-3.3243 I (1)</td>
</tr>
<tr>
<td>NSAVG</td>
<td>-3.4663 I (1)</td>
<td>-3.592 I (1)</td>
</tr>
<tr>
<td>OPEN</td>
<td>-11.8836 I (1)</td>
<td>-4.2498 I (1)</td>
</tr>
<tr>
<td>PCGDP</td>
<td>-4.4862 I (1)</td>
<td>-4.1993 I (1)</td>
</tr>
<tr>
<td>UNEMP</td>
<td>-6.5641 I (1)</td>
<td>-0.8485 I (1)</td>
</tr>
<tr>
<td>SSE</td>
<td>-5.0864 I (1)</td>
<td>-5.0858 I (1)</td>
</tr>
<tr>
<td>RULE</td>
<td>-4.847 I (1)</td>
<td>-4.5681 I (1)</td>
</tr>
<tr>
<td>REGQ</td>
<td>-6.0816 I (1)</td>
<td>-5.7844 I (1)</td>
</tr>
<tr>
<td>PINST</td>
<td>-5.9093 I (1)</td>
<td>-1.2515 I (1)</td>
</tr>
</tbody>
</table>

Source: Authors’ Computation.

4.3 Testing for Co-integration

Co-integration tests are designed to test for the existence of long-run equilibrium among variables in the model, as this is vital for the purpose of policy-making. Following the approach by Johansen and Juselius (1990) maximum likelihood test statistics, the Maximum Eigenvalue and Trace tests were utilized to determine the number of cointegrating vectors. The cointegrating test were performed allowing for the absence of linear trends. Table 3 reports the estimates of Johansen procedure and standard statistics. From the test, both tests indicate the existence of, at least, one (1) cointegrating equation at the 5% significance level.

Table 3: Johansen Co-integration Test Results

<table>
<thead>
<tr>
<th>Null Hypothesis</th>
<th>Trace-Statistic</th>
<th>Max. Eigen-statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>r = 0</td>
<td>171.9592**</td>
<td>116.6116**</td>
</tr>
<tr>
<td>r ≤ 1</td>
<td>55.34763</td>
<td>26.82412</td>
</tr>
<tr>
<td>r ≤ 2</td>
<td>28.52351</td>
<td>17.64083</td>
</tr>
<tr>
<td>r ≤ 3</td>
<td>10.88268</td>
<td>10.55002</td>
</tr>
<tr>
<td>r ≤ 4</td>
<td>0.332653</td>
<td>0.332653</td>
</tr>
</tbody>
</table>

Note: **Rejected at the 5% significance level.
4.4 Results from Empirical Models

The results from the ECM (short run) analysis and the OLS (long run) analysis are reported in Table 4.

Table 4: Results from Empirical Models
Source: Authors’ Computation

<table>
<thead>
<tr>
<th>Short-run Dynamic Model (ECM Equation)</th>
<th>Long-run Inter-temporal Model (OLS Equation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent Variable: D(Z-SCORE, Prob of default)</td>
<td>Dependent Variable: Z-SCORE, Prob of default</td>
</tr>
<tr>
<td>Method: Least Squares</td>
<td>Method: Least Squares</td>
</tr>
<tr>
<td>Included observations: 29 after adjustments</td>
<td>Included observations: 30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-0.0002</td>
<td>0.000598</td>
<td>-0.3344</td>
<td>0.7411</td>
<td>C</td>
<td>0.4588</td>
<td>0.3508</td>
<td>1.3079</td>
<td>0.2457</td>
</tr>
<tr>
<td>D(MPR)</td>
<td>0.2685</td>
<td>0.1318</td>
<td>2.0372</td>
<td>0.0254**</td>
<td>MPR</td>
<td>-4.7132</td>
<td>2.0045</td>
<td>-2.3513</td>
<td>0.0195**</td>
</tr>
<tr>
<td>D(PCGDP)</td>
<td>0.0002</td>
<td>0.0958</td>
<td>0.0021</td>
<td>0.8955</td>
<td>PCGDP</td>
<td>0.0447</td>
<td>0.0121</td>
<td>3.6942</td>
<td>0.0011***</td>
</tr>
<tr>
<td>D(NSAVG)</td>
<td>-1.2926</td>
<td>0.2916</td>
<td>-4.4328</td>
<td>0.0007***</td>
<td>NSAVG</td>
<td>-0.8975</td>
<td>0.1124</td>
<td>-7.9849</td>
<td>0.0000***</td>
</tr>
<tr>
<td>D(RGDP)</td>
<td>-0.1028</td>
<td>0.0306</td>
<td>-3.3595</td>
<td>0.0001***</td>
<td>RGDP</td>
<td>-0.1769</td>
<td>0.0289</td>
<td>-6.1211</td>
<td>0.0000***</td>
</tr>
<tr>
<td>D(NRR)</td>
<td>0.0088</td>
<td>0.2518</td>
<td>0.0349</td>
<td>0.8958</td>
<td>NRR</td>
<td>0.0104</td>
<td>0.0478</td>
<td>0.2176</td>
<td>0.4785</td>
</tr>
<tr>
<td>D(EXRv)</td>
<td>0.6533</td>
<td>0.3357</td>
<td>1.9461</td>
<td>0.0819*</td>
<td>EXRv</td>
<td>0.3801</td>
<td>0.2578</td>
<td>1.4744</td>
<td>0.1378</td>
</tr>
<tr>
<td>D(OPEN)</td>
<td>1.2232</td>
<td>0.3519</td>
<td>3.4760</td>
<td>0.0152**</td>
<td>OPEN</td>
<td>-1.5877</td>
<td>0.4578</td>
<td>-3.4681</td>
<td>0.0155**</td>
</tr>
<tr>
<td>D(UNEMP)</td>
<td>0.0794</td>
<td>0.0557</td>
<td>1.4255</td>
<td>0.1511</td>
<td>UNEMP</td>
<td>0.0943</td>
<td>0.7854</td>
<td>0.1201</td>
<td>0.4587</td>
</tr>
<tr>
<td>D(SSE)</td>
<td>-1.2575</td>
<td>0.9878</td>
<td>-1.270</td>
<td>0.4785</td>
<td>SSE</td>
<td>-1.0875</td>
<td>0.7845</td>
<td>-1.3862</td>
<td>0.3478</td>
</tr>
<tr>
<td>D(PINST)</td>
<td>1.3607</td>
<td>0.2012</td>
<td>6.7629</td>
<td>0.0000***</td>
<td>D(PINST)</td>
<td>1.8078</td>
<td>0.2492</td>
<td>7.2544</td>
<td>0.0000***</td>
</tr>
<tr>
<td>D(REGQ)</td>
<td>-0.1089</td>
<td>0.0322</td>
<td>-3.3820</td>
<td>0.0047***</td>
<td>REGQ</td>
<td>-0.2174</td>
<td>0.0722</td>
<td>-3.0111</td>
<td>0.0054***</td>
</tr>
<tr>
<td>D(RULE)</td>
<td>1.1519</td>
<td>0.7667</td>
<td>1.5024</td>
<td>0.1478</td>
<td>RULE</td>
<td>1.5147</td>
<td>0.8587</td>
<td>1.7639</td>
<td>0.0755*</td>
</tr>
<tr>
<td>ECM</td>
<td>-0.7814</td>
<td>0.2152</td>
<td>-3.6310</td>
<td>0.0005***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R-squared: 0.7969, Adj R-squared: 0.6947, F-statistic: 15.1214(0.0008), Durbin-Watson (DW) stat: 2.1293
R-squared: 0.9538, Adj R-squared: 0.9481, F-statistic: 90.2698(0.0000), Durbin-Watson (DW) stat: 1.9832

Findings are broadly similar and seemed robust to modelling techniques, although considerable differences abound in significance level of parameter estimates. The $R^2$ of 0.9538 was very good in the long run (OLS) analysis, suggesting that regressors explained 95.4 percent systematic variations in likelihood of default in the Nigerian banking system, captured by the Z-score. The F-statistics was also very impressive, passing the 1 percent significance test, while the DW statistics of 1.9832 indicates absence of first-order serial correlation. The short-run equation was relatively very impressive, with an $R^2$ of 0.7969.
Thus, the explanatory variables used in the equation explained 79.7 percent of the probability of banking system distress in Nigeria. The F-statistics of 15.1214 (with a p-value of 0.0008) easily passed the significance test at the 1 percent level. Hence, the hypothesis of a significant log-linear relationship between Overall banking system default likelihood and regressors in the equation is validated. The ECM (error correction mechanism) had a negative sign as expected (-0.7814) and with a t-statistics of -3.63 passed the significance test at the 1 percent confidence level. The speed of convergence to long-run equilibrium is remarkably high at 78.14 percent, implying that 78.14 percent disequilibrium in the previous year is corrected and converges to its long-run equilibrium path in the current year.

In terms of the individual parameter estimates, monetary policy, proxy by monetary policy rate, has mixed outcome. The coefficient of MPR was negative and significant at the 5% level in the long run inter-temporal (OLS) model, suggesting that, raising the policy rate reduces the likelihood of banking system distress. But in the short run differenced equation, MPR coefficient was however positive and significant at the 5% level, which suggests that, raising MPR beyond a certain threshold, intensifies the probability of banking system distress. The result is crucially important for monetary authorities to develop effective framework for the conduct of monetary policy in Nigeria to effectively support the financial system.

The coefficient of ratio of private credit to GDP (PCGDP) was positive in both the OLS and ECM, but was only significant in the dynamic model at the 1% level. The positive sign suggests that, increases in credit advanced to the private sector potentially can led to a banking system distress should strategic non-performing loan hold sway due to occurrence of extenuating events. The coefficient of national savings (NSAVG) was negative and highly significant at the 1% level in both the short-run differenced model and long run (OLS) equation. The result suggests that, increases in domestic savings levels reduce the probability of banking system distress in Nigeria. This finding confirms the importance of liquidity within the financial system. The coefficient capturing access to resources, proxy by real GDP (RGDP) was negative and also highly significant at the 1% level, suggesting that, increases in economic output promotes the resilience of the banking system through favourable transmission effects on output, job creation and income.

The coefficient capturing resource dependency, measured by natural resource rent, and exchange rate volatility (EXRv) coefficient are both positive and broadly not significant at known levels, except in the ECM for EXRv which was significant at the 10% level. The result confirms the effects of resource curse on banking system stability, and shows the devastating effects of exchange rate volatility on banking system resilience. The coefficient capturing the extent of economic openness (OPEN) shows mixed results: It was positive and significant at the 5% level in the ECM, while it had a negative-sign and was significant in long run steady-state model. The result shows that openness of the domestic economy to external environment is both a blessing and a curse, if it serves as...
a vent for the transmission of external vagaries into the local economy. Unemployment coefficient had a positive and non-significant effect on probability of banking system default in Nigeria during the period under study. The result shows the potential impact of unemployment on banking system resilience. Widespread loss of jobs will eventually lead to high incidences default by both individuals and firms, and hence, result in strategic non-performing loans accumulation in banks books which can subsequently degenerate to broad based banking system failure. Literacy level, proxy by SSE, had the expected negative sign but was not significant in both the short run dynamic model and long run steady state equation.

Results from variables of institutional quality reveal compelling findings. The coefficient of Political Stability and Absence of Violence/Terrorism, which measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism, was positive and highly significant at the 1% level. The result confirms the destabilizing effects of political instability on banking system resilience. From the result, 100% increase in political instability would lead to 136.1% and 180.8% probability of banking system distress in Nigeria in the ECM and OLS, respectively.

Rule of Law Coefficient, captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, had positive sign, but only significant at 10% level in the long run steady state model. The relatively weak property rights and poor contract enforcement in the country may undermine the stability of the domestic banking system. The coefficient of Regulatory Quality was negative and highly significant at the 1% level. The result suggests that, increased perception of government’s ability to formulate and implement sound policies and regulations that permit and promote private sector development, results in lower likelihood of banking system distress in Nigeria.

4.5 Stability Test: CUSUM and CUSUMsq
We investigated the stability of the parameters employed in the empirical model by employing the cumulative sum of the residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMsq) plots developed by Brown, Durbin and Evans (1975). The results are shown in figures A and B, respectively. Parameter instability exists when CUSUM and CUSUMsq deviate outside the confidence bands reflected by the two critical (dotted) lines. From the results, both CUSUM and CUSUMsq stayed within the 5% critical lines, suggesting that stability of the parameter in the period under study, and hence results obtained in this study are essentially robust for policy formulation.
5.0 CONCLUSION AND POLICY RECOMMENDATIONS

This study investigated whether monetary policy promotes banking system resilience in Nigeria using time series data from 1989 to 2018 within the error correction modeling framework. OLS technique was also used for robustness checks. The findings of the study show the importance of monetary policy as a very vital variable in explaining the probability of banking system default in Nigeria. The coefficient of monetary policy had mixed outcome, possessing the tendency to both curb banking system distress on the long run, but results in higher probability of banking system default on the short run, suggesting possibility that policy changes may distort economic agents’ expectation and behaviour. The effects of macroeconomic environment were also aptly observed.

From the results, growth in national savings, economic activities (RGDP), openness in the long run equation and regulatory quality curb the spate of banking system failure in Nigeria, while growth in private credit, exchange rate volatility, political instability and non-adherence to the rule of law heightens the risk of domestic banking system distress in Nigeria. Unemployment variable had a positive non-significant effect in the model, suggesting that, widespread loss of jobs by both individuals and firms may increase accumulation of NPL which erodes banking sector capital, thus increasing the risk of a system-wide banking distress.

From empirical findings, this study recommends that, changes in the monetary policy rates should be conducted through well researched framework, so that monetary policy administration would encourage the resilience of banking system. The country’s economic managers and policy makers should provide a favourable business environment devoid of growth-drags in a bid to preserve economic agents’ preferences within acceptable institutional requirements. Policy makers should avoid proffering ideas that causes
distortions in the macroeconomic aggregates in order to remove factors that cause internal and external imbalance in banks books. In all, the institutional quality should be enhanced to include effective adherence to rule of law, while ensuring the promotion of transparency in the conduct of regulation so as to safeguard the practice of financial intermediation to attain banking system resilience in Nigeria.

REFERENCES


