

Market Risks Management and Performance of Deposit Money Banks in Nigeria: The Challenges of 4th Industrial Revolution

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Abstract

This study examined the effect of market risks on performance of 15 banks in Nigeria spanning from 2011 to 2020. The study relied on secondary data derived from the selected banks' financial statements to determine and measure the effect of fluctuations in market risks on Nigerian banks performance in this era of 4th industrial revolution by applying an all-inclusive panel least square estimate. The study used the ex-post facto research design. The data were obtained from annual reports of the 15 sampled banks. Accordingly, four (4) specific objectives and hypotheses were stated and the data obtained were subjected to some preliminary tests such as descriptive, correlation analysis and variance inflation factor. The hypotheses were tested and analyzed using panel least square estimate. The empirical analysis covered 150 bank-year observations and the results shows that interest rate risk (IRSK), foreign exchange rate risk (FXRSK) and capital adequacy risk (CARSK) have negative yet noticeable effect on the Nigerian banks' performance while equity risk (EQRSK) have positive yet minimal effects on Nigerian banks' performance on the short run. Meanwhile, on the Kao Cointegration test evidenced that, market risk has a long run effect on banks' performance in Nigeria. Consequently, market risk measured by IRSK, FXRSK, and CASK decreases the likelihood for Nigerian banks to make huge profit to a very large extent in the periods under review. As such, if Nigerian banks desire higher income especially in this era of 4th industrial revolution, they need to optimally manage their market risks.

Keywords

Market Risks, Foreign Exchange, Interest Rate, Equity Risks and Performance

1. Introduction

Since the 2007-2009 Financial Crisis up to the 4th industrial revolution saga, the role of risk management has become increasingly more important. With the establishment of Basel III in year 2009, the capital regulatory policy was increased while new measures were introduced. Consequently, with the stringent bank regulations, financial restructuring put in place alongside changes in bank models, banking operations have become less capital intensive in recent times (Bank of International Settlements, 2018). With these developments, Bank profitability has dwindled due to these changes which have made bank risk taking to increase though which is not unconnected with the two challenges of industrial revolution which is geared towards a slow-down in most economies during this period (Udoezika & Orjinta, 2021). During these periods, the financial performance of most listed firms in Nigeria reduced drastically. Meanwhile, others issued profit warnings in the 2016 financial year alone. From available statistics, most companies performed poorly and almost collapsed in the 3rd industrial revolution which occurred between 2013 and 2017. This ugly incidence however transcended to the 4th industrial revolution era suggesting that a more proactive approach to curtail this ugly trend was required which even affected the banking sector (Onyefulu, Okoye, & Orjinta, 2020; Mutegi, 2017).

A sing-song of risk management has continued to resonate among industry practitioners as a panacea, though with some discordant views. Although, most studies reported that market risk efficient management improves bank financial performances but there still exist inconsistent results. Market risk component of financial risk management measured by using interest rate, exchange rate, equity and capital adequacy risk was reported to have mixed impact on bank performance. A strand of the literature reported the existence of a statistically significant positive impact such as Udoezika & Orjinta (2021), Onyefulu, Okoye, & Orjinta (2020), Noor, (2019); Matayo & Muturi (2018); Mudanya & Muturi (2018); Lelgo & Obwogi (2018); Juma & Atheru (2018) and Harelimana (2017). These studies show that, bank risk management improved bank performance. Contrarily, the works of Shetty & Yadav (2019); Juma & Atheru (2018) however, evidenced that, effect of market risk moved in non-linear/transverse directions. Furthermore, from another perspective, the work of Wamalwa & Mukanzi (2018) evidenced that, both market risk management parameters aid bank performance are not related.

While the above research outcomes provide valuable insights on market risk management, it is therefore evident that they have not induced and provided a clear cut relationship between both market risk and bank performance. Consequently, this study examined the effect of market risk on bank performance in Nigeria spanning from 2011-2020. The study seeks to achieve the under listed specific objectives:

- 1) Examine the effect of interest rate risk on bank performance in Nigeria.
- 2) Investigate the effect of foreign exchange risk on bank performance in Ni-

geria.

3) Examine the effect of equity risk on bank performance in Nigeria.

4) Investigate the effect of capital adequacy risk on bank performance in Nigeria.

For ease of reference, the remaining part of this study is divided into four sections. Accordingly, in the second section, we reviewed some related literature to explore the theoretical constructs and hypothesis development while the third section discusses the methodology. The Fourth section looked at the data presentation and analysis while in the last section we drew our conclusion and proffer recommendations for policy implication.

2. Literature Review and Hypotheses Development

Banks, while discharging their fundamental financial intermediation roles, are usually faced with both endogenous and exogenous risk. These forms of risks are collectively called market risks. Examples of these forms of risks are: interest rate risks, foreign exchange risks equity risks and capital adequacy risks. These forms of risks are highly instrumental in the determination of bank performance. Consequently, each of these forms of market risks are discussed and hypothesized below:

2.1. Interest Rate Risk and Banks' Performance

Interest (or lending) rate is a percentage of the principal the borrowers pay to use the money they borrow from creditors. Udoezika & Orjinta (2021) submitted that, both interest rates and bank performance moves in linear fashion such that a higher interest/lending rate leads to higher bank performance. This is because when the interest rate is high, banks are expected to make more money as they will have to take advantage of the huge interest rate differentials *i.e.* the variance which is the difference between the amounts which the bank generates from investing in comparison to the amount the bank pay customers as the interest on deposit. These further signal that banks gain more from charging high interest rate over and above interest rate on deposit received. This is however not in all cases since a higher interest rate/lending rate may dissuade the deficit economic units from seeking bank loans as a result of high cost of services on the borrowed funds. This in turn has the capacity to reduce bank profitability too since banks make profit from interest rate differentials (Aluko, Kolapo, Adeyeye, & Oladele, 2019). Similarly, Sathyamoorthi, Mapharing, Mphoeng, & Dzimiri (2020) showed that, interest/lending rate exerted adverse considerable impacts on ROA and ROE of Banks in Botswana. However debt ratio had adverse yet minimal effects on ROA and ROE of Banks in Botswana. Meanwhile, aggregate debt to assets ratio reported direct yet minimal effects on ROE only. Furthermore, loan deposit ratio reported high adverse considerable impacts on ROA and ROE of Botswana's banks from 2011-2018.

Mansyur (2017) investigated financial risk on financial performance in Indo-

nesia from 2011-2015. The study employed the path analysis in its methodology. Findings suggests that liquidity, foreign exchange risk does not affect bank performance while interest rate risk and credit risk were significant but they were moving in negative and positive directions. Similarly, Maniangi (2018) examined financial risk and bank performance using 44 commercial banks in Kenya between 2006-2015. The study was a primary data-based study and a sample size of 220 respondents was used. Findings suggest that there is a significant positive relationship between interest rate risk and bank performance.

Arising from these contradicting views, this study hypothesizes that: *IRSK exerts no effects on ROAS of Nigerian banks (Hypothesis 1).*

2.2. Foreign Exchange Risk and Banks' Performance

Foreign exchange risk otherwise known as currency risk is said to occur if a bank incur huge loss due to currency fluctuations (Agbeja, Adedokun, & Udi, 2016). Udoezika & Orjinta (2021) were of the opinion that every international business is affected by the ever-changing currency worth implied in the contracts.

Isaac (2015) investigated foreign exchange risk on bank performance in Nigeria between 1997 and 2013. The study employed the ordinary least square in its methodology. Findings from the study suggest that foreign exchange risk has a significant effect on bank performance.

Hence, the study emphasizes that, studies on foreign exchange risk bank performance are few. Notwithstanding t, the scanty empirical literature on foreign exchange risk, we hypothesize that *FXRSK exerts no effect on ROAs of banks in Nigeria (Hypothesis 2).*

2.3. Equity Risk and Banks' Performance

Equity risk, at its most basic and fundamental level, is the risk associated with holding common or preferred equity. Although investors can build equity in various ways, including paying into real estate deals and building equity in properties, equity risks are risk associated with the purchase of either common or preferred equity. Consequent upon the paucity of empirical literature of equity risk and banks performance, we hypothesize that *EQRSK exerts no effects ROAs on Nigerian banks (Hypothesis 3).*

2.4. Capital Adequacy Risks- and Banks' Performance

Capital adequacy is the capital which a bank needs to hold as stipulated by its financial regulators. It is a parameter which guarantees whether, a bank has enough equity to sustain her from operating losses while trying to honour withdrawals. This parameter is measured in terms of aggregate capital in relation to aggregate risk-weighted-assets which show the amount of capital an institution holds relative to the risk profile of its assets. Capital adequacy is evaluated using the minimum core capital which is the absolute amount of capital that institutions are required to maintain at all times for banks and mortgage finance com-

panies as a requirement by the apex bank (Olalekan, Mustapha, & Irom, 2018) Udoezika & Orjinta (2021) concluded that bank capital base influenced banks' Performance (ROA) positively.

Majumber & Li (2018) investigated the effect of bank capital requirement on the risk and performance of banks in Bangladesh. The study used OLS in its methodology. Findings however, revealed that there is an inverse relationship between performance and risk.

However, the question is, what extent of capital do a bank need to achieve high performance? Arising from this, this article hypothesize that, CARSK exerts no effects on ROAs of Nigerian banks (Hypothesis 4).

The foregoing assertions are diagrammatically presented in **Figure 1**.

2.5. Theoretical Framework

This study draws strength from the signaling theory (SIT) and the financial distress theory (FDT). The Signaling theory was propounded by Spence in 2002. This theory states that, most times, managers have more perfect knowledge/information about market risk than shareholders (Auronen, 2003; Spence, 2002). Hence, managers are employed to manage bank risk. However, managers relate the market risk to shareholders based on the information presented in the financial statements. As such, if they manage it efficiently, bank performance will increase significantly. Since market risk retards banks' ability to achieve it profitability objective, it is paramount that such risk is curtailed. Consequently, asymmetric information occurs when considering the risk taking tendencies of bank managers on banks' overall performance.

Secondly, FDT was developed by Baldwin and Scott in 1983. The theory holds that, a firm/bank is said to be in distress if it fails to pay all its outstanding debt as at and when such obligation is due. This occurs if such firm/bank fails to meet up all its debt covenants and also starts reducing the amount paid to shareholders as dividends. In the case of the banking industry, such situation is said to

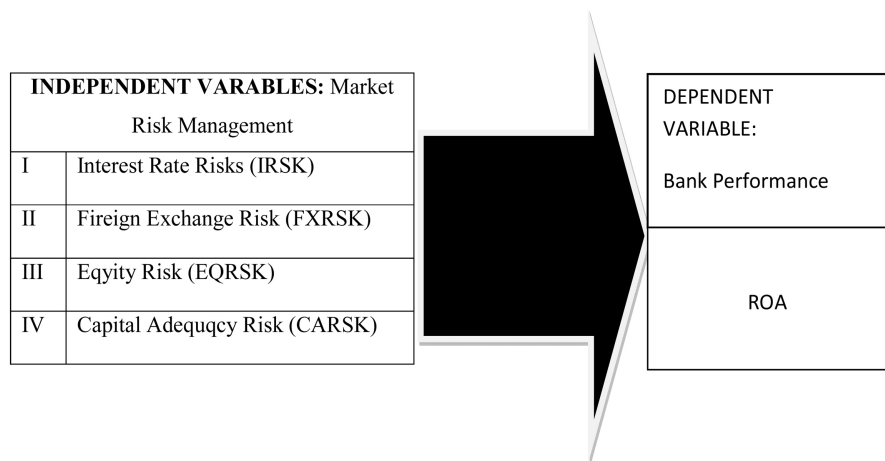


Figure 1. Relationship between independent variable (Market risk management) and dependent variable (bank performance). Source: Researchers' theoretical constructs (2022).

happen if banks stops honouring deposits and disbursing approved loans. This in turn may lead to panic withdrawal by depositors which eventually leads to a bank run and later bank failure. Another sign is increasing non-performing loans at an uncontrollable rate. Hence, if proactive measures are not put in place especially in the case of panic withdrawal, such bank may collapse eventually (Wamalwa & Mukanzi, 2018). By implication, market risk has mixed effects on banks' performance.

2.6. Literature Gaps

From the literature reviewed above, there is no indigenous study that has used interest rate, foreign exchange, and equity risk to proxy market risks with focus on the 4th industrial revolution in Africa.

3. Methodology

This paper chose the Ex post facto research design. The central focus of this paper is on market risk management and banks' performance. Meanwhile, in terms of population, there are 8 banks with international presence, 11 with national presence, and 3 with regional presence. This culminated into a total of 22 quoted banks as at 31st December, 2021. However, the paper only sampled 15 banks due to the followings:

1) The 3 banks with regional presence which are Globus Bank Ltd, Suntrust Bank Nigeria Ltd, and Providus Bank Plc. do not have complete data. Hence, they were removed from the sampling frame. This culminated to 18 banks left in the sample.

2) The annual reports of 3 banks with national presence such are Citibank Ltd, Titan trust bank Ltd, and Standard Chartered bank equally do not have complete data. Hence, they were dropped from the sampling frame. This culminated to 15 banks left in the sample.

The approach to arrive at the 15 banks is termed the multi-stage sampling which first involves subjecting the sampling units to more than one sampling approach. Hence, banks with unique financial reporting disclosure requirements were only chosen. Consequently, the study covered 15 banks for 10 years spanning 2011 down to 2020. This culminated to 150 observations.

The start of 2011 is chosen because this period is generally considered as the heat of the financial crisis in which the first severe sub-prime losses were incurred. However beyond 2011, many banks were still illiquid after the completion of the capitalization exercise. Our model has ROA as the dependent variable which is expressed as a function of market risk variables measured by IRSK, FXRSK, EQRSK, and CARSK. This is econometrically stated below (Table 1):

$$ROA_{it} = \beta_0 + \beta_1 IRSK_{it} + \beta_2 FXRSK_{it} + \beta_3 EQRSK_{it} + \beta_4 CARSK_{it} + \varepsilon_{it} \quad (1)$$

where,

ROA stands for returns on assets;

Table 1. Operationalization of variables.

Variables (code)	Operational Definitions	Prior Studies where inspiration were drawn from
Dependent Variable (Performance)		
ROA	Net Income/Total Assets	Onyefulu, Okoye, & Orjinta (2019), Agbeja, Adelokun, & Udi (2016)
Independent Variables (Market Risk proxies)		
IRSK	log of Net Interest Margin (NIM) or Difference between the cost of borrowing and return on saving (investment) by bank customers	Agbeja, Adelokun, & Udi (2016).
FXRSK	Measured as the log of exposure in a certain currency, multiplied with the variation in time of the foreign exchange.	Agbeja, Adelokun, & Udi (2016).
EQRSK	Log of Variance between the expected return and the actual return provided by an investment.	Udoezika & Orjinta (2021).
CARSK	Measured as Tier 1 capital + Tier 2 capital/Risk weighted assets	Udoezika & Orjinta (2021)

Researchers' conception (2022).

IRSK represents interest rate risk;
 FXRSK stands for foreign exchange risk;
 EQRSK means equity risk;
 CARSK represents capital adequacy risk;
 ε_i stands for the error term.

4. Results Estimation and Discussions

The paper conducted some preliminary data tests namely: descriptive statistics, correlations, panel unit root test, Kao Cointegration test, alongside various diagnostic tests. The formulated hypotheses were tested and analyzed using the panel regression methodology. Justifiably, the regression estimates were used to either reject or accept the hypothesis based on its p-value at 5% significant level. Each preliminary data tests are presented and discussed in **Tables 2-5**.

Table 2 reported that, the sampled banks ROA has a mean value of 15.68% with a maximum value of 91.95% and a minimum value of -42% respectively. The large difference between their highest and lowest values indicates that their performance differs greatly. This evidenced that, the banks are homogeneous in nature. This large extreme value recorded by ROA implies that some sampled

Table 2. Descriptive statistics analysis.

Variables	Mean	Maximum	Minimum	Standard Deviation	Observations
ROA (%)	15.68085	91.95000	-42.0000	1.919932	150
IRSK (%)	16.95100	18.99000	15.14000	15.90120	150
FXRSK (%)	0.014500	0.230000	-0.15000	0.013283	150
EQRSK (%)	1.643100	9.330000	0.010000	1.191495	150
CARSK (%)	15.64085	39.88000	0.100000	12.89588	150

Source: Researcher Computation (2022).

Table 3. Correlation analysis.

	ROA	IRSK	FXRSK	EQRSK	CARSK
ROA	1.000000				
IRSK	-0.088522	1.000000			
FXRSK	-0.005277	-0.021434	1.000000		
EQRSK	-0.065728	0.063558	-0.017196	1.000000	
CARSK	-0.087358	0.101758	0.016386	0.029336	1.000000

Source: Researcher's summary of correlation result (2022).

Table 4. Panel unit root test (Levin, Lin & Chu t^* unit root test).

Variable	Chi-square	P-value	Order of Integration	Decision
ROA	-3.73787	0.0001	1(1)	Stationary
IRSK	-7.87482	0.0000	1(0)	Stationary
FXRSK	-4.54812	0.0000	1(0)	Stationary
EQRSK	-2.44602	0.0073	1(0)	Stationary
CARSK	-5.14320	0.0000	1(0)	Stationary

Source: Eviews output (2022).

Table 5. Kao residual cointegration test.

	t-Statistic	Prob.
ADF	-2.910683	0.0005

Source: Eviews output (2022).

banks performed very profitably while others performed poorly. This therefore means that banks with mean value of ROA higher or equal to 15.68% are high profitable banks while banks with the value below 15.68% are low profitable banks. Hence, Nigeria banks had been efficient enough to generate a higher rate of ROA.

IRSK have a mean/average value of 16.95 and a deviated by 15.90% suggesting

considerable clustering of IRSK for the distribution around its mean. The maximum, minimum values are 18.99%, and 15.14% respectively. FXRSK have the following figures for: maximum, minimum, and mean: 0.23%, -0.15% and 0.01%. Whereas, EQRSK values for maximum, minimum and mean: 9.33%, 0.01% and 1.64% values CARSK has a minimum value of 10% and a maximum of 39.88%; an average (mean) of 15.64% with a standard deviation of 12.89%. The average amount of CARSK is higher than the lowest capital requirement of the BASEL and Central Bank of Nigeria (15%) showing that the banks have the ability to bear loss results from a loan default. It is an indication that all variables clustered around their average values. This means that there are no distortions in the regression process. This also justifies the use of panel least square estimation techniques. Hence, any recommendations made to a very large extent would represent the exact nature/characteristics of the study population.

Table 3 was used to establish the degree and nature of association between market risk components and bank return on assets. From the above, IRISK exhibited a positive but very weak association with EQRSK and CARSK (IRSK/EQRSK and CARSK = 0.063 and 0.10) while IRSK exhibited a positive but very weak association with FXRSK (IRSK and FXRSK = -0.02). More so, FXRSK exhibited a negative but very weak association with EQRSK (FXRSK and EQRSK = -0.017). Furthermore, FXRSK was positively correlated with CARSK. Similarly, equity risk has positive but weak correlation with CARSK. Therefore, these relationships indicate low likelihood of multi-collinearity problem.

The Levin, Lin and Chu t unit root test evidenced that all the study variables are stationary at levels except ROA. This evidenced that the result is not spurious.

To further revalidate the model is stationarity stated in **Table 4**, the Kao cointegration test is presented in **Table 5**. The result evidenced that, market risk has a long run effect on performance (ROA) of DMBs in Nigeria.

4.1. Robustness Check

To ensure that the model is well-fitted for prediction, the variables were subjected to the following robustness check:

The various robustness checks in **Table 6** evidenced that, no omitted variable (*i.e.* the model is correctly-specified), Homoskedastic, the random effect model (REM) is preferred over the fixed effect model (FEM), and Panel Least Square (PLS) is preferred over the REM. To further check the above claim, we conducted Variance Inflation Factor (VIF) and the Tolerance value (TOV) result is provided in **Table 7**.

From **Table 7**, the average VIF value is 1.5232. Since it is less than 10, it depicts that, the effect of multi-collinearity is negligible. Given these test results, all the variables were maintained in the regression model which also justifies the use of panel least square (PLS) estimation techniques in running the analysis which informed the presentation and discussions.

Table 6. Robustness checks.

Robustness Checks	F-statistic	Prob. Chi-Square	Conclusions
Ramsey RESET Test	0.318118	0.5736	No omitted Variable
Heteroskedasticity Test	0.871081	0.9723	Homoskedastic
Hausman Test	8.302191	0.1307	Random Effect Model is preferred
Breusch Pagan Test	0.327332	0.5672	Panel Least Square is preferred

Source: Summary of regression result (2022) from E-views.

Table 7. VIF and TOV tests.

Variable	VIF	TOV
IRSK	1.3597	0.7355
FXRSK	1.1048	0.9051
EQRSK	1.3682	0.7309
CARSK	2.2601	0.4425
Average VIF	1.5232	0.7035

Source: Researcher's summary of VIF and TOV result (2022).

4.2. Result Presentation and Discussions

To examine the effect of the regressor (IRSK, FXRSK, EQRSK, and CARSK) on the regress and (ROA), we employed the panel regression analysis since the data had both time series and cross-sectional series properties (2011-2020). **Table 8** presents the PLS result estimates:

From the result in **Table 8**, the study observed that the R. squared value was 0.44 (44%) and the R-squared adjusted value was 0.3409 (34.1%) approximately. The R-squared value, that is, the coefficient of determination value stood at 44% which implies that 44% of the systematic variations in the dependent variable were explained in the model while about 56% were unexplained thereby captured by the stochastic error term. This reveals that about 44% ROA can be attributable to the market risk components selected for the study.

Furthermore, the F-statistics value of 2.419 and their P-value of 0.0006 depicts that the market risk is significant statistically on the overall. This confirms the appropriateness of our model. The Durbin-Watson stat. value of 2.069 depicts that the model is well spread since the value is approximately 2 signals noauto-correlation problem and that error are independent of each other.

Individually, IRSK showed a negative coefficient value of -1.315 , t-value of -1.262 and a P-value of 0.2085.

4.3. Interest Rate Risk and ROA

The inverse coefficient value of -0.252105 depicts that, IRSK is negatively related

Table 8. Summarized panel least square (short run estimate).

Regress and: ROA			Periods covered: 10	
Cross-sectional units: 15			Total observations: 150	
Variables	Coefficients	Standard Error	t-Statistic	Prob.
C	1.653440	0.629272	2.627544	0.0100*
IRSK	-0.252105	0.064990	-3.879132	0.0002*
FXRSK	-0.480082	0.070991	-6.762588	0.0000*
EQRSK	0.020320	1.111168	0.018287	0.9854
CARSK	-0.724333	0.139068	-5.208489	0.0000*
R-squared	0.440204	F-statistic		2.419180
Adjusted R-squared	0.340913	Prob (F-statistic)		0.000653
Durbin-Watson stat				2.069209

Note: *Signals significant at 1% level. Source: Summary of regression result (2022) from E-views.

to bank performance in Nigeria. This means that a percentage (%) rise (fall) in banks ROA is associated with a corresponding fall (rise) in the IRSK. By implication, if IRSK is not monitored appropriately, most of bank earnings will be used to pay interest. The t-value of -3.879132 reveals that banks IRSK has an inverse effect on ROA and such impact is significant. Findings are in tandem with [Mansyur \(2017\)](#) but at variance with [Udoezika & Orjinta \(2021\)](#); [Maniangi \(2018\)](#) and [Sathyamoorthi et al. \(2020\)](#).

4.4. Foreign Exchange Risk and ROA

Similarly, FXRSK has negative and significant effects on ROAs of Nigerian banks having recorded an adverse coefficient value of -0.480082 . By implication, this means that a 1% fall/rise in FXRSK results to a corresponding rise/fall in ROA of banks. Invariably, this means that increases in the risk of FXRSK of Nigerian banks decrease the likelihood for them to make profit. Findings are at variance with the works of [Isaac \(2015\)](#).

4.5. Equity Risk and ROA

Furthermore, both EQRSK and ROA are linear. By implication, this means that a 1% increase in EQRSK management increases ROA of banks while 1% decreases in the EQRSK of Nigeria banks reduces bank profit margin. The t-value of 1.199 reveals that banks EQRSK has negligible effects on ROA of the targeted banks. This further connotes that, EQRSK improves ROA of banks minimally.

4.6. Capital Adequacy and ROA

As indicated in [Table 5](#), CARSK have adverse effects on ROA. This means that banks with lower CARSK have more incentive to increase their profitability base traceable to effective risk management. By implication, this means that a 1% de-

crease in CARSK management increases banks' ROA. This means that as CARSK increases, it decreases the likelihood for Nigerian banks to make huge profit to a very large extent. Findings are in tandem with the outcome of Majumber & Li (2018).

5. Conclusion and Recommendations

Signaling from the various results discussed above, the study concluded that, market risk measured by IRSK, FXRSK, and CASK decreases the likelihood for Nigerian banks to make a huge profit to a very large extent in the periods under review. As such, if Nigerian banks desire higher incomes especially in this era of 4th industrial revolution, they need to optimally manage their market risks. Also, policy makers and bank regulators need to review the external factors which influence bank performance in other for them to continually maintain their capital base and at the same time manage both their interest and foreign exchange rates properly.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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