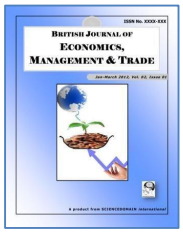

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Macro-Stress Testing in Deregulated and Consolidated Regimes: Episode of Nigerian Banks

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Authors' contributions

This work was carried out in collaboration between all authors. The study was designed by the NU and he contributed immensely to the literature review. Author NP read through the work and did major corrections where necessary before the submission; while author AA developed the model and managed the analysis. Finally all the authors approved the manuscript.

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ABSTRACT

The study provides a modified credit risk to reveal the relationships between a set of macroeconomic variables and bank risk in Nigeria for 1981 to 2013 using time series data from the various volumes of the CBN Statistic bulletin and the annual financial review of the banks. The results reveal that growth rate, interest rate and monetary policy rate have significant relationships with credit risk while unemployment and money supply maintain zero relationships. However, the strength of these relationships is found to be stronger in the regime of consolidation than deregulation era in Nigeria.

Keywords: Macroeconomic variable; credit risk; wilson; deregulation; consolidation; Nigeria.

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1. INTRODUCTION

Macro-stress tests were parts of the provisions of the Financial Stability Assessment program (FSAP) which was established by International Monetary Fund (IMF) and World Bank (WB) in 1999. In the light of recently inter-country financial crises, the potential impact of the banking sector on economic stability that is quantified through stress testing or scenario analysis has attracted the interests of monetary authorities, investors and scholars to different magnitudes. To be precise, macro stress testing involves an empirical process of determining the level of risk exposure of the banking system or any other financial oriented systems to severe but plausible shocks. Thus, the essence of stress testing is to reveal the degree of vulnerability or the extent to which a system is prone to un-expectations.

The empirical episode of stress testing is originally introduced by [1]. In his study, he models default risk to be explicitly linked with some set of macroeconomic variables and this model is based on relatively simple logistic function employed in regression analysis. Also, in the most recent time, [2] suggests the logistic model for estimating inputs to stress testing modeling. [3,4] adopt the Wilson's framework in Austrian banking sector. Their studies primarily estimate the relationship between macroeconomic variables and credit risk for corporate default rate. Later on, [5] update the study of stress testing model for the Austrian National Bank. In the same token,), [6] and [7] initiate the macroeconomic variables for finish economy. All of these studies are similar and they are rooted on the logistic credit risk model of [1].

Besides these studies, there are several other ones that examine the nexus between macroeconomic variables and banks' balance sheet items of different countries. For instance, [8] employ vector Autoregression (VAR) mechanism using Non performing Loans (NPLs) and macroeconomic variables respectively for explained and explanatory variables in the Nordic countries- Germany, Belgium, United Kingdom, Greece and Spain using pooled data regression analysis for a period 1980 to 2002. Even, [9] analyse the potential impacts of monetary responses to supply and demand side shocks on banks' losses in Norway. Their findings majorly explain how stress tests could be integrated into a country's monetary policy decision making process. It is obvious that most of these studies are carried out in advanced countries, leaving emerging African countries including Nigeria uninvestigated on this subject matter. Without equivocation, this seemingly gap attracted our concern to examine the risk exposure of Nigerian banks in two interdependent regimes (i.e. deregulation and consolidation) which other studies have not explored. The rests of the paper are organized as: section 2 literature review; section 3 methodology and data; section 4 empirical results; section 5 conclusion and recommendations.

2 LITERATURE REVIEW

The study of [10] shows that the relationship between economic cycle and bank risk exposure is dialectical. [11] posit that in a healthy economic climate, both borrowers and lender are confident about investment projects and their abilities to amortize their obligations. Therefore, as macroeconomic environments worsened at a time of recession or stagnation, the risk associated with intermediation tends to increase drastically. Since banks are vulnerable to adverse selection and morally hazarding behaviour of their borrowers it is plausible for them to adopt stringent credit standards in order to reduce risk as suggested by [12,13].

Also, [12,10,2,14,15,16,17] confirm in their respective studies that there is contemporaneously negative relationship between Gross domestic product and non-performing loan. Contrary, [18] find zero relationship between gross domestic product and credit risk in Sub Saharan Africa countries. This position is evident in the findings accredited to [19,20] in the banking systems of Austrian and Slovenian. [19,20] conclude that the effect of inflation on the bank profit margin depends on whether the operating expenses rises at a faster rate than inflation. Therefore, Inflation is a distinct macroeconomic factor that influences the variability of banking sector risk exposure. Inflation erodes the net value of money which in turn generally, reduces the rate of return on investments. High inflation rates are generally associated with a high loan interest rate. In essence, high interest rate increases cost of lending, which fosters an increase in the debt obligations of investors, consequently leading to

an increase in the credit risk of the banking sector. [1] investigate the relationship between current inflation and one year lag inflation with credit risk and discover direct relationship between current inflation and credit risk and zero relationship between one year lag inflation and credit risk in the government owned banks. Also, their results reveal that there is no any relationship between inflation and credit risk in the private sector owned banks. Analogously, [14,21] empirically investigate the impact of inflation on credit risk in North Cyprus and Euro Zone countries and document monotonic relationship between them Interest rate seems to be a strong determinant of credit risk because it influences the debt burden of borrowers. This means that the trade-off between interest rate and credit risk is expected to be positive. In fact, a rise in debt burden caused by an upward increase in interest rates could lead to a higher rate of classified loan [20,22, 23]. [24] discovers a significant but negative relationship between real interest rate and bank failure. Contrary, [25] in Sub-Sarahan Africa finds positive relationship between real interest rate and credit risk. This implies that a rising interest rate could trigger the cost of investment and thereby necessitate higher possibility of default or failure to honour debt obligations consequently leading to non-performing loans. In different study, [10] employ interbank interest rate to measure the impact of interest rate on toxic loans. They find a significant and positive relationship between toxic loans and interest rate. [26] discovers the same relationship between the interest rate measured by ten year Italian Treasury bond and the loan loss provision. [17] conducts study in Greece, Ireland, Portugal, Spain and Italy (GIPSI) from 1997 to 2011 and discovers monotonic relationship between long term interest rate and credit risk. This overwhelmingly supports the convention that high interest rate increases the obligation of borrowers and thus increases the banks credit risk or failure. In Australia, [27] find no any significant relationship between short-term interest rate and credit risk. The model of [28,29] predicts that in an instance of a positive productivity shock, rates of inflation and interest are bound to fall while output increases. It is further asserted in the model that the deposit rate moves in the same proportion with the policy rate. Thus, a reduction in the interest rate associates with a decrease in the cost of banks' funding. Also, a decrease in the deposit rate raises the probability that returns of projects are high enough to cover the all claims of depositors. The reduction in interest rates reduces banks' return on assets. This reduction together with the more fragile balance sheet composition increases bank risk. Invariably, banks optimally increase the ratio of external funding in an attempt to maximize return to bank capital. [30] [16,31] in their studies of Honkong, Tunsian and Romanian banking sectors, find inverse relationship between inflation and credit risk. However, some other studies by [20,32,17] in cases of Solvenian, Italian, and GIPSI banking systems, maintain no any relationship. [32] Find direct relationship between money supply and credit risk in Italian banking system. But conversely, [25] discovers no relationship between money supply and credit risk. [17] studies the relationship between exchange rate and credit risk in Greece, Ireland, Portugal, Spain and Italy, from 1997 to 2011 and finds negative relationship between them. In the same token, [16] conduct study in Tunisia and employ ratio of risk weighted assets to total assets as proxy of credit risk and document negative trade-off between exchange rate and credit risk and the same result is evident in north Cyprus by [14]. [33] conclude that increased exposure to credit risk lowers profits; while [34] affirms that bank failures triggered by stress may result in a credit crunch.

3. METHODS

The study employs and modifies [1], credit risk model. The specification of Wilson apparently relates default risk to some set of randomly selected macroeconomic variables and it is rooted on the relatively simplicity of the logistic equation often employed in ordinary Least Square regression analysis. Wilson's specification is characterized with non linear logistic functions which are more empirically suitable for analyzing a relationship in a non linear model than the linear ones. Wilson's model was first developed for Mckinsy Company as credit portfolio specification which placed credit risk proxied by default rate as an explained variable on macroeconomic variables. Thus, our specification expresses a relationship between credit risk and some macroeconomic variables. The specification follows a logical process as:

In the first place, we have to develop the banking sector-specific index which is arrived as follows:

$$cc_{b,t} = (1 + e^{-y,t})^{-1} \quad (1)$$

The equation can be rewritten as follows

$$cc_{b,t} + cce^{-yb,t} = 1 \quad (2)$$

$$cce^{-yb,t} = 1 - cc_{b,t} \quad (3)$$

$$\ln [cc_{bt}] = \frac{1- cc_{b,t}}{[y_{b,t}]} \quad (4)$$

Therefore,

$$Y_{b,t} = \frac{\ln[cc_{b,t}]}{[1-cc_{b,t}]} \quad (5)$$

Where: $y_{b,t}$ is the banking sector-specific index at time (t), ln is the natural log, $cc_{b,t}$ is the classified credit ratio (i.e. default at time (t))

Therefore, we employ [3] approach to formulate the banking sector-specific index ($y_{b,t}$) which is contrary to the approach adopted by [6] .

Note: lower value of $y_{b,t}$ with lower $cc_{b,t}$ implies healthy state of the economy. Hence, index ($y_{b,t}$) represents overall state of the economy and it can be expressed as the linear function of any exogenously selected economic factors, thus:

$$Y_{b,t} = \lambda_0 + \beta_t \sum_{t=1}^{n} x_{,t} + \mu_t \quad (6)$$

t = 1, 2'……,n
n = number of explanatory variables.

Where: λ_0 is the intercept; β_t takes value from β_1 β_2, β_3 …… β_n for the set of regression coefficients related to the selected macro-economic factors; x_t takes value from x_1 x_2, x_3, …….. x_n for the selected economic variables, and μ_t is the stochastic error term which is assumed to be independent and identically distributed i.e. $\mu_{s,t} \sim Ð(o, \delta_t^2)$
In line with the literature, the macro-economic variables that are selected are GDP growth rate (Gr), changes in money supply (Δms), interest rate (Ir) monetary policy rate (mpr) and unemployment rate (Ur). Thus, equation (6) can be restated as follows:

$$Y_{b,t} = \alpha_0 + \alpha_1 Gr_t + \alpha_2 \Delta ms_t + \alpha_3 Ir_t + \alpha_4 mpr_t + \alpha_5 Ur_t + \varepsilon_t \quad (7)$$

To capture the effects of deregulation and consolidation policies on banking sector specific index, we proxy them with dummy variables in which case deregulation takes dum (1) and consolidation takes dum (2); then equation (7) becomes:

$$Y_{b,t} = a_0 + a_1 Gr_t + a_2 \Delta ms_t + a_3 Ir_t + a_4 mpr_t + a_5 Ur_t + a_6 dum(1) + w_t \quad (8)$$

$$Y_{b,t} = b_0 + b_1 Gr_t + b_2 \Delta ms_t + b_3 Ir_t + b_4 mpr_t + b_5 Ur_t + b_6 dum(2) + z_t \quad (9)$$

3.1 Data Source

The data that are applied in this study are purely secondary data in nature. The data relating to non classified credit are collected from the annual statement of account for each of the banks; while, growth rate, money supply, interest rate, unemployment rate and monetary policy rate data are sourced from the various volumes of CBN statistical bulletin to cover a reasonable period of years ranging from 1981 to 2013.

4. DETERMINATION OF OPTIMUM LAG LENGTH

The conducts of unit root test, Granger Causality test and other similar tests are hinged on maximum lag length. Therefore, we determine the maximum lag strength applicable in this study using the appropriate information criteria as selection techniques. The results of these techniques are reported in Table 1

Table 1. Optimum lag length selected by all information criteria

Lag	Log 1	LR	FPE	AIC	SC	HQ
0	-26.6	NA*	0.72	2.51	2.80*	2.59*
1	-25.7	1.31	0.73	2.52	2.85	2.61
2	-25.15	0.76	0.77	2.55	2.94	2.66
3	-23.20	2.56	0.72*	2.48*	2.91	2.60
4	-22.25	1.17	0.73	2.48	2.96	2.62
5	-22.22	0.03	0.80	2.56	3.09	2.71

*Note: * implies lag order selected by the criterion, LR: means sequential modified LR test statistic. FPE: Final prediction error. AIC: Akaike Information criterion. SC: Schwarz Information criterion. HQ: Hannan-Quin Information criterion.*
Source: Researcher's Computation

Table 1 presents the optimum lag order selected by each of the all information criteria. The results show that SC and HQ provide evidence in support of zero lag order; while FPE and AIC select maximum lag length of 3. LR does not select any as indicated in the table. Since, the AIC is employed when considering the predictive power of a model; it is therefore plausible to use the lag order select by AIC for the conduct of various tests adopted in this study.

4.1 Determining the levels of Stationarity of Variable Series

It is generally agreed that any time series regression conducted without testing for the presence of a unit root may lead to spurious or nonsensicant conclusion. Hence, to avoid doubt, we conduct a unit root test using Augmented Dickey Fuller (ADF) technique. The ADF test is conducted for the specified variables series under the assumption of intercept, based on 3 maximum lag lengths as selected by the Akaike Information criterion (AIC). Also, for the purpose of uniformity 1 percent Mackinnon critical value is chosen for comparison with the ADF statistic in all the variables series. The results of the ADF test are reported in Table 2.

Table 2 summarizes the results of the unit root test at first difference. It is observed that the ADF statistics are larger than the Mackinnon critical statistics for each of the variables. Therefore, all the specified variables are stationary when they are integrated of order one I (1). Since the variables are I (1) compliant, further empirical investigation can be conducted as follows:

4.2 Examining the Nature, Size and Magnitude of the Short-run Relationship among the Specified Variables

In this study, we apply step-wise regression analysis to select the macro economic variables that explain default rate properly. However, in consonant with the work of [35] coupled with the fact that our sample period is relatively short; our final model include as few explanatory variables as possible. The estimated values of the model (i.e. equation3.8 in section three) are reported in Table 3.

Table 3 depicts the results of the credit risk model for Nigerian banking sector over a period of 1981 to 2011. The observed t-values for economic growth rate; cost of capital or interest rate and monetary policy rate are 2.08, -2.75 and 1.78 respectively. Given a critical t-value of 1.70 at 5 percent level of significance; the null hypothesis that growth rate, cost of capital and monetary policy rate do not have significant influence on the variable of default rate is rejected. Thus, the credit risk exposure of the banking sector in Nigeria is significantly influenced by the combination of three macro economic factors. In an equal token, the t-values for unemployment rate and rate of money supply are -0.48 and -1.48 respectively. These values are less than the critical t-value (1.70) in absolute terms; therefore unemployment rate and rate of money supply do not exert significant contribution to risk exposure in the Nigerian banking sector.

Table 2. Unit root test results based on ADF statistics for the specified series

Variable	ADF Stat	Mackinnon	Remark
Y(-1)	-8.36	-3.68	Stationary
GR(-1)	-6.37	-3.69	Stationary
UR(-1)	-6.04	-3.71	Stationary
MSR(-1)	-4.42	-3.71	Stationary
IR(-1)	-9.43	-3.69	Stationary
MPR(-1)	-6.39	-3.7	Stationary

Note (-1) represents lag one values of the variables; Source: Researcher's Computation

Table 3. Estimated values of the static credit risk model for Nigerian Banking Sector

Variable	Coeff. Value	Std error	t-value	P-value
Constant (α_0)	-1.04	(0.3)	[-3.47]**	0.00
gr (α_1)	1.46	(0.7)	[2.08*]	0.05
ur(α_2)	-0.25	(0.32)	[-0.78]	0.44
msr(α_3)	-1.42	(0.96)	[-1.48]	0.15
ir(α_4)	-2.45	(0.89)	[2.75]**	0.01
mpr(α_5)	1.56	(0.88)	[1.78]*	0.09

*Note: The figures in parentheses and brackets are the standard errors and t-statistics respectively. The critical t-value @ 5% level of significance is approximately 1.70 while the Adjusted R-squared an F-statistic for the credit risk model are 0.16 and 2.13 respectively. *and ** denote significant at 5% and 1% & 5% respectively; Source: Researcher's Computation*

Looking at the coefficient values of these factors as revealed in Table 3; it is true that unemployment rate, rate of money supply and interest rate have negative sign suggesting that an increase in unemployment rate, rate of money supply and cost of capital/loan could lead to a decline in default rate. This is possible because any increase in unemployment; money supply or cost of loan able funds may bring about a corresponding decrease in the rate of borrowing which may consequently decrease default rate. Growth rate has positive coefficient value which means an increase in economic growth may lead to high rate of borrowing to sustain the expected growth prospect; consequently the default rate may increase especially when unexpected financial crisis emerged. Monetary policy rate has a positive relationship with default rate. This is an indication that monetary policy could serve as control variable in our specified credit risk model; when annual default rate is high, the monetary authorities could propose policy to influence those macro economic variables that are causing a rise in default rate.

4.3 Effects of Deregulation Policy on the Credit Risk Exposure of the Nigerian Banking Sector

The study considers the deregulation policy that was initiated in 1986, as a dummy one variable in the credit risk model stated as equation 3.9. The estimated values of this equation are presented in Table 4.

The regression results computed from equation 3.9 are summarized in Table 4 According to these results, the deregulation policy proxied by dummy one has observed t-value of 0.31; meaning that there is positive but insignificant relationship between deregulation and default rate or credit risk exposure of the Nigerian banking sector. Therefore, the introduction of the deregulation policy into the Nigerian banking sector does not significantly influence the variations in the risk exposure assumed by the Nigerian banks. However, the policy has positive effect on default rate. This suggests that the more Nigerian monetary authorities relax control over the operations of the banking institution, the more likely the institution can be prone to default risk. Thus, guided regulation could be the alternative policy in Nigeria. Furthermore, the Adjusted R-squared of the Credit Risk Model without dummy one is 0.16 while that of the model with dummy one is 0.13. This is an indication that deregulation policy has reduced the joint contribution of all the explanatory variables stated in equation 3.8. In other words, deregulation policy has increased the number of residual factors that could determine the changes in default rate. This is not consistent with a-priori because deregulation policy is expected to reduce the level of risk exposure of the banking sector.

4.4 Effect of Consolidation policy on the Credit Risk Exposure of Nigerian Banking Sector

The consolidation policy was ushered in 2004 by the authority of the Central Bank of Nigeria (CBN). In this study, the policy is captured with dummy two as stated in equation 3.10. The regression results of this equation are reported in Table 5.

The regression results depicted in Table 5 show that the dummy two that captures consolidated policy has an observed t-value of -2.67. Given a critical t-value of 1.70 at 5 percent significant level, we can deduce that consolidation policy maintains negative but significant relationship with default rate. Thus, default rate decreases with an increase in capitalization rate or an increase in the equity capitalization rate or an increase in the equity capital of the banking sector reduces the risk of credit exposure of the sector. In a nutshell, our findings are overwhelmingly in favor of consolidation policy as a guided regulatory policy measure employed periodically as a tool of resuscitating the banking sector from failure. Also, it is clear from our findings that the most significant variable that explains Nigerian banking sector default rate is the cost of capital or interest rate while a guided deregulation policy takes the second position. Therefore, periodic intervention of the monetary authority is necessary in curtailing the risk exposure of the banking sector in Nigeria.

4.5 Examining the Break-down Effects in the Credit Risk Model adopted in the study

To analyze the dynamic properties of the system, we employ the forecast error variance decomposition (FEVDC) and impulse response functions (IRF) which are computed from the moving average (MA) represented of the VECM. In computing IRF and FEVDC, our ordering is as follows: growth rate, unemployment rate, rate of money supply, interest rate, monetary policy rate and credit risk. By introducing a one-period

standard deviation shock to one of the endogenous variables, the observable response of the system to the effects, either positive or negative are reported in Table 6; while the breakdown of the variance decomposition attributed to each endogenous variable is shown in Table 6.

The results of the impulse response functions (IRFs) are presented in Table 6. Since the target variable is credit risk; the IRFs analyze the effects of changes in growth rate, unemployment rate, rate of money supply, interest rate and monetary policy rate on changes in credit risk. The results reveal that for a period of ten years horizon credit risk displays positive relationships in the period except in years 6 & 10, with the specified variables in the system. This suggests that the relationships of the credit risk with the other variables break or change intermittently for the observed period.

The results of the variance decomposition as shown in Table 7 reveal that about 59.12 percent of the forecast error of the Nigerian banking sector credit risk is explained by its own innovations in the first period of estimation, and throughout the ten years estimation period, its own shocks fluctuate consistently over time. Also, the shocks of growth rate, unemployment rate, rate of money supply, interest rate and monetary rate appear to be inconsistent and respectively explain about 25.98, 5.75, 18.67, 7.76, and 19.98 percents variations in credit risk for the last period. However, we discover that among all the variables, growth rate is the most sensitive variable to credit risk in Nigerian banking sector.

Table 4. Variable for the Nigerian Banking Sector

Variable	Coefficient	Std error	t-value	Pvalue
Constant(β_0)	-1.1	(0.35)	[-3.12]**	0.00
gr (β_1)	1.37	(0.76)	[1.81*]	0.08
ur(β_2)	-0.23	(0.33)	[-0.70]	0.4
msr(β_3)	-1.6	(1.13)	[-1.42]	0.17
ir(β_4)	-2.53	(0.94)	[-2.68]**	0.01
mpr(β_5)	1.67	(0.96)	[1.74]*	0.09
dum1β_2	0.14	(0.46)	[0.31]	0.76

*Note: The figures in parentheses and brackets are the standard error and t-statistics respectively. The critical t-value @ 5% level of significant level is 1.70, while the Adjusted R-squared an F-stat are 0.13 and 1.73 respectively. * and ** denote significant at 5% and 1% & 5% respectively Source: Researcher's Computation*

Table 5. Estimated value of credit risk model with dummy two for Nigerian Banking Sector

Variable	Coefficient	Std error	t-value	Pvalue
Constant(α_0)	-0.87	(0.28)	[-3.12]**	0.00
gr (α_1)	1.19	(0.63)	[1.88]*	0.07
ur(α_2)	-0.26	(0.29)	[-0.90]	0.37
msr(α_3)	-1.1	(0.87)	[-1.26]	0.22
ir(α_4)	-1.9	(0.83)	[-2.29]*	0.03
mpr(α_5)	0.78	(0.84)	[0.94]	0.36
dum 2 (a_6)	-0.76	(0.28)	[-2.67]**	0.01

*Note: The figures in parentheses and brackets are the standard errors and t-statistics respectively. The critical t-value @ 5% level of significance is approximately 1.70 while the Adjusted R-squared an F-stat are 0.32 and 3.40 respectively. * and ** denote significant at 5% and both 1% & 5% respectively; Source: Researcher's Computation*

Table 6. Results of Impulse Response Functions (IRFs)[Response of credit risk to other variables]

P	GR	UR	MS	IR	MPR	Y
1	0.000000	0.000000	0.000000	0.000000	0.000000	0.575279
2	0.252217	-0.127297	-0.211671	0.156204	-0.006811	0.357428
3	0.254089	-0.202249	0.309644	-0.154883	0.305439	0.197885
4	0.129766	0.032257	-0.024080	0.077995	-0.097694	0.067363
5	-0.007257	-0.035374	0.098681	0.130265	0.038778	0.190418
6	0.030189	0.018364	0.062025	0.009551	0.055043	-0.047923
7	0.025412	0.023663	0.029926	-0.015412	0.056813	0.050982
8	-0.015226	0.010967	-0.062273	0.004420	-0.034787	0.032734
9	-0.018151	0.008068	0.001569	-0.001536	0.054095	0.064407
10	0.031109	0.003259	-0.007899	0.003448	0.015919	-0.009829

Source: Researcher's Computation

Table 7. Variance decomposition of credit risk for a period of ten years

P	S.E.	Y	GR	UR	MS	IR	MPR
1	0.208911	59.12118	11.45318	0.053990	14.04149	2.194130	13.13603
2	0.221479	34.04254	27.35920	2.959857	21.75629	6.432758	7.449354
3	0.270344	22.11672	26.92307	6.201160	19.96698	5.452810	19.33926
4	0.272387	21.40649	27.97853	6.063129	19.28955	5.854879	19.40742
5	0.293840	22.08205	26.56883	5.838814	18.13586	7.994443	19.38001
6	0.298453	22.07831	26.32406	5.818007	18.53317	7.918982	19.32748
7	0.302956	21.95494	26.28227	5.821634	18.40639	7.863889	19.67088
8	0.303729	21.86677	26.12649	5.796184	18.76401	7.820061	19.62648
9	0.304706	21.81397	25.95142	5.760632	18.69451	7.774619	20.00485
10	0.305831	21.84853	25.97943	5.754584	18.67079	7.764747	19.98192

Source: Researcher's Computation

5. CONCLUSION AND RECOMMENDATIONS

The study presents a fresh empirical study on macro-stress testing in Nigeria during deregulation and consolidation eras; by modifying the structure of the credit risk model of (35). The estimated values of this model reveal that growth rate, interest rate and monetary policy rate maintain significant relationship with credits. However, the direction of this relationship is found to be non-monotonic in the case of interest rate which does not justify the empirical stance of (16) but queue behind the work of (29). Furthermore, we discover that unemployment and money supply have consistent zero relationship with bad risk. Finally, our study reveals that while the deregulation policy fails to improve the strength of these relationships; consolidation does. Thus, we recommend that monetary authorities should always check the over bloated activities of the Nigerian banks to avert bank failure or minimize bad risk through regular consolidation framework. Also, banks should focus on higher interest rate with low debt profile whenever the monetary policy rate is unfavorable to them.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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