Demand Deposit Contracts and Probability of Bank Runs in Nigeria

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Abstract: - The problem of bank runs is a global phenomenon and often damaging to the banking systems both in developed and developing countries. Monetary authorities always find it very difficult to resolve such a crisis; hence, it became imperative to examine this scenario in the case of Nigeria. Therefore, we examined the effect of demand deposit contracts on the probability of bank runs in Nigeria. This is considered a major contribution to the literature on finance from the perspective of an emerging market economy (EME). In this study, a multilevel Tobit regression approach was employed. This study identified statistically significant and positive effects of liquid assets (total assets) and total loans (total deposits) on bank runs in Nigeria. Based on the results, the study concluded that bank-specific factors have an effect on bank runs, and from these variables, liquid assets/total assets and total loans/total deposits have significant effects on bank runs. As a sequel to the findings and conclusion of this study, it was recommended that to avoid such a banking crisis, there is a need for deposit money banks in Nigeria to maintain adequate liquid assets and ameliorate the high level of deterioration in the quality of risk assets as well as the cost of funds.

Key-Words: - bank runs, demand deposit contracts, deposit money banks, liquid assets, non-performing loans.

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1 Introduction

Financial institutions play a dynamic and fundamental role in the growth of any economy, and the success of this role further depends on the structure of the macroeconomy. Banking occupies one of the most significant positions in the financial system. A bank run happens if depositors start to withdraw money from banks out of concern that the institutions may run out of funds, which, in severe cases, leads to bank failures. Instead of actual insolvency, a bank run often results from panic. An example of a self-fulfilling prophecy would be a bank run, which is the result of panic pushing a bank into actual insolvency. The bank faces the risk of failing if customers keep taking their deposits out of circulation. Thus, what appears to be panic may become a genuine default. The failure of banks, in the opinion of [1], has very serious consequences for households, businesses, and governments as it increases the rate of unemployment, a source of financial disintermediation, resulting in shallow financial depth, weak capital accumulation, and a general decrease in purchasing power. This presupposes that the failure of deposit-taking institutions should be avoided by national regulators due to their damaging effects on the whole economy, as the cost of resolution is always a huge burden on taxpayers. Besides, [2], noted in their research that in countries with markets that are tranquil, there are attempts to avoid crises, and this is done through general policies such as the introduction of deposit insurance and the prescription of minimum benchmarks in the form of capital adequacy levels. However, deposit insurance has not been adequate in preventing the collapse of financial institutions, as the experience of the last global financial crisis has shown. The types of customers' bank accounts allow withdrawals without prior notice, have no maturity period, and have no limit on the number of withdrawals; hence, banks that are not well-capitalized become susceptible to failure when a large number of depositors withdraw their deposits en- masse. Banking firms are profit-oriented and earn income from several sources, but the major source of

these is non-traditional income sources, such as trading with customers' deposits and, in the process, creating risky assets. This inevitably exposes the entities to risks that, if not mitigated, could cause both solvency and liquidity issues, such that distress may set in. Banking, as defined by [3], is the business of maturity transformation, or "borrowing short to lend long." Term lending is one of the arrays of services banking firms render to households, corporate entities, and governments. In this direction, they function to create further wealth out of available financial resources, taking cognizance of particular organizational risk parameters. Loanable credit decisions are generally associated with significant risks. Sequel to this, [4], averred that these call for both caution and tact. Some studies, such as those by [5] and [6], were more concerned with evaluating the determinants of DMB's credit portfolios, but how a solvent, liquid, and profitable bank can fail due to the nature of demand deposit contracts, which allow large withdrawals of deposits by customers, has not been well investigated.

Banking distress has characterized the Nigerian banking environment. For instance, [7], exposed that in the early 1990s, Nigeria's domestic savings as a GDP percentage fell sharply to 6%, and the country's saving-to-GDP ratio averaged just 11.3% annually during that time due to the crisis in the banking industry. Systemic distress in the financial sector can lead to macroeconomic disequilibrium, which can negatively affect credit availability with the consequent reduction in output. On their part, [8], attested to the damaging effects of macroeconomic instability caused by disappointment in the banking business, pointing out that manufacturing capacity use dropped from 8.7% in 1986 to a low level of 5.4% in 1995 in the domestic economy. According to [9], the contribution of manufacturing as a percentage of GDP as of December 2020 stood at 8.5%. [8], further pointed out that banking distress in Nigeria weakens its ability to attract foreign direct investment, leading to a significant rise in the poverty level in Nigeria. Statistics provided by [10], showed that net capital flows in Nigeria declined from US$103,033.18 in 2013 to US$24,804.97 in 2017. This decline translates to about 315% and justifies the argument by [8], of the rise in the poverty level in Nigeria. Based on these statistics and the results of research findings, the issue of banking distress deserves more investigation, as the sector is critical to the economic development of Nigeria. The issue of the collapse of deposit money banks (DMBs) has remained a worrisome situation in Africa's largest economy, considering its grave implications and consequences for the overall financial health of the country. Between 1998 and 2006, licenses for 45 DMBs were revoked in Nigeria, [11]. It can be argued that poor governance and a high level of non-performing loans, among other issues, may have accounted for the high rate of failures of these banks, but the nature of demand deposit contracts with their customers and their effects on increasing the likelihood of bank runs have not been sufficiently researched, hence this study. This is particularly worrisome because of the issue of contagion due to the nature of the interconnection of demand deposit banks (DMBs). In fact, [12], pointed out that as DMBs are interconnected with each other due to the nature of banking activities, the failure of one will have spillover effects on not only the stakeholders of the failed entity but on the stakeholders of other entities due to the contagion effect. Based on this argument, we hypothesize that demand deposit contracts have no significant effect on bank runs in Nigeria. The issue of bank runs remains a major concern for DMBs' clients, employees, shareholders, the government, and other stakeholders. The issue of bank failures has largely remained unsolved, despite regulators' persistent efforts, which led to the creation of the Nigerian Deposit Insurance Corporation (NDIC). Aside from these recent occurrences, there isn't much documentation on how deposit withdrawals from different banks spread throughout Nigeria.

Despite the contagious nature of Nigerian banks, there is a dearth of study in the literature concerning the effect of deposit money contracts being incomplete contracts on the high rate of bank failures in Nigeria. More so, the existing literature points to a growing amount of guidance on the underlying causes of bank runs in developed countries, but not enough evidence exists in the case of emerging economies; hence, this study focuses on Nigeria. Besides, the role of demand deposit contracts, which are incomplete, as a primary cause of bank runs in the case of advanced economies exists in the literature. Deposit withdrawals from a distressed bank can cause withdrawals at other similar banks in the same region, particularly if these banks have interbank exposures to the distressed bank, according to recent bank-level evidence, [13]. The motivation for this study is the highly influential

work of [14], with the same title as this. However, the implication of this study as a Nigerian case study was that bank runs are a common occurrence in the Nigerian banking system, despite the severe crises that have been prevalent throughout its economic history. Because the reasons why bank contracts are less stable than other forms of financial contracts in a low-income country like Nigeria have not been adequately addressed by current theoretical analysis, the study's findings will significantly shed light on the characteristics of previous bank runs in the country. Therefore, this is a domestication of that study in the case of a developing country characterized by financial crises as well as weak distress resolution mechanisms based on the high rate of institutional failures. In fact, [14], claimed that when numerous clients take all of their money out of their accounts at once out of concern that the institution might go bankrupt, there is a liquidity issue. In fractional reserve systems, deposit-taking institutions only keep a small percentage of their assets in cash. As more customers withdraw their money, there is a likelihood of default in such banks, and this will trigger more withdrawals to the point where the outfit runs out of cash. [15], asserts that the likelihood of bankruptcy increases with the amount of money taken out, which leads to even more withdrawals. To address the panic, the institution may restrict the number of withdrawals made by any one customer or halt all withdrawals. Also, the organization may get more cash from other banks or from the Central Bank to increase its cash on hand. [16], asserts that since a banking firm typically keeps only a small percentage of deposits as cash on hand, it must increase their cash position to meet the withdrawal demands of their customers. One method that can be used to increase cash on hand is to sell off assets, sometimes at significantly lower prices. This may result in huge losses to the organization, as sales are often at huge discounts to solve urgent liquidity needs. The empirical literature emphasizes the role of firm characteristics, customer behavior, the nature of bank-customer relationships, and the extent to which panic triggered could lead to massive withdrawals of funds by bank customers, but some of the predictor variables used in the analysis of this study are scanty in the literature. This, therefore, presupposes that there is a need to upscale research in this field following the present concern regarding the issue being investigated. Non-performing loans, loan-to-deposit ratio, net interest margin, firm size, and firm age are important crucibles that affect the financial performance and, indeed, the overall stability of banking firms, which influence customers' decisions whether to withdraw or not in the event of financial fragility. The nature of demand deposit contracts, which may arise due to the behavioral patterns of bank depositors in the event of a trigger in bank runs, is, therefore, a cause for concern in an environment that has witnessed a mass of bank failures. Besides, economists, policymakers, academics, and business owners take cognizance of this fact regarding their perception of the capability of financial institutions to withstand shocks that could lead to the instability of such institutions. Hence, the main objective of this research is to evaluate the effects of deposit money contracts on the probability of bank runs in Nigeria.

2 Literature Review

2.1 Theoretical Review

The Modern Theory of Financial Intermediation serves as the foundation for this investigation. The modern theory of financial intermediation, which incorporates both traditional theory and modifications to the financial environment, was introduced by [17]. According to [18], financial development has a big impact on economic expansion. The author made it clear that the financial system makes transactions easier, reduces risk, mobilizes savings, distributes savings, and keeps an eye on managers' actions after funding projects. This, therefore, explicates the fact that the efficiency of operations, especially interest rate management, is highly imperative. [19], defined financial intermediation as the process of financial resource mobilization through intermediaries for subsequent lending to needy economic units. This theory, as formalized by the studies of [20], [21] and [22], views financial markets as pivotal players in economic development. These studies revolve around the postulation that financial developments spur economic growth and account for the differences in the prosperity of nations. [23], on the contrary, argues that financial markets merely depend on domestic industry and, as such, only grow to service the same. [21] and [22], argue that policies leading to the repression of such markets reduce the incentives to save. These authors identified within the context of this work that bank deposits refer to the various

compositions of deposits held by banks at any point in time. [24], assert that generally, deposit rates, inflation rate, and money supply, among others, theoretically influence the composition of bank deposits.

2.2 Empirical Review

[15], averred that the role of a society's income level and distribution could also influence the level and composition of deposits. [25], enthused that seasonality and festivity factors significantly influence people's savings habits, while [15], observes that inflation tends to negatively affect the level of banks' deposits. At the same time, [26], argues that when other investment outlets seem less appealing, people tend to patronize time deposit accounts as an alternative investment outlet for their surplus funds. [27], stated that concerning the European and US established, the net interest margins of banks were significantly influenced by the different institutional designs of capital-based, but in the case of continental Europe, bank-based markets. It can be argued that a well-capitalized firm would be in a better position to withstand short-term liquidity shocks that could precipitate a liquidity crisis.

The Russian banking system is used as a testing ground, [28], to examine the interactions between risk-based deposit insurance, deposit rates, and bank failures. The results of a CAMEL analysis show that when a fixed-rate deposit insurance system is replaced with a risk-based system with premia linked to insured deposit rates provided by a bank, the cost of insured deposits becomes a predictor of bank failures, private banks lacking excessive capital stop raising insured deposit rates to fund loan growth and increases in bank risk lead to a decrease in reliance on insured deposits. Banks will no longer offer insured deposit rates that are significantly higher than the market. The findings imply that risk-based deposit insurance programs that discourage high insured deposit rates may aid in lowering bank moral hazard.

The Diamond-Dybvig model of bank runs is expanded by [29], to include a deposit amount requirement. The study establishes an equivalency result, showing that, if the deposit level is above a particular threshold, efficient allocation is possible in equilibrium when the propensity to run is zero. The lower the deposit level within this range, the more tempted patient depositors are to withdraw early. The best banking system involves less-than-full deposits and follows the equilibrium path when the propensity to run is positive and specific requirements are satisfied.

[30], investigated contagion that runs in banks. The study found that when a player withdraws from one bank, it increases their belief that other players in their own company will also withdraw, which increases their likelihood of withdrawing. This phenomenon is known as the "trigger" effect. By emphasizing that panicked withdrawals impact depositors' beliefs and are therefore contagious, but only if depositors are aware that there are financial connections between their institution and the observed institution, the authors made a crucial observation. Underscoring the significance of bank-depositor relationships in preventing bank runs, [13], established that banks' relationships with their depositors help them reduce the issue of financial fragility and that uninsured depositors are most likely the first to run. This establishes the role of heuristics in the probability of bank runs, which extends the argument of animal instincts among banking firms' customers since behavior affects customers' decisions to withdraw their deposits or not.

[31], examined Nigerian savings, inflation, and the effects these factors have on economic expansion. Using the 2-stage least squares (2SLS) method to extract annual time series data from Nigeria from 1980 to 2013, they found that while the exchange rate had a positive effect on economic growth, inflation had a negative relationship with both real interest rates and economic growth. [32], used time series data from 1990 to 2012 to examine the relationship between market structure and bank profitability in Nigeria. The collusion hypothesis was tested using time-series techniques of co-integration and error-correction mechanisms to determine whether a long-run relationship exists between the profits of commercial banks and concentration in the banking industry. The findings demonstrated a long-term correlation between the likelihood of bank runs and the makeup of the Nigerian banking industry.

[33], used an exploratory research design to further consider the issues arising from the Nigerian interbank market. Regulatory interventions occasionally impede the efficient distribution of funds in the market, in addition to the inefficiencies brought on by the interaction of market forces. bolsters the argument that adjustments to the ratio should be made infrequently and only when there is a compelling reason not to use market-based

instruments (such as government or CBN securities); this suggests that using government or CBN securities that represent open market operations is a viable architecture for the implementation of monetary policy.

The study between demand deposit contracts and the probability of bank runs in Nigeria is relevant to the recent state of the Nigerian banking sector. However, little literature is available. Furthermore, the little literature available is concentrated in the developed economies, with no study documented in the jurisdiction of this study. Therefore, this study intends to fill these gaps by examining the effects of demand deposit contracts on the probability of bank runs in Nigeria.

3 Methodology

3.1 Research Design, Population, and Sampling

This study employed an ex-post facto research design, which is important as the study employed data that have already been validated. The population of the study comprised all sixteen (16) banks listed on the Nigerian Exchange as of December 31, 2021. The purposeful sampling technique was used in selecting thirteen (13) banks as of December 2021, which formed the sample size. These banks were selected about the volume of their assets over the past ten years, as well as banks with an updated financial report and also based on the availability of data. The thirteen (13) banks listed on the Nigerian Stock Exchange as of December 2020 are First Bank of Nigeria Holding Co. (FBNH) Plc., Guaranty Trust Bank (GTB) Plc., Zenith Bank Plc., Access Bank Plc, Stanbic IBTC Bank Plc, United Bank for Africa (UBA) Plc, Fidelity Bank Plc, First City Monument Bank (FCMB) Plc, Sterling Bank Plc, Unity Bank Plc., Wema Bank Plc., Union Bank of Nigeria Plc., and Ecobank Nigeria Plc. This study covered a period of twelve (12) years, which is from 2010 to 2021.

3.2 Nature and Sources of Data

Secondary data were employed in this study. The data were panel in nature and were sourced from audited annual financial reports and accounts of selected deposit money banks listed on the Nigerian Exchange Ltd. The data were sourced in the period covering 12 years (2010–2021).

3.3 Model Specification

The multilevel Tobit regression model was adopted and its simple form is presented below:

$$y_{ij,t} = \beta_0 + \beta_i x_{ij,t} + u_j + \varepsilon_{ij,t} \quad (1)$$

$$y^*_{ij,t} = \begin{cases} h & if\ y_{ij,t} \geq h \\ y_{ij,t} & Otherwise \end{cases} \quad (2)$$

When censorship is applied, the Equ. (1) becomes:

$$y^*_{ij,t} = \beta_0 + \beta_i x_{ij,t} + u_j + \varepsilon_{ij,t} \quad (3)$$

$y_{ij,t} =$ *dependent variable which is not observed directly*
$\beta_0 = intercept, \beta_i = slope,\ x_{ij,t} =$ *independent variable,*
$u_j = random\ intercept,\ \varepsilon_{ij,t} =$ random error (normally distributed)
$y^*_{ij,t} = observed\ outcome\ (latent\ variable)$
$h =$ upper limit (threshold) such that if $y^*_{ij,t} = y_{ij,t}$ if the data is uncensored.
Also, $i = individual\ cases, j =$ *clusters of cases and* $t = time\ (in\ years)$

The Marginal Effects on the latent variables can be computed as;

$$M.E_{tobit} = \frac{\delta E(y^*_i / x_i)}{\delta x_{ij}} \quad (4)$$

In other to properly capture the work of Goldstein and Panzer (2005), empirically, the above models are specified as follows:

$$NPL^*_{ij,t} = \beta_0 + \beta_1 DSD_{ij,t} + \beta_2 NIM_{ij,t} + \beta_3 FSZ_{ij,t} + \beta_4 FAG_{ij,t} + u_j + \varepsilon_{ijt} \quad (5)$$

$$LDR^*_{ij,t} = \beta_0 + \beta_1 DSD_{ij,t} + \beta_2 NIM_{ij,t} + \beta_3 FSZ_{ij,t} + \beta_4 FAG_{ij,t} + u_j + \varepsilon_{ijt} \quad (6)$$

Where;
NPL = Non-performing loans
LDR = Loan-to-deposit ratio
DSD = Demand Deposit Contracts
NIM = Net Interest Margin
FSZ = Firm Size
FAG = Firm Age
ε_{ijt} = Random error term

$NPL^*_{ij,t}$ and $LDR^*_{ij,t}$ are observed (latent) variables from NPL and LDR that are rightly censored at 5% and 65% threshold (as prescribed by CBN). The 5% and 65% simply serve as the

threshold in our regression models because higher NPL and LDR ratios indicate that the banks are at greater *risk of loss.*

3.4 Method of Data Analysis

In this study, a multilevel Tobit regression approach was used. Multilevel panel-data models or mixed-effects models are considered to have both fixed effects and random effects for which the outcome is censored. This approach has been used extensively on different outcomes (ordered, counted, or binary) and in diverse fields. The approach follows the Maximum Likelihood (ML) approach. Marginal effects on observed (latent) variables were computed and interpreted in probability form. The choice of this approach is informed by the fact that the models are made for censored (at a threshold h) dependent variables; they can also fit panel data models; and they allow the prediction of the probability of having latent variables above the prescribed limit, which may lead to bank runs. Under this approach, an LR test is conducted comparing the multilevel fixed-effect models with one-level ordinary linear regression. However, the significance of this test's result suggests that multilevel fixed-effect models are preferred. Before the multilevel fixed-effects regression analysis, descriptive analysis that gave basic statistics and highlighted the possible associations among the variables of interest at a glance was carried out using common statistical tools such as mean, median, minimum, maximum, and standard deviation.

4 Results and Discussion

The results and findings are presented and discussed in this section. The section opens with a descriptive statistic regarding the profitability of bank runs in Nigeria and demand deposit contracts. The correlation matrix, which illustrates the degree of association between the dependent and independent variables, is presented after this. The potential for multicollinearity among the explanatory variables was also assessed using the correlation coefficients of the explanatory variables. The interpretation of the estimated model's results for non-performing loans and the loan-to-deposit ratio comes next.

The study's conclusions were put into context by discussing studies that support and refute the study's findings in a subsection titled "General Discussion."

4.1 Descriptive Statistics

Table 1. Descriptive Characteristics of Demand Deposit Contracts and Profitability

Variables	Obs.	Mean	Std. Dev.	Minimum	Maximum
NPL	156	9.86	11.77	0.30	78.15
LDR	156	51.82	18.41	3.55	108.41
DSD	156	60.28	15.86	11.75	163.65
NIM	156	6.59	2.62	3.58	8.49
FSZ	156	22.17	0.84	18.87	23.46
FAG	156	37.21	16.47	5.00	76.00

Source: Authors' computation, 2023.

4.1.1 Interpretation for Descriptive Statistics

Table 1 presents the descriptive statistics for demand deposit contracts and profitability of listed deposit money banks in Nigeria. On average, the non-performing loan ratio (NPL) of the banks between 2010 and 2021 is estimated at 9.86%, which is above CBN's benchmark of 5% for deposit money banks in Nigeria, indicating the continued resilience of the Nigerian banking system. The implication of this was that a higher NPL would cause banks to limit their credit supply to borrowers, which often causes credit supply contraction. This indicates that the asset quality of these banks deteriorated in the period under review. The highest and lowest NPL ratios during the period were 78.15% and 0.30%, respectively, with a standard deviation of 11.77, which shows that NPL varies across banks. The loan-to-deposit ratio (LDR) has an average value of 51.82%. This is below the CBN's benchmark of 65%, which means these banks were unable to comply with regulatory provisions. The demand deposit ratio (DSD) is seen to have an average value of 60.28%, with minimum and maximum values of 11.75% and 163.65%, respectively. This indicates that, on average, the banks studied exceeded regulatory requirements; however, some of the banks were observed to have very low ratios in the region of the minimum threshold. The net interest margin (NIM) of the banks during the period hovers between 3.58% and 8.49%, with an average value of 6.59%, which appears low as interest is a traditional source of income for banks. The average values of firm size (FSZ) and firm age (FAG) during the period were found to be 22.17 and 37.21 years, respectively.

4.2 Correlation Analysis

Table 2. Correlation Matrix for Demand Deposit Contracts and Profitability

Variables	NPL	LDR	DSD	NIM	FSZ	FAG
NPL	1					
LDR	0.089	1				
DSD	0.329	0.092	1			
NIM	0.167	0.068	0.053	1		
FSZ	-0.268	0.146	-0.058	0.372	1	
FAG	0.091	-0.269	0.141	-0.468	-0.181	1

Source: Authors' computation, 2023

4.2.1 Interpretation for Descriptive Statistics

Table 2 presents the pairs of correlation between demand deposit contracts and the profitability of listed deposit money banks in Nigeria. The results revealed that demand deposit ratio, net interest margin, and firm age were positively associated with non-performing loans, while firm size had a negative association with the non-performing loans of the selected listed deposit money banks in Nigeria. In addition, there is evidence that demand deposit ratio, net interest margin, and firm size were positively related to the loan-to-deposit ratio of the selected listed deposit money banks in Nigeria, while firm age is negatively related to the loan-to-deposit ratio of the listed deposit money banks in Nigeria. The correlation coefficients of the selected variable are weak because they are all within 0–0.35. This gives the intuition that the variables are not correlated with one another, suggesting that there is a possibility that the variables are non-collinear or less correlated.

4.3 The Tobit Regression

The fixed effect Tobit regression results that examined the relationship between demand deposit and liquidity ratio indicators (NPL and LDR) are presented in Table 3 (Appendix). In this study, the lower limit for the non-performing loan ratio is 5% (as prescribed by CBN), while that of the loan-to-deposit ratio (LDR) is 65% (as prescribed by CBN) and right-censored. However, to interpret the Tobit models' results, marginal effects were estimated and used.

4.3.1 Interpretation

Table 3 (Appendix) reports the Tobit Panel regression result for the demand deposit contracts and profitability of deposit money banks in Nigeria. To ascertain the appropriate model for the interpretation of results between the random effect and the fixed effect Tobit models, the Likelihood ratio test was used. The significance of the likelihood ratio test with a statistic of 5.216 and 7.678 at the 5 and 1 percent level, respectively, for the non-performing loan and loan-to-deposit ratio equations, suggests that the fixed effect Tobit model is appropriate. Thus, the likelihood ratio test rejects the null of the random effect model and accepts the alternate of the fixed effect model.

Using the results of the marginal effects for each of the equations, starting with the non-performing loan equation, there is evidence that demand deposits, net interest margin, and firm age have a positive relationship with the non-performing loan, while firm size is negatively related to the non-performing loans of deposit money banks in Nigeria. In addition, the results show the probability of recording more than 5% of the non-performing loans by the deposit money banks significantly varies with demand deposit (DSD) and net interest margin (NIM). The results showed that the marginal effect of demand deposit and net interest margin has a significant impact on non-performing loans of the deposit money bank in Nigeria (DSD = 0.008, p-value = 0.001, and NIM = 0.081, p-value = 0.016). This suggests that demand deposits and net interest margins are significant factors influencing changes in non-performing loans at the deposit money banks in Nigeria.

Conversely, there is evidence that the marginal effect of firm size and firm age has no significant impact on non-performing loans of deposit money banks in Nigeria (FSZ = -0.072, p-value = 0.208, and FAG = 0.031, p-value = 0.742). This implies that firm size and firm age are not significant factors influencing changes in the non-performing loans of deposit money banks in Nigeria. In addition, the Wald chi-square was used to test the overall model. The result showed that at the 1 percent level of significance, the Wald test statistic of 24.963 is statistically significant; thus, the model rejects the null that demand deposit contracts have no significant impact on the non-performing loans of deposit money banks in Nigeria and accepts the alternate hypothesis that demand deposit contracts have a significant impact on the non-performing loans of deposit money banks in Nigeria.

The loan-to-deposit ratio equation revealed that the demand deposit contracts and firm size have a

positive relationship with the non-performing loan, while net interest margin and firm age are negatively related to the loan-to-deposit ratio of deposit money banks in Nigeria. The results show the probability of recording more than 65% LDR by the banks significantly varies with demand deposit (DSD) and firm size (FSZ) as well. Explicitly, the results show that the marginal effect of demand deposit (DSD) on the loan-to-deposit ratio (LDR) is positive and statistically significant at the 1% level (DSD = 0.117; p-value = 0.000), suggesting that the probability of recording LDR above 65% by the banks is increased by 11.7% given an increase in DSD. Similarly, the result reveals that the marginal effect of firm size (FSZ) on the loan-to-deposit ratio (LDR) is statistically significant at the 5% level (FSZ = 0.102; P-value = 0.021), indicating that an increased FSZ increases the probability of having an LRD ratio above 65% by 1.02%. Furthermore, the results show that the effects of net interest margin (NIM) and firm age (FAG) are found to be statistically insignificant.

In addition, the Wald chi-square was used to test the overall model. The result showed that at the 1 percent level of significance, the Wald test statistic of 216.215 is statistically significant; thus, the model rejects the null that demand deposit contracts have no significant impact on the non-performing loans of deposit money banks in Nigeria and accepts the alternate hypothesis that demand deposit contracts have a significant impact on the loans-to-deposit ratio of deposit money banks in Nigeria.

4.4 General Discussion

The study ascertained that the marginal effect of demand deposit contracts on both the non-performing loan ratio and the loan-to-deposit ratio was positive and statistically significant, with coefficients of 0.008 and 0.117 and their corresponding probabilities of 0.001 and 0.000, respectively. Similarly, the marginal effect of the net interest margin on the non-performing loan ratio was positive and statistically significant at the 5% level, with a coefficient of 0.081 and a probability value of 0.016. However, the net interest margin was negative and not statistically significant in the loan-to-deposit ratio equation. In addition, the marginal effect of firm size showed a negative but insignificant effect on non-performing loans, but firm size was positive and statistically significant on the loan-to-deposit ratio. The rationale for the non-significance of bank size on non-performing loans could be traced to other factors such as liquidity ratio, capital adequacy ratio, and inflation rate, which are deemed necessary to be significant factors influencing the non-performing loans, [34]. The study also attested that while firm age was positive on non-performing loans, it was equally positive on loan-to-deposit ratio; however, both were not statistically significant. The rationale why bank age is not a significant factor influencing non-performing loans and loan-to-deposit in Nigerian banks is alluded to by the unstable polity as well as frequent changes in banking laws and regulations, which led to the collapse of many banks and the merger and acquisition of the top banks in the country. This is clear evidence that demand deposits have positive and significant effects on both non-performing loans and loan-to-deposit ratios. The rationale for the positive and significant effect of demand deposits on non-performing loans and the loan-to-deposit ratio in Nigeria is that as investors increase their demand deposits, banks' non-performing loans will increase because customers' deposits provide banks with the capital to make such loans. On its part, firm size only had positive and significant effects on the loan-to-deposit ratio. This is because as the bank's size grows, the possibility of customer deposits also increases, thus increasing the amount of loans granted to borrowers by the bank.

The study focused on demand deposits and the probability of bank runs (recoding high NPL or LDR) in Nigeria using panel data that covers a period from 2010 to 2021. The study analyzed the data using a censored (right) multilevel Tobit regression approach. The approach revealed that an increase in demand deposit contracts increases the probability of having very high non-performing (NPL) and loan-to-deposit (LDR) ratios, accordingly, increasing the probability of bank runs. This is in line with the assertions of [28], [29], [35] and [36] that the growth of customer deposits has a positive impact on bank lending activity. However, [26], argued that a well-capitalized firm would be in a better position to withstand short-term liquidity shocks that could precipitate a liquidity crisis. Following this assertion, it can be stated that the growth of customer deposits positively affects bank lending and causes an increase in non-performing loans and the loan-to-deposit ratio of the banks, which in turn increases the probability of bank runs in Nigeria. Also, we found that increased bank size (FSZ) increases the probability of recording non-performing (NPL) and loan-to-deposit (LDR) ratios above the prescribed

limit by CBN, therefore increasing the probability of bank runs. Furthermore, net interest margin (NIM) and firm age did not significantly predict the probability of recording high or low non-performing (NPL) and loan-to-deposit (LDR) ratios above the prescribed limits in this study.

5 Conclusion and Recommendation

This study focused on demand deposit contracts and the probability of selected deposit money banks in Nigeria to ascertain the significance of demand deposit indicators (customer deposit/total asset) on bank runs in Nigeria whose financial standings are of more concern to the regulatory bodies of the financial system in the country. This was achieved by collecting data from thirteen (13) banks' annual financial reports from the period 2010 to 2021, while Tobit regression was used as the estimation technique. Based on the results, the study concluded that bank-specific factors have significant effects on bank runs, and these variables—liquid assets/total assets and total loans/total deposits—have significant effects on increasing the probability of bank runs. In particular, the study posited that bank deposits in Nigeria are structured largely towards demand deposits rather than the more stable time deposits; this, therefore, indicates that there is a need for a structural shift in the composition of the deposit base of these banks, which requires far more time deposits than unpredictable demand deposits.

Based on the findings and conclusion above, the following recommendations suffice: First, to avoid bank runs, there is a need for DMBs in Nigeria to maintain adequate liquid assets, high demand deposit ratios above the regulatory benchmarks, high total assets, and reduce bad debt losses and other associated costs of credit. Banks should evolve a strategy to engage the services of factoring agents before their doubtful loans get bad to make them stable and withstand any stress that could emanate from bank runs. Second, the top management of DMBs in Nigeria should develop effective strategies aimed at mobilizing more time deposits for their operations, as this has the likelihood of providing a safety net to guard against bank runs. Third, it may be pertinent for regulatory authority to consider urgently the need for ring-fencing of these banks beyond the current practice of cash reserve and liquidity ratios to make Nigerian banks healthy and stable, as demand deposit contracts are unpredictable and, hence, unreliable in the event of bank runs.

6 Limitation of the Study

This study is limited to deposit money banks in Nigeria; hence the result cannot be an interpretation of demand deposit contracts and probability of bank runs for other financial institutions such as microfinance banks and finance houses whose functions have also been extended to the collection of low value deposits in addition to the provision of consumer lending services.

7 Suggestions for Further Studies

Future studies should endeavor to look into other financial institutions such as microfinance banks and finance houses. In addition, the time frame for the study could be extended to cover at least between 2008 and 2022 to capture the effects of the financial crisis of 2008 and the COVID-19 pandemic that ravaged the global economy from 2019 to 2022.

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Conflict of Interest

The authors have no conflicts of interest to declare.

APPENDIX

Table 3. Tobit Regression Result

	Dependent Variable = NPL		***Dependent Variable = LDR***	
Independent Variables	***Coeff.*** ***(Std. Err.) [P>|z|]***	***Marginal Effect*** ***dy/dx*** ***(Std. Err.) [P>|z|]***	***Coeff.*** ***(Std. Err.) [P>|z|***	***Marginal Effect*** ***dy/dx*** ***(Std. Err.) [P>|z|***
DSD	0.216***	0.008***	0.303**	0.117***
	(0.035) [0.000]	(0.003) [0.001]	(0.127) [0.026]	(0.018) [0.000]
NIM	2.421**	0.081**	0.128	-0.084
	(0.988) [0.024]	(0.027) [0.016]	(1.895) [0.988]	(0.207) [0.915]
FSZ	-1.808	-0.072	4.741**	0.102**
	(1.291) [0.126]	(0.052) [0.208]	(2.291) [0.022]	(0.049) [0.021]
FAG	0.083	0.031	-0.201	-0.186
	(0.091) [0.407]	(0.223) [0.742]	(0.385) [0.483]	(0.014) [0.415]
Constant	18.265		-44.79	
	(27.540) [0.489]		(50.541) [0.789]	
Observation	156		156	
Wald chi2(4)	24.963***		16.215**	
P-val > chi2	0.000		0.014	
Log likelihood	-493.487		-367.093	
LR vs tobit	5.216**		7.678***	
P-val	0.016		0.002	

*Source: Authors' computation, 2022. Note: ***, ** and * represents significance at 1%, 5% and 10% respectively*