Deposit Insurance and Insolvency Risk Taking Among Systemically Important Banks in Nigeria

Yusuf Haliru
Bank Examination Department
Nigeria Deposit Insurance Corporation

Abstract

The relationship between Deposit Insurance (DI) and Insolvency Risk (IR) has been in academic space, but has received relatively less empirical research attention especially as it relates to Systemically Important Banks (SIBs) Framework introduced in September 2014 in Nigeria. The study examined the effect of DI on IR of the eight SIBs in Nigeria for the period 2006 to 2015. Using the Random Effect Panel Regression estimate, the results indicated that DI has no significant effect on the insolvency risks of the SIBs. The effects of premium (PRERA) and coverage (COVRA) on IR are negative and non-significant at 5% level. A sign that some banks had embarked on riskier investments in return for higher profits in order to declare high dividend to the shareholders is a clear indication of the presence of moral hazard and adverse selection which was caused by lack of market discipline by the banks' stakeholders". The regulatory decision for upward review of insured deposits does not trigger the banks to take excessive risk of insolvency. The study therefore recommends that the existing practice of risk-based premium assessment for non-systemic banks should be maintained by the insurer, while an enhanced assessment for the SIBs should be put in place. The current maximum insured amount of N500, 000 per deposit of the SIBs should be reviewed every five years by the Nigeria Deposit Insurance Corporation (NDIC) so as to be in line with best practice. The study further recommends that Systemic Importance Index (SII) as a new measure of systemic size of banks should be introduced to replace total assets.

Key Words: Deposit Insurance, Premium, Coverage, Insolvency Risk and Domestic Systemically Important Banks

JEL classification codes: C23; G21; G32; G33

1 Introduction

The 2007-2009 global financial crisis highlighted the need for improved assessment of systemic risk. As many banks were overleveraged both on- and off-balance sheet, the rapid deleveraging of these institutions resulted in significant losses, declines in bank capital, and a severe contraction in liquidity. Due to the interconnectedness of many of these global financial institutions, the losses accrued by counterparties contributed to the meltdown of the financial system. The speed and depth of the recession surprised authorities requiring a massive rescue of the global financial system. The extent of the support required illustrated the need to review the prevailing approaches to monitoring and regulating the financial system as the crisis raised serious concerns about the presence of systemically important financial institutions (SIFIs) reflecting the heightened awareness of contagion risk.

A major step to resolving this weakness was the adoption of a series of reforms known as Basel III developed by the Basel Committee on Banking Supervision (BCBS) and review of Deposit Insurance policies and banking systems. The Basel III rules were geared towards correcting the widely held conclusion that the financial crisis was precipitated by low solvency levels in many of the global SIFIs. Regulators and central banks embarked fundamentally on reforming international prudential frameworks to improve internal risk controls and strengthen capital and liquidity regulations given the interaction between liquidity and solvency. The reforms recognize and distinguish (SIFIs) (banks and non-banks) because of their potential impact on the broader economy if they fail. The SIFIs are also domesticated and are called Domestic Systemically Important Institutions.

Insolvency is the situation of being incapable to pay the money owed, by a person or business, on time. There are two forms: cash-flow insolvency and balance-sheet insolvency. Cash-flow insolvency happens when a bank cannot settle its debts as they fall due, despite the fact its assets may be worth higher than its liabilities. Balance-sheet insolvency is when a person or company does not have adequate assets to reimburse debts owed. Insolvency risk (IR) or Default risk is the likelihood that companies or individuals will be incapable to honour the required payments (interest or principal or both) on their debt obligations as and when due.

Deposit Insurance (hereafter, DI) is a system recognized by government to safeguard savers against the loss of their funds placed with member institutions (commonly banks) in the instance that a member institution is incapable to meet its burden to savers. Countries have the option to adopt either explicit or implicit DI. Under explicit DI, there is full government participation in terms of ownership, funding, regulation, coverage, pay-out, and membership. On the other hand, implicit DI depicts a circumstance where there is no recognised system arranged and whole resolutions and actions can be flexible and ambiguous.

Financial Stability Board (FSB, 2010) states that an explicit DI is desirable to any other deposit safety arrangements because it explains the governments' commitments to depositors. This in effect removes the uncertainties and inequities of implicit arrangement. To support this view, Demirgüç-Kunt, Kane and Laeven (2014) indicated that in 2013, 190 countries worldwide have adopted DI. Out of the number, 58.9% have explicit DI in place, while 41.1% have no explicit DI in place. Nigeria is one of the countries that have an explicit DI since 1989 following the passage of the enabling Statute, the Nigeria Deposit Insurance Corporation (NDIC) Act No.22 of

1988 (currently substituted with NDIC Act No. 16 of 2006). Also, the Central Bank of Nigeria (CBN) and NDIC in September 2014 have developed a structure for regulation and supervision of Domestic Systemically Important Banks (DSIBs) so as to limit the economic impact of bank distress and restore confidence in the financial system.

The establishment of SIBs framework is expected to subject systemically large banks to better market discipline since they appear to be too big to save. But the design of DI adopted in a particular circumstance may appear to have two distinctive effects on the banks' risk-taking. First, it can boost the risk-taking for existing banks (intensive margin effect). Second, it can encourage the entry of riskier banks (extensive margin effect). Whether the effect is intensive or extensive, DI will end up further subsidizing the riskier banks that are considered SI at the cost of small healthy banks especially when the design of premium and coverage vary. Varying DI premium at fixed-rate results in being the scheme of DI under priced for weak banks and overpriced for safe banks. Thus, the safe banks end up subsidizing the vulnerable ones. Also, rising coverage tends to weaken market discipline and intensify the notorious moral hazard problem by inducing banks toward taking excessive risk. The inefficiencies of market monitoring by customers permits bankers and regulators to hide their setbacks which will be too late for public to detect when there is a crisis due to negligence and regulatory forbearance. Consequently, the public will perceive Systemic Importance (SI) as a basis of market power that makes the banks less responsive to market discipline.

Considering the fact that there are series of DI and other banking reforms across the globe, lack of more empirical studies, inconclusive effect of DI on bank risk-taking and the emergence of negative externalities associated with SIBs have called for a new challenge in the world of research. To this end, there is the need to examine the effect of DI on Insolvency Risk-taking (IR) among DSIBs in Nigeria, hence the reason behind this study.

The study assesses the effect of DI on IR taking of eight quoted SIBs in Nigeria for the period 2006 to 2015. The choice of the period was warranted due to fact that banking industry increased in size post consolidation, the lessons learnt by global financial institutions and in 2014 the nomenclature of 'too-big to fail' had been replaced with SIBs framework in the country. The findings will help banks in addressing their risk management policy shortcomings, take prompt corrective actions through compliance with policies, regulations and guidelines

issued by regulatory authorities. To the best of our knowledge, this is the first study that assess impact of deposit insurance on insolvency risk-taking among SIBs in Nigeria.

The remainder of this paper is organized as follows: Section two reviews empirical studies and the theoretical framework on DI and IR taking of banks. Section three provides the study methodology and section four presents results and discussion of findings. Finally, section five concludes the study and offers some recommendations.

2 Review of Related Literature

2.1 Deposit Insurance and Insolvency Risk

Several studies show that the operation of a deposit insurance system is associated with a greater share of bank assets (Camara et al., 2020; Wheelock, 1992). Stella, Bojana, and Vesna (2022) study the impact of the deposit insurance system on bank stability over the period 2005 to 2014 using bank risk variables: z-score and ratio of non-performing loans to total loans. By applying a dynamic panel analysis using the GMM Arellano–Bond (AB) estimator to a sample of EU countries and selected Southeast European countries, the results provide proof that big and systemically important banks behave in a riskier way, misleading the tenacity of the deposit insurance scheme and jeopardising the safety of banking systems.

Similarly, investigating a large number of banks in developed and developing countries during the period from 1970 to 2010, Calomiris and Chen (2020) concluded that generous deposit insurance is related to riskier assets of banks. Empirical proof points out that depositors respond to changes in deposit insurance limits (Iyer et al., 2017) and to changes in deposit insurance reliability (Bonfim & Santos, 2020). This is established by current evidence from Gattia and Oliviero (2021), who found that an increase in deposit insurance has a negative effect on the funding cost per unit of customer deposits and that this effect is stronger for riskier banks.

Calomiris and Jaremski (2019) investigated the role of deposit insurance on depositors' and bankers' behaviour and compare the behaviour of insured and uninsured banks located in the same states, as well as uninsured banks in neighbouring states. They find that DI encouraged banks to increase their insolvency risk because doing so did not prevent them from competing aggressively for the deposits of uninsured banks operating nearby. In fact, increasing risk was necessary to fund the higher interest payments that presumably attracted depositors. They also find that voluntary insurance systems created weaker subsidies for risk-taking by insured banks than mandatory insurance systems.

Gamze (2014) examined the effect of DI on default risk of 26 banks in Turkey between 2002Q4 and 2013Q1. The study proxied DI as insured deposits ratio and insolvency risk was measured by Z-score (that is distance to default). Using panel regression model to analyse the data, the result suggests that DI has positive and significant effect on default risk. His finding indicated that when banks are highly insured, they tend to reduce their overall default risk, meaning that effective DI has stabilized the banking system in Turkey by decreasing insolvency risk.

Dao (2014) examined the effect of DI on default risk of 29 commercial banks in Vietnam from 2010 to 2012. DI was measured as the ratio of annual DI premium to total deposits, while default risk was measures by Dao (2010) equation for credit scoring (ROE, net profit margin, asset utilization, equity multiplier, non-interest margin and ratio of non-interest income to non-interest expense). Adopting panel regression model to analyse the data, the result indicated that DI premium has a negative and significant relationship with banks' default risk (that is the higher the DI premium, the lower default risk undertaking by banks).

There was supposition in the literature that the effect of DI on bank risk is time varying. For instance, Anginer, Demirguc-kunt & Zhu (2014) examined the impact of DI on default risk for a sample of 4109 publicly traded banks in 96 countries for the period 2004-2006 (pre global financial crisis) and 2007-2009 (period of global financial crisis). Market based measure of default risk was adopted and was computed as logarithm of Z-score (calculated as average bank return on assets plus bank equity to asset ratio, scaled by the standard deviation of return on assets over a five-year rolling window). While dummy variable of COV was adopted to measure DI. Using Pooled regression to analyse the data, the result suggested that DI has a positive and statistically significant effect on bank default risk at 1% level during crisis period and a negative and statistically significant effect on bank default risk in pre-crisis years. However, the average effect of DI over the whole sample period was negative, showing that destabilizing effect during normal period is higher in degree compared to the stabilizing effect during the world financial instability. However, the scope of the study does not cover the post crisis period (2010 onward) which was considered by policy makers and regulators very crucial in restructuring financial instability. In addition, the classification of the banks according to their size (large or small) was not captured.

There was a growing assumption that larger banks (systemically important/too-big-to-fail) are more prone to undertaking risky investments because they become collectors of beneficial

policies in the form of either DI or bail out from governments. Enkhbold and Otgonshar (2013) in their study of 401 banks in 31 Asian countries over the period 2000 to 2010 found that when bank risks are measured by z-score, the pattern of relationship between partial DI and insolvency risk was negative. The result indicated that a rise in interbank deposits may have a detrimental effect on overall insolvency risk because of the contagion risk involved. In the case of full guarantee, their results suggested that interbank deposits tend to rise because the guarantee supports banks to increase investments. Further, they found that higher economic growth is positively correlated with Z-score. Their explanation was that banks in faster-growing economies have greater incentives to assume higher risk. One of the shortcomings of the study is the use of data covering post crisis period which is considered very vital in readjusting financial regulations.

Mathias (2013) investigated the effect of deposit insurance adoption on default risk using panel of 18,733 unique banks across 117 countries for the period 1986 to 2011. Default risk was measured by log of Z-score (the sum of Capital to Asset ratio and average Return on Average Asset (ROAA) over the standard deviation of ROAA for a given period) and DI adoption was measured by dummy variable 1 and 0. The result suggested that post DI have significant effect on default risk. Also, the study established that DI adoption on SIBs translates to higher risk of insolvency but the coefficient associated with the interaction term was positive and significantly different from zero. The finding of this study was good except that in a cross-sectional study of this nature, the researchers may be limited to the real data of individual banks of the countries under study. Also, there was no explanation on the type of defaults the banks assumed irrespective of whether it is first- or second-round default. Further, the scope of the study was not current, and the operating licenses granted to those banks were not distinguished.

Le (2013) confirmed, in an analysis of 117 countries for the period 1986-2011 that the introduction of a deposit insurance system surges bank risk by significantly reducing capital buffers (the ratio of capital to assets of banks decreases by 15%). This decrease in capital buffers is defined by an increased risk of insolvency (reduced by 15%). According to Lambert et al. (2017), the introduced changes in the US deposit insurance system (2000–2012) regarding the amount of deposit insurance led to increased risk taking by banks, particularly for banks with lower capitalization.

Sharifah and Rubi (2012) investigated the impact of DI on default risk of 18 Islamic banks in Malaysia from 2002 through 2010. The study measured default risk as ratio of equity to total assets and overhead to asset ratio. A dummy variable for period of adoption and insurance premium method were used to measure DI. By adopting random effect model of estimation on the data, the estimated coefficients of DIs were positive (1.278 and 1.102) and statistically insignificant at 10% level (0.46) for ratio of equity to total assets. At 5% level, it was statistically significant (0.02) for overhead to asset ratio. The results indicated that post DI event increased the insolvency risk of the Islamic bank in Malaysia. However, the too-big-to-fail guarantee did not exist amid all the banks as the sign of the estimated coefficient for log of bank asset was negative for all the models and statistically insignificant. The scope of their study did not capture enough post crisis period. Thus, this study expands period of the study in order to accommodate current change in regulation amongst the banking models in the country. Also not covered in their work was the ownership structure of the Islamic banks.

Ankinand and Wihlborg (2010) analysed the effect of DI COV, ownership, and bank risk-taking of 32 countries between 2002 to 2010. The study used z-score to proxy for default risk and OLS regression as the tool of analysis. The results suggested that foreign ownership was associated with higher risk-taking as measured by Z-score. The results also suggested that for Emerging Markets, the curve was downward sloping indicating that risk-taking as measured by Z-scores increased with explicit DI COV. The design features of DI scheme in those countries were not discussed in their study.

In another study, Davis and Obasi (2009) examined the relationship between DI, its design features and default risks for a sample of 914 banks over the period 1995 to 2003. They captured DI by its design features and measured by dummy variables, while default risk was proxied by ratio of return on average assets. Using Generalized Method of Moments (GMM) estimator, the study found that DI has negative (-3.9677) but significant (0.000) effect on default risk of the sampled banks at 1%. The same effect was obtained on the design features of DI and default risk. The study did not examine the effect of technology and competition in risk management among the banks.

Studies of foreign ownership of banks hold the argument that alien banks bring benefits to the home banking sector by incorporating technology and expertise in risk management. They also boost competition, thereby forcing home banks to raise efficiency. Analysts however argued that

the strengthened competition could make fragile home grown banks into taking excessive risks. For instance, Levy-Yeyati and Micco (2007) found that foreign banks were associated with higher default risk, measured by the Z-score, than home grown banks in a sample of Latin American banks. All the above studies under this section concentrated on bank-based measures of default risk. They were able to do so because of its immense benefits such as wide usage by researchers as it joins the leverage risk with two extra dimensions of risk: the profitability and the volatility of returns. Practitioners especially regulators regularly apply it to evaluate the economic health of a bank and play a significant role in the forecasting of distress (Macha, 2016).

Gropp and Vesala (2004) examined the relationship between DI, debt-holder monitoring, and risk-taking for 128 banks over the period 1992-1998 for 15 EU countries. They measured default risk of the banks by idiosyncratic stock price volatility (inter-day volatility of bank's share price) and DI was measured by dummy variable that take value of 1 or 0 otherwise for explicit or implicit system respectively. By adopting panel regression analysis, the study found that banks, which comprised particularly large proportion of the financial system in a given country, do not adjust their risk-taking. The coefficient of DI was positive (0.126) and statistically significant (0.035) at 5% level. They interpreted this finding as evidence that, "too big to fail" has remained an important issue pre and post the introduction of explicit DI and added that the boundary of the safety net to depositors was only reliable for smaller banks.

2.2 Theoretical Framework

This study adopts Hands-on theory as its framework. Hands-on theory was first proposed by Arrow (1963) and later enhanced by McKinnon (1973) and Shaw (1973). This theory posits that the government (as insurer) should protect its interest by forcing insured banks to sustain their portfolios at a given level of risk which is appropriate to the cost of DI. Under a pure hands-on approach, the government is faced with the formidable task of monitoring all aspects of all banks' operations, as well as the further task of assimilating the information obtained in some meaningful way that relates to the cost at which DI will be priced.

The theory lies behind current law restrictions on banking activities and organizational structures in Nigeria. It also, underlies bank capitalization and accounting requirements, as well as the perspective system on Hands-on regulation which the government uses to implement regulatory requirements (Williamson, 1994).

Government DI has been confirmed very successful in protecting banks from runs, but at a cost since it leads to moral hazard. By offering a guarantee that depositors are not subject to loss, the provider of DI bears the risk that they would otherwise have borne. Consequently, it diminishes depositors' motivation to monitor banks and to demand an interest payment proportionate to the risk of the bank. Additionally, when the insurance scheme charges the bank a flat rate premium, the bank did not internalise the full cost of risk and therefore it has an incentive to take on more risks (Keeley, 1990).

Merton (1977) established the use of the arbitrage pricing method, originally developed for pricing options on common stock, to analyse the DI distortion on banks' risk–taking incentives. He shows that DI can be analysed as a put option on the value of the bank's assets with a striking price equal to the agreed maturity value of its debt. If the insurance premium is risk– insensitive, the bank can raise the value of the put option by raising the risk of its assets and/or declining its capital–to–assets ratio. A bank's appetite for risk is further improved with an increase in rivalry in the banking sector and a reduction in the value of the bank's charter (Marcus, 1984; Keeley, 1990; Hellmann, Murdock & Stiglitz, 1997).

3. Methodology

This study adopts ex-post factor research because it concentrates on establishing relationships between some identified variables and the nature of their relationships for the period under study. The population for this study is all eight (8) quoted SIBs in Nigeria as at 31st December 2015. These banks are Guaranty Trust Bank, First Bank, Diamond Bank, United Bank for Africa, Eco Bank, Skye Bank, Access Bank and Zenith Bank.

Data on these banks are sourced from their respective Annual Reports and Financial Statements and CBN Statistical Bulletin. The DI data are obtained from the NDIC Annual Reports and Financial Statements. The data covered the period 2006 to 2015.

Panel regression technique was employed to estimate the parameters of the estimated equation. The study estimated pooled Ordinary Least Squares (OLS), Fixed effect (FE) and Random effects models. Pooled OLS model assumed that all the eight SIBs are the same by denying the heterogeneity or individuality that may exist among them. The FE model allows for heterogeneity or individuality among the eight SIBs by allowing them to have own intercept value. While in the random effects model, the eight SIBs have common mean value for the intercept. The appropriateness of the FE and Random effect models was checked by Hausman test. This tests whether the unique error are correlated with regressors (Baltagi, 2001). The null

hypothesis is that the preferred model is random effect, while the alternative hypothesis is that the FE model is preferred. Where p-value is more than 5%, random effect model is to be used otherwise, use FE model when p-value is less than 5%.

The study tests for robustness of whether the selected model was actually random. This was performed by adopting the Breusch and Pagan's (1980) Lagrange Multiplier (LM) test for random effects. The Breusch and Pagan statistic test the null that variance of the random effect is zero; so under the null OLS is consistent. If you do not reject the null, it means that you cannot estimate the model using Random Effects. This would mean that all the banks have the same intercept. Conversely, when the variance of random effects is different from zero, then run the random effects model. Meaning that each of the banks have different intercepts. The estimated equation is given as:

$$IR_{it} = \beta_0 + \beta_1 PRERA_{it} + \beta_2 COVRA_{it} + \beta_3 SII_{it} + U_i + E_{it} \dots\dots\dots\dots\dots\dots [1]$$

Where:

IR is SIBs' risk-taking indicator. This indicator is the dependent variables. PRERA represents the Deposit Insurance Premium Ratio defined as annual assessed premium per bank divided by total deposits, and COVRA is Deposit Insurance Coverage Ratio defined as total insured deposits per bank divided by total deposits, used as DI indicators and are the independent variables.

The apriori is that PRERA will reduce the risk taking of SIBs. This is because deposit insurer assesses banks' premium based on their risk profile. The study expects that variation in COVRA will reduce insolvency risk, bank run, adverse selection and moral hazard and increase market discipline. This is because deposit insurer varies coverage level in ensuring stable financial system.

SII is a control variable and stands for systemic importance index, calculated as the Principal Components Analysis of substitutability (total deposits), complexity (Gross number of branch networks) and size (total assets)) and is an indicator of systemic importance.

It is worth nothing that, according to the 'too big to fail' dogma, large banks are systemically important banks. Due to the fact that they are provided with government support in case of insolvency, they are more likely to engage in risky operations and thus make unverifiable loans that become uncollectible over time (Stella, et al., 2022).

$\beta_1, \beta_2 and\ \beta_3$are coefficients of independent and control variables. $i\ and\ t$ are individual bank and year respectively. $\beta_0 and\ E_{it}$ are constant and error term respectively.

IR is insolvency risk and is measured by log of z- score. The z-score is an insolvency risk measure that represents the probability that an individual bank's losses exceed its shareholder equity. It is estimated following Mathias (2013) as:

$$Z_{it} = \frac{\mu[ROAA_{it}] + CAR_{it}}{\sigma[ROAA_{it}]} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

Where CAR is capital adequacy ratio, ROAA stands for return on average assets, σ is the standard deviation of ROAA for three year rolling window. The higher the z-score the lower the risk of insolvency (Mathias, 2013). Several studies (Stella, et al., 2022; Sharifah, 2020; Haliru, 2017; Anginer *et al.* (2014); Mathias, 2013; Locksley, 2013; Gamze *et al*., 2012; Roy, 1952) used this measure of risk.

4 Results and Discussion

4.1 Descriptive Statistics Result

Table 1 presents descriptive statistics results using mean, maximum, minimum and standard deviation.

Table 1: Descriptive Results

Variable	Mean	Maximum	Minimum	Standard Deviation
IR	1.2510	2.6442	0.0000	0.5711
PRERA	0.5176	0.8146	0.3792	0.2490
COVRA	0.8586	0.9753	0.7538	0.3015
SII	1.2564	4.8084	0.0091	0.8985

Source: Authors' Computation by STATA Version 13.0

Source: *Authors' Computation by STATA Version 13.0*

Table 1 shows that the minimum value of IR is 0% and maximum value is 264.4%; while the average (mean) value of IR is 125.1%. This indicates that some banks were very close to insolvency at certain period because they used more depositors' and other creditors' funds to finance higher portion of their total assets. On the average, some banks are far from insolvency. PRERA, COVRA and SII have maximum approximate values of 81.5% , 97.5% and 481%.

While the corresponding mean values of PRERA, COVRA and SII are 51.8%, 85.9% and 126%. The maximum value of PRERA indicates that the highest premium paid by a particular banks was 81.5% of total deposits and the highest coverage level was 97.5% of the total deposits. Also, on average premium paid by the banks was 51.8% of the total deposits and that of coverage level was 85.9% of the total deposits. These signify that some banks' risk-taking profiles are high and different and they are deficient in fully executing their risk management and corporate governance policies. However, premium within the scope of the study were charged on banks using fixed rate and differential assessment methodology by the NDIC.

Table 2 represents results of Multicollinearity among the independent variables based on Variance Inflation Factor test.

Table 2: Variance Inflation Test for Multicollinearity

Variable	**Variance inflation factor (VIF)**	**1/VIF=Tolerance**
SII	1.08	0.927271
PRERA	1.05	0.952207
COVRA	1.03	0.970047
MEAN VIF	**1.05**	

Source: Author's Computation by STATA Version 13.0

The results obtained indicated that Multicollinearity does not exist among all independent variables because VIF values are consistently less than 10. Also, the mean VIF is less than 10 (1.05) as well as the tolerance value of less than 1.

Table 3: Wooldridge Test for Autocorrelation in Panel Data

H_0: No first-order autocorrelation H_1: There is first-order autocorrelation

Study Hypothesis (H)	***Model***	**F**	***Prob> F***	***Remark on the test results***
H_1	1	0.095	0.7666	No autocorrelation, retain Random effect model

Source: Author's Computation by STATA Version 13.0

Table 3 represents results of autocorrelation tests using the Wooldridge (2002) test for panel data The Wooldridge test is attractive because it can be applied under general conditions and is easy to implement (Drukker, 2003).The results indicate that the error terms are not correlated with the past values of idiosyncratic error term U_i, which confirmed that the model's estimates presented are efficient, unbiased and BLUE.

Table 4: Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity

Ho: Residuals are Homoscedastic H_1*: Residuals are Heteroscedastic*

Study Hypothesis (H)	***chi2(1)***	***Prob > chi2***	***Remark on the test***
H_1	0.26	0.6085	Residuals are Homoscedastic

Table 4 presents the Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity and was performed on the residuals. The residuals are Homoscedastic when the data was transformed. The results showed that the probability value (0.6085) was more than 0.05, which indicated that the"noise" or random disturbance in the relationship between the independent variables and the dependent variable is the same across all values of the independent variables. Also, indicated that the variance in the error term is not constant.

Table 5: Breusch and Pagan Lagragian Multiplier (LM) Test for Random Effects

H_0*: Pooled OLS model is appropriate* H_1*: Random effects model is appropriate*

Study Hypothesis (H)	***Model***	***chibar2(1)***	***Prob > chibar2***	***Remark on the test***
H_1	1	21.32	0.0000	*Random effect model is appropriate*

Source: Author's Computation by STATA Version 13.0

From Table 5, the results of the LM tests still confirmed the model estimate is BLUE because the p-value of 0.0000 is less than 5%.. The random effects model estimated produced result of transformed data that get rid of autocorrelation in errors. That was confirmed by the serial correlation tests conducted as presented in Table 3 above.

Table 6 represents results of panel regression estimates (Fixed Effect and Random Effects Models).

Table 4: Deposit Insurance and Insolvency Risk : Panel Regression Estimates

Variable	*Fixed Effect*	*Random Effect* ✓	*p-value (Random Effect)*
PRERA	0.012308	-0.0014907	0.823
COVRA	-0.0003357	-0.0003102	0.339
SII	0.0963218	0.0861066	0.017
CONSTANT	1.445914	0.1061143	0.000
R-SQUARE	0.0577	0.0689	
F-Stat	2.38	6.94	
Prob > F	0.0783	0.0737	
Hausman (chi2(3))	5.44		
Prob-hausman (Prob>chi2)	0.1425		
No of observations	80		

Source: Author's Computation by STATA Version 13.0

From Table 6, the selection of which panel estimation is preferred was made by conducting Hausman specification test. The random effects was preferred and selected because the Prob>chi^2 was 14.25% which is more than 5%. Under the random effects estimation, PRERA has negative effect (-0.0014907) on IR and the effect is non-significant (p-value 82.3%). This indicates that there is no statistical evidence to prove that high premium paid by SIBS to NDIC prevents them from taking additional insolvency risk. This could be due to shift from flat-rate premium system to differential premium system in 2008 and increase of deposits coverage in 2008 and 2010 amongst others.

Also, COVRA has negative effect (-0.0003102) on the IR and the effect is non-significant (p-value 33.9%). This indicates that there is no statistical evidence to prove that coverage levels applied by the NDIC on SIBs' deposits prevent them from taking additional liquidity risk. This

may be as result of changes in coverage levels as witnessed in the 2006 (from ₦50, 000 to ₦200, 000) and 2010 (from ₦200,000 to ₦500,000) and exemption of interbank deposits from the insured coverage in the 2007, among others (NDIC, 2009).

The SII has positive effect (0.0861066) on the IR of the banks and the effect is significant (p-value 1.7%) at 5%. This indicates that there is 98.3% statistical evidence to prove that DI do not significantly prevents SIBs in Nigeria (as confirmed by SII) from taking an excessive IR for the period under study.

The study found that DI has no significant effect on the insolvency risks of the SIBs. The individual effect of PRERA was negative and non-significant on the insolvency risk. This indicates that the premium charged by the deposit insurer on the SIBs does not prevent them from taking additional risk. This is possible because some of the banks' z-scores were less than 1 (as confirm from the descriptive statistics in Table 1), which is a symptom that some banks' equities are not capable of absorbing losses. It is also an indication that the switch of premium payment by the deposit insurer (for the banks) from flat rate to risk-based has not fully yielded a desired result. This could be that the returns earned on assets are not sufficient to pay off the costs incurred by the banks and that some banks' earning assets (at times) are sold at 'fire sales' in order to satisfy the customers' demands.

This result confirms the finding in Sharifah and Rubi (2012) which documented proof of statistically non-significant relationship between the DI dummy and the ratio of equity to total assets. More so, the finding in this study is inconsistent with the findings in Stella et al.,(2022), Dao (2014), Mathias (2013), Davis and Obasi (2009), Levy-Yeyati and Micco (2007), Gropp and Vesala (2004), which established evidence of positive and significant relationship. The differences in the results could be as result of measurements. For example, Dao (2014) measured default risk using Dao (2010) equation for credit scoring (ROE, net profit margin, asset utilization, equity multiplier, non-interest margin and ratio of non-interest income to non-interest expense).

Similarly, the study found that COVRA has negative and non-significant effect on the default risk of the SIBs. This indicates that varying insured deposit amounts of the SIBs by the deposit insurer (for the study period) prevents them (but with limited evidence) from taking additional default risk. This is a clear indication of presence of moral hazard and adverse selection which was caused by lack of market discipline by the banks' stakeholders. In addition, it is a sign that

the overall burden of customers' deposits was shouldered by the insurer. This in effect, is a sign that some banks had embarked on riskier investments in return for higher profits in order to declare high dividend to the shareholders. The finding in the current study is in line with the finding in Enkhbold and Otgonshar (2013), which documented proof that banks in faster-growing economies have greater incentives to assume higher risk. However, the finding contradicts the findings in Gamze (2014), Anginer *et al.* (2014), which documented evidence that when banks were highly insured, their overall default risk tend to reduce. Also, the effect of SII on the default risk was positive and significant. This shows that as the DI is in place and the banks are growing bigger, their risk to insolvency is significantly increasing. This is also in line with Stella et al., (2022) which documented evidence that large and systemically important banks behave in a riskier manner.

5. Conclusion and Recommendations

The significance of the deposit insurance system is mostly marked in times of crisis to retain confidence in the banking system and inhibit depositors' fear and a bank run. In circumstance where the consequences of risk banking occur, such as a debility in lending and support of risk banks, the deposit insurance system is seen as justified to achieve social welfare.

This study examined the effect of DI on IR of SIBs in Nigeria. Findings of the study revealed that DI has no significant effect on the insolvency risks of the SIBs. Premium assessed on SIBs is a relevant regulatory measure (to a lesser extent) in preventing insolvency risk in Nigeria. The regulatory decision for upward review of insured deposits coverage in the country does not triggered the banks to an excessive risk of insolvency, as there is no clear sign of any government bailout for the period under study. Thus, there is a stabilizing effect of the government guarantees on the SIBs in Nigeria. It is, therefore, worth noting that this paper designates an empirical basis for underscoring the prominence of the deposit insurance system in confirming banking stability, as well as the stability of the whole financial system.

The study therefore recommends that the existing practice of risk-based premium assessment for non-systemic banks should be maintained by the insurer, while an enhanced assessment for the SIBs should be put in place. This is based on the findings that premium does not significantly reduced IR. The effect of COVRA was significant at 5%, while that of PRERA was insignificant at all levels. The results supported the moral hazard argument that DI makes banks less sensitive in

screening and monitoring of loans and this attitude raises the level of non-performing loans and advances.

Also the new measure of bank size, the SII, should be used for measuring size of SIBs instead of total assets. These will help in reducing the moral hazardous behavior and adverse selection effects.

For practitioner's policy improvement, the study further indicated that the SIBs' framework in Nigeria may not be robust enough to mitigate contagion effect since the banks resort to taking excess risk on insolvency. The requirements of monthly and quarterly reports of their financial conditions and risk management activities submitted to the regulators as highlighted in the page 10 to 12 of the framework should be strictly followed and revisited when the need arises. In effect, the capital buffers introduced under the Basel3 should be proactively implemented by the banks and effectively monitored by both the banks' management and regulators.

The study also recommends that the NDIC should continue from time to time to review its coverage level (every 5 years based on best practices) so as to see whether an adjusted COVRA should be put in place specifically for the SIBs as they used their size to engage in excessive risk taking especially on loans and advances. Also, an enhanced risk-based premium assessment method should be used by the NDIC in order to further regulate activities of the banks. Also, banks' regulators and managements should ensure that sound risk management policy is actively in place and periodically reviewed and monitored.

5.2 Limitations of the Study and Suggestions for Further Research

This study has suffered several limitations among them are lack of extended data that covered the period up to 2023 for the key variables to enrich the scope of the study. In addition, several policies, guidelines, circulars, and frameworks improvements (such as Basel 3 Capital Buffers, Large Exposure, Liquidity Coverage Ratio and Net Stable Funding Ratios) have been issued by the NDIC and Central Bank of Nigeria aimed at reshuffling the domain of the banking practice in the country which the study did not consider. Also, paper did not captured amendments to NDIC Acts 2023 in relation to timing of deposit insurance coverage pay-outs.

Reference

Arrow, K. J. (1963). Uncertainty and the Welfare Economics of Medical Care. *American Economic Review*, 53(5), 941-69.

Anginer, D., Demirguc-kunt, A., & Zhu, M. (2014). How Does Deposit Insurance Affect Bank Risk? Evidence from the Recent Crisis. *Journal of Banking and Finance*, 48, 312-321.

Angkinand, A., &Whihlborg, C. (2010). Deposit Insurance Coverage, Ownership and Banks' Risk- taking in Emerging Markets. *Business Facility Articles and Research*, Chapman University.

Baltagi, B.H. (2001). Econometrics Analysis of Panel Data . (2nd ed.), England: John wiley & sons.

Bonfim, D., & Santos, J. A. C. (2020). The importance of deposit insurance credibility (Work ing Paper, w202011). Banco de Portugal, Economics and Research Department. Re trieved December 10, 2021, from https://ideas.repec.org/p/ptu/wpaper/w202011.html

Breusch, T. S., & Pagan, A.R. (1980). The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics. *Review of Economic Studies, 47(1), 239-253.*

Calomiris, C. W., & Chen, S. (2020). The spread of deposit insurance and the global rise in bank asset risk since the 1970s. NBER Working Papers 24936. National Bureau of Economic Research, Inc.

Calomiris ,C.W., & Jeremski, M. (2019). Stealing Deposits: Deposit Insurance, Risk-Taking, and the Removal of Market Discipline in Early 20th-Century Banks. The Journal of Finance, 74(2).available on https://onlinelibrary.wiley.com/doi/pdf/10.1111/jofi.12753

Camara, A., Davidson, T., & Fodor, A. (2020). Bank asset structure and deposit insurance pricing. Journal of Banking & Finance, 114, 105805. https://doi.org/10.1016/j.jbankfin.2020.105805

Dao, T.B. (2014). Deposit Insurance and Bank Risks in Vietnam. FMT, Hanol, University Hanol.

Dao, B.D.T. (2010). Credit Securing Model for Manufacturing Vietnam Company. Thesis , Hanol University.

Davis, E.P., & Obasi, U. (2009). Deposit Insurance Systems and Bank Risk. *Economic and Finance Working Paper*, 9(26).

Demirguc-kunt, A., Kane, E.J., & Leaven, T. (2014). Deposit Insurance Design and Implementation : Policy Lessons from Research and Practice. *World Bank Policy Research Working Paper*, 396.

Drukker, D. (2003). Testing for Serial Correlation in Linear Panel Data Models. *STATA Journal*, 3 (2), 168-177.

Enkhbold, .E & Otgonshar, B. (2013). The Effect of Deposit insurance on Risk-taking in Asian Banks. *Asian Journal of Finance and Accounting*, 5(1), 104-126. doi:10.5296/ajfa.v51/.3023.x

Financial Stability Board (2010). Update on Unwinding Temporary Deposit Insurance Arrangements.Retrieved on 4th July, 2016 from http://www.financialstabilityboard.org/publications/r_1006.pdf

Gamze, G.Y. (2014). Effect of Deposit Insurance System on Banks' Risk-taking Incentives in Turkey. *Journal of Business, Economics and Finance*, 314, 444-457.

Gamze, G.Y., Yusuf, D., & Kalkhan, G. (2012). The Link Between Deposit Insurance and Banks' Risk-taking. *3rd International Symposium on Sustainable Development*, Sarajeno.

Gropp, R., &Vesala, J. (2004). Deposit Insurance, Moral Hazard and Market Monitoring. *European Central Bank Working Paper Series*, 302.

Gattia, M., & Oliviero, T. (2021). Deposit insurance and banks' deposit rates: Evidence from the 2009 EU policy. International Journal of Central Banking, 68, 171–206.

Haliru, Y. (2017). Effect of Deposit Insurance on Credit Risk of Domestic systemically important banks risk-taking in Nigeria. ICAN International Journal of Accounting.

Hellmann T., Murdock, K., & Stiglitz J. (1997). Financial Restraint: Toward a New Paradigm. In Aoki, M., Okuno-Fujiwara, M., & Kim, H. (ed.), The Role of Government in East Asian Economic Development: Comparative Institutional Analysis. Oxford: University Press.

Iyer, R. T., Jensen, N., Johannesen, N., & Sheridan, A. (2017). The run for safety: Financial fragility and deposit insurance [EPRU Working Paper Series 1602]. Economic Policy Research Unit (EPRU).

Keeley, M.C. (1990). Deposit Insurance, Risk and Market Power in Banking. *American Economic Review*, 8(5), 1183-1200

Lambert, C., Noth, F., & Schuwer, U. (2017). How do insured deposits affect bank risk? Evi dence from the 2008 emergency economic stabilization act (SAFE Working Paper Se ries, 38).

Le, M. (2013). Deposit insurance adoption and bank risk-taking: The role of leverage [Work ing Paper, 2013-41]. Paris School of Economics, 1–38.

Levy-yeyati, E., & Micco, A. (2007). Concentration and Foreign Penetration in Latin American Banking Sectors: Impact of Competition and Risk. *Journal of Banking and Finance*, 31, 1633-1647.

Locksley T. (2013). *Insolvency risk in the Jamaican Banking Sector and its Implications for Financial Stability*. Available on http://www.boj.org.jm/uploads/pdf/papers_pamphlets/papers_pamphlets_Insolvency_risk_in_the_Jamaican_banking_sector_and_its_implications_for_financial_stability.pdf

Macha, K. (2016). Accounting and Market Based Risk Measures as Predictors of Bank Defaults. Master thesis. Erasmus School of Economics, Erasmus. Available on https://thesis.eur.nl/pub/36473/M76-Micha_431951.pdf

Mathias, L. (2013). Deposit Insurance Adoption and Bank Risk-Taking: the Role of Leverage. *Paris School of Economics Working paper*, 41. Available on https://halshs.archives-ouvertes.fr/halshs-00911415/document.

Marcus, A.J. (1984). Deregulation and Bank Financial Policy. *Journal of Banking and Finance*, 8, 557- 565.

Merton, R.C. (1977). On the Pricing of Contingent Claim and the Modigiliani-Miller Theorem. *Journal of Financial Economics*, 15 (2), 241-250.

McKinnon, R. (1973). *Money and Capital in Economic Development*. Washington D.C: The Bookings Institution.

Nigeria Deposit Insurance Corporation (1997). Bank Deposit Insurance in Nigeria. P.N Umoh (ed.). Lagos: Paga publishing.

Roy, A.D. (1952). Safety First and the Holding of Assets. Econometrica, 20, 431-449. http://dx.doi.org/10.2307/1907413

Sharifah, A.S.A., & Rubi, A. (2020). How Does Risk-based Deposit Insurance Premium Affect Bank Risk Taking? Islamic Bank vis a vis Conventional Bank. *Journal of Technology Management and Business, 7(2), 32-49.* DOI: https://doi.org/10.30880/jtmb.2020.07.02.004

Sharifah, A.S.A., & Rubi, A. (2012). Deposit Insurance System: An Exposition for the Islamic Banks in Malaysia. *International Journal of Social Sciences and Humanity Studies*, 4(2).

Shaw, E. (1973). *Financial Deepening in Economic Development*. New York: Oxford University Press.

Stella, S. N., Bojana, O. D., and Vesna, B. (2022). Deposit insurance, banking stability and banking indicators. Economic Research-Ekonomska Istraživanja. Available on https://doi.org/10.1080/1331677X.2022.2033130

Breusch, T. S., & Pagan, A.R. (1980). The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics. *Review of Economic Studies, 47(1), 239-253.*

Wheelock, D. C. (1992). Deposit insurance and bank failures: New evidence from 1920s. Economic Inquiry, 30(3), 530–543. https://doi.org/10.1111/j.1465- 95.1992.tb01979.x

Wooldridge, J. M. (2002). Econometric Analysis of Cross Section and Panel Data. MIT Press, Cambridge, MA.