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Modelling Banks' Interest Margins in Nigeria

Ini S. Udom, Ngozi T. I. Agboegbulem, Ngozi V. Atoi, Abiola O. Adeleke, Ochoche Abraham, Ogochukwu G Onumonu and Murtala Abubakar¹

This study applied panel analysis to determine the factors influencing interest margins in Nigeria using bank-specific, sector-specific and macroeconomic data ranging from 2010:Q1 to 2014:Q2. Based on the Hausman test, a fixed effect model in a generalized form (GLS) was estimated. The result shows that credit risk, growth in loans and advances, staff operating cost, GDP growth, inflation rate and money supply growth are significant determinants of interest margins in Nigeria. Consistent with previous studies, staff cost exerts highest impact on interest margins followed by fixed effects term. Further analysis of the banks' fixed effects reveals that seven banks control about 64%, which raises a policy concern for banks' supervisors. The result also reveals that banks usually transfer their staff operating costs to customers by either imposing exorbitant lending rates or low deposit rates or both. This study recommends the formulation of strategies for reducing growing banks staff cost in the area of levels of compensation, employee turnover, redundancy, automation processes and outsourcing of non-critical tasks should be given due attention to ensure efficiency and competitive margin that could spur growth in Nigeria.

Keywords: Interest Margin, Panel Data Models, Weighted Least Squares

JEL Classification: C23, E43

1.0 Introduction

The intermediation role of Banks in the developmental process is acknowledged by the Government and other stakeholders in Nigeria. The financial system in Nigeria is dominated by the Banks. As at end 2013, total assets of the Deposit Money Banks (DMBs) stood at ₦24,468.3 billion constituting 80.3 per cent of total financial system assets. Insurance and Pension funds' assets represented 14.9 per cent while the other Non-Bank Financial Institutions accounted for the balance of 4.8 per cent. This shows that the bulk of the mobilization and allocation of funds is within the banking system. It therefore becomes necessary to examine the efficiency of this

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intermediation process. The major parameter for assessing this is net interest rate margin of banks.

Depositors are paid some amount as interest for parting with their funds while borrowers are charged some amount as lending rates for making use of the funds. The difference between the lending and the deposit rates constitutes the margin. Net interest margin or interest margin and interest rate spread (spread, in short) are used interchangeably in most literature. However, some authors prefer to use the term net interest margin when using *ex post* data (difference between interest income and interest expense of banks), while others prefer interest rate spread when focus is on *ex ante* data (difference between banks quoted lending and deposit interest rates) (see Enendu, 2003). In this study, to avoid ambiguity, *ex post* data was used and interest margin was defined in broad terms as the ratio of difference between interest income and interest expense to total assets for individual banks. High margin increases banks profitability but tends to decline the efficiency of financial intermediation process, and efficient financial intermediation is seen as a necessary condition for the achievement of price stability of the monetary authority and growth in the economy.

This margin has remained relatively high over the years in Nigeria with adverse implications for savings mobilization and investment. For instance, from January 2011 to June 2014, interest rate spread which mimics interest margin averaged 20.51 percentage points, compared with average consolidated deposit rate of 3.42 per cent. High margins imply interest rate movement in two directions and corresponding consequences. A lower deposit rate discourages savings and therefore reduces bank deposits, resulting in scarcity of investible funds. On the other hand, high lending rates curtail borrowing and investment. In an economy like Nigeria where the bulk of intermediation is by the banks, this scenario could stifle investment and curtail growth in the economy.

The question therefore is why should interest margins remained persistently high in Nigeria despite the reforms in the banking sector? Several reasons have been adduced for the high margins. Some have attributed this phenomenon to the market structure in Nigeria, arguing that the few big banks dominate the market and dictate the lending and deposit rates. Others have focused on macroeconomic and environmental factors like inflation, economic growth, market risk and operating cost.

The purpose of this paper is to investigate the determinants of interest margins in Nigeria, with a view to recommending policies that will reduce the spread. This study is significantly different from other similar studies done in Nigeria such as Enendu (2003), Onwioduokit and Adamu(2005) and Akinlo and Owoyemi (2012) in two important ways. Firstly, while others used annual data, this study used a higher frequency data. Considering the fact that interest rate is reported daily for policy decisions, a higher frequency data than annual would yield a better regression estimates. Secondly, while statutory returns of individual banks prepared based on the same prudential requirements were used in this study, other authors sourced data from the statement of accounts and annual report of individual banks.

The rest of the paper is presented as follows: following this introduction is Section 2, which presents brief overview of banking system and some macroeconomic indicators in Nigeria. Section 3 focuses on related literature, Section 4 is on data source and methodology used in the study while Section 5 presents the empirical results and its policy implications. Section 6 summarizes and concludes the paper.

2.0 Brief Overview of Banking System and Some Macroeconomic Indicators in Nigeria

The beginning of formal banking activities in Nigeria was traced to 1892, with the establishment of the First Bank by the African Banking Corporation. The early banking activities preceded the era of west African currency board, followed by the free banking era until the financial sector reforms was introduced in 1986, which saw the emergence of liberalized financial system in Nigeria. The liberalization of Nigeria banking system as part of the adoption of the Structural Adjustment Programme (SAP) in 1986 led to establishment of many private banks with inadequate capital. The existing 40 banks comprising of 28 commercial and 12 merchants banks in 1986 rose to 120 banks; 66 commercial and 54 merchants, before the end of 1992, implying that 80 banks; 38 commercial and 42 merchants, were established within the period. Consequently, there was increased drive for deposit mobilization which was accompanied by relatively high deposit interest rate, which also pushed up the lending rates thus further increasing the interest margin. Furthermore, banks with liquidity challenges sourced funds at the interbank market at high interest rates within the bands of 25 and 35 per cent,

which is transferred to borrowers in line with the theory of transmission mechanism.

However, the number of banks which declined from 120 in 1992 to 89 in 1998, due to the liquidation of 31 terminally distressed banks, further reduced to 25 after the successful banking consolidation in 2005. Due to the heterogeneous nature of banks interest rates pricing models, the Central Bank of Nigeria (CBN) originated a circular directing DMBs to include staff operating cost in the pricing model initially excluded before this period. The directive allows banks to construct bank specific all-inclusive risk-based interest rate pricing model and quote lending rates as fixed spread over the prevailing monetary policy rate (MPR). The latter is aimed at influencing lending rates and interest spread as the monetary policy committee changes the MPR on the basis of changes in the general price level, output or both. As at 2015Q1, there are 24 DMBs in operation consisting of 21 commercial (including 3 nationalized banks), 2 merchants and 1 non-interest.

Table 1: Average Deposit and Lending Rates: January 2011 to June 2014

Item	Consolidated	Maximum	
	Deposits Rate	Lending Rate	Spread
Average	3.42	23.93	20.51
Minimum	2.05	21.75	19.70
Maximum	4.75	26.07	21.32

From Table 1, the consolidated deposit rate is the weighted average of interest paid on saving and all tenured time and term deposits. The deposit tenor ranges from 7days to over-12months. The average consolidated deposits rate offered during the period of January 2011 to June 2014 was 3.42 per cent while the maximum lending rate was 23.93 per cent. Consequently, the interest rate spread which reflect banks' interest margin stood at 20.51 percentage points.

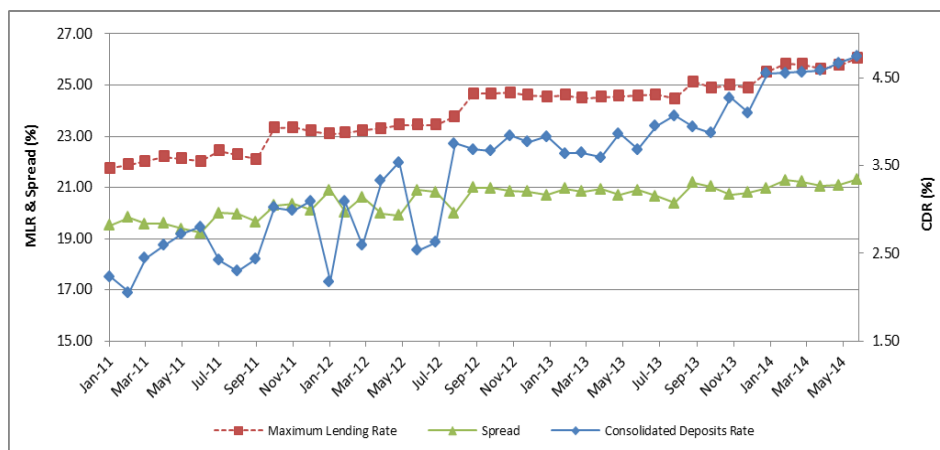


Figure1: Interest Rate Spread along with Consolidated Deposit and Maximum Lending Rates from January 2011 to June 2014

As presented in Figure 1, the time series plot of the average consolidated deposits rates from January 2011 to June 2014 ranges 2.05 per cent to 4.75 percent. The plot shows an upward trend of interest rate spread and the consolidated deposit rate remained significantly low over the sample period.

2.1 Behavioural Pattern of Determinants of Interest Margin in Nigeria Banks

Interest Rate Spread (IRS) in Nigeria, measured in terms of its broad definition is influenced by individual banks specific variables, banking sector specific parameters and some macroeconomic variables. The extent of responsiveness of IRS to these variables, using cross-section panel data, is examined in section 5. However, it is pertinent to examine the dynamics of these variables vis-à-vis IRS in an aggregated form in order to shed some light on the overall characteristics of Nigeria banks and possibly identify potential factors that could influence IRS. To achieve this, scatter plot of IRS against each of aggregated banks specific, banking sector specific and macroeconomic variables was used.

2.2 Aggregated Nigeria Bank Specific Variables

The Structure-Conduct-Performance in finance theory postulates that commercial banks lay the incidence of high operational cost on their customer through higher interest margin. Validating this hypothesis, Park and Weber (2006) and Tregenna (2009) empirically established positive relationship between IRS and banks operational cost. Figures 2 and 3 below express the

relationships between aggregate banks operational cost (staff operating cost and cost of physical capital) and IRS.

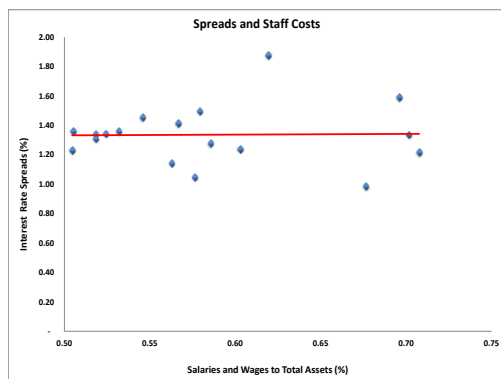


Figure 2: IRS and Staff Cost

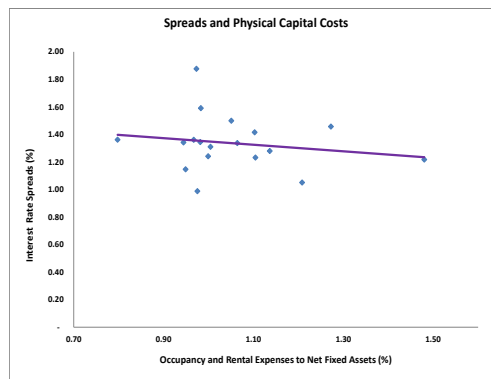


Figure 3: IRS and Cost of Physical Capital

Surprisingly, staff cost (measured as aggregate salaries and wages of the banking industry) and IRS depicts no relationship as shown in figure 2. Also, in figure 3, interest rate spread shows a slight negative response to changes in the cost of physical capital. The reflections of these scatter plot are deviations of theoretical expectation of positive relationship. This expected positive relationship may have been subsumed by the outlier observed in the interest rate spread during the fourth quarter of 2010. During that period, at the aftermath of global financial crisis, Assets Management Company of Nigeria (AMCON) was created to take up the eligible bank assets that had built up over the years to ensure that banks remain in business, some banks place strict restriction to credit access by way of interest rate hike as well downsizing of existing labour size. Consequently, interest income of banks rose significantly and operational cost declined. Again, the CBN advice for banks to reduce operational cost also cut across the efficient management of physical assets, which significantly brought down the cost of capital of some banks. However, the impact of the outlier may not be evident if individual effects of the banks are accounted for.

Scale of operations, measured by growth in banks credit to customers, is seen as another bank specific determinant of IRS. An increase in the scale of operations is expected to reduce the average cost of operations if the risk management system adopted by risk managers is efficient. This will consequently lower IRS because customers would be expected to benefit from the reduction in the average cost.

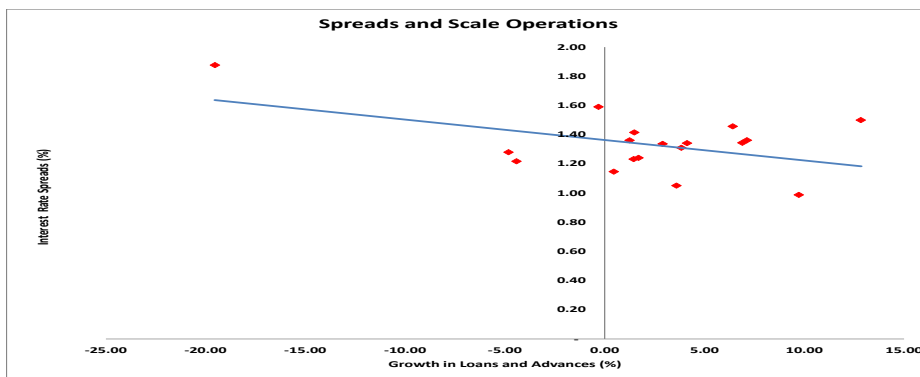


Figure 4: Growth in Loans and Advances (%)

Figure 4 establishes the existence of negative relationship between IRS and scale of operation of Nigeria banks, consistent with theoretical expectations.

Risk aversion and credit risk could be considered important determinants of IRS in Nigeria. Theoretical expectation holds that the more risk-averse banks are, the higher the proportion of the equity components of their total balance sheet capital. Thus, to moderate the fluctuations in profit, the deposit base must be shored-up through higher deposit rate. Therefore, increase in deposit rate when level of risk-aversion is high will tend to reduce the IRS. On the other hand, negative correlation is expected between IRS and credit risk captured (default risk) by the ratio of non-performing loans to total loans because default risk is usually embedded in the loan rate.

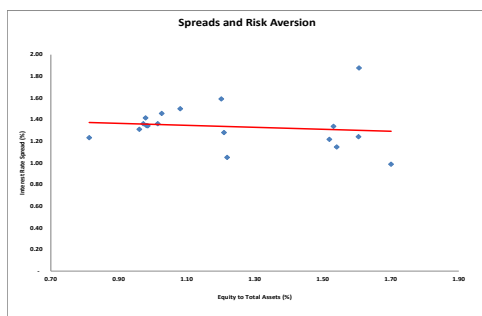


Figure 5: Ratio of Equity to Capital (%)

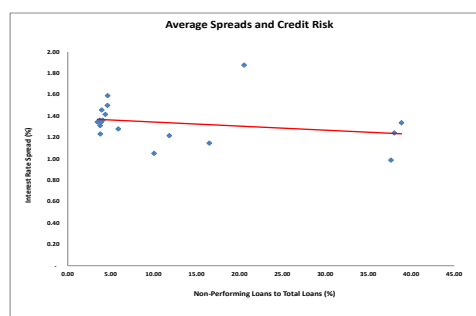


Figure 6: Ratio of Non-Performing Loans to Total Loans

The scatter plots in figures 5 and 6 suggest that, on the aggregate, IRS may not significantly respond to the changes in risk aversion and credit risk in Nigeria. Although a cursory look at the graphs depicts a negligible negative association, which is inconsistent with theoretical expectations. This may not

be unconnected with the presence of the outlier and individual characteristics of the Nigeria banking system.

2.3 Banking System Variable

Herfindahl-Hirschman index (HH index) is a standard measure of banks' control of market share with respect to total assets, loans or deposits and it is seen as an important determinant of interest rate spread. Banks with expanded control of the market are most likely to benefit from economics of large scale thereby reducing their average cost. Such banks with high control of market share may not pursue aggressive deposit mobilization strategy and may even lower interest expense through the reduction in deposit rate. The reduction in interest expense would stimulate increase in IRS. Thus, negative relationship exists between IRS and market concentration as shown in figure 7.

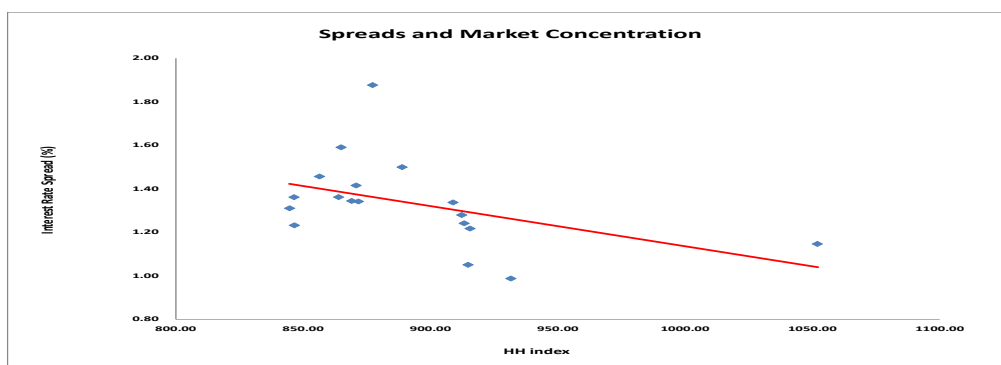


Figure 7: IRS and Market Concentration

2.4 Macroeconomic Indicators

The commonly used macroeconomic variables in related studies are monetary policy rate (MPR), inflation rate and Gross Domestic Product (GDP). It has been documented that highly volatile macroeconomic environment induces greater risk and banks could account for such risk through wider interest margin. Inflation indicates the cost of doing business and firms borrow at a higher cost in inflationary period. Where increase in inflation is expected, it becomes necessary to adjust the nominal interest rates in order to enhance positive real interest rate where savers will not be left worse-off. Huybens and Smith (1999) posit that inflation exacerbates informational asymmetries, thereby creating a wider IRS. Hence, positive relationship is expected between inflation rate and IRS.

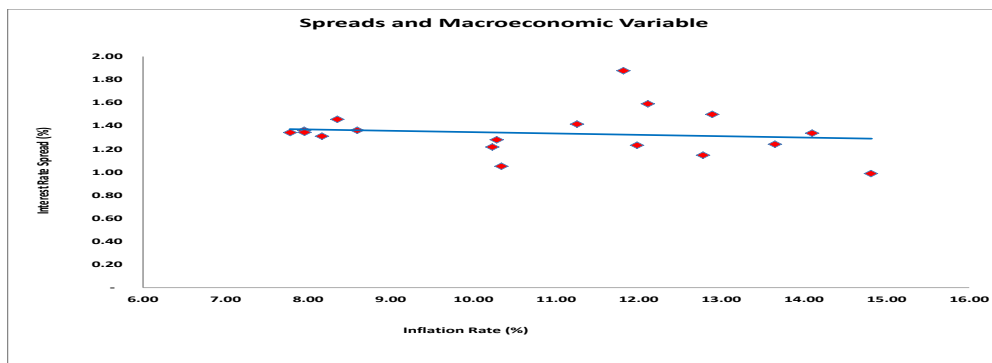


Figure 8: IRS and Inflation Rate

Virtual inspection of the figure 8 suggests a slight negative correlation between inflation and IRS of the Nigeria banking sector. This is inconsistent with *a priori* expectation.

The MPR determines the rate at which banks can borrow from and lend money to the central bank, which influences interbank and interest rates set by banks for savers and borrowers. Interbank rate is the cost of borrowing and lending excess fund in the interbank market mainly for banks. Movement in the interbank interest rates reflects the liquidity position in the banking system. An increase in interbank rate implies high cost of fund which is also transmitted in high banks' lending to their clients. Interbank rate is used as a proxy for MPR.

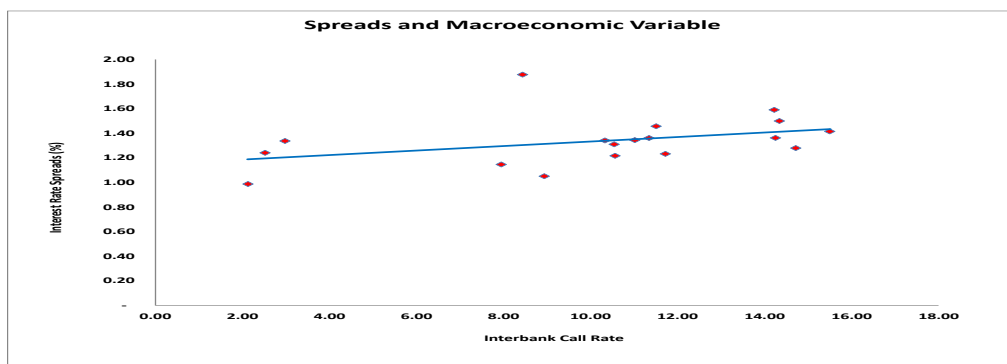


Figure 9: IRS and Interbank Call Rate

The scatter plot of interbank rate and IRS of the entire banking sector in Nigeria reveals a fairly positive association as shown in figure 9, which is consistent with economic theory.

GDP measure the productive capacity of all economic activities and the real GDP is the nominal value deflated by inflation. Intuitively, an increase in

nominal GDP would stimulate greater competitions among banks, which has the tendencies of driving down IRS. On the other hand, a decline in real GDP could amount to credit risk and banks desire passing this risk to customers through higher IRS. Thus a negative relationship is expected between GDP and IRS.

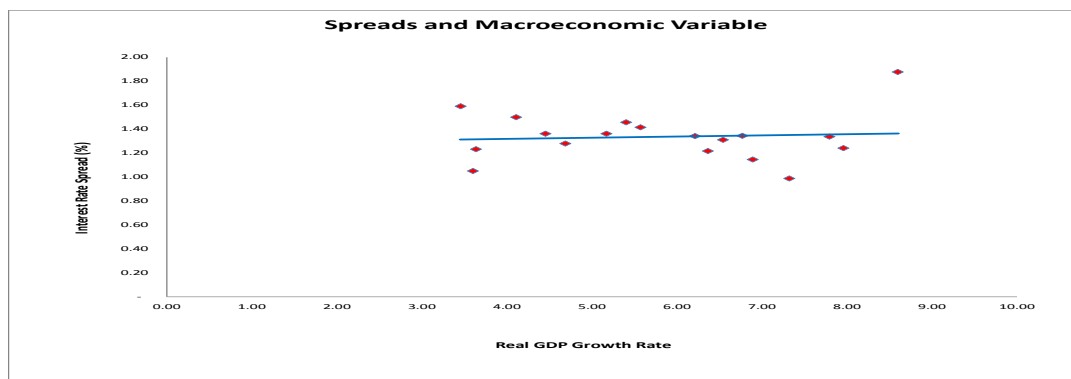


Figure 10: IRS and GDP Growth Rate

The graph of IRS and GDP in figure 10 reveals a slight positive relationship, although negative correlation was expected based on *a priori* expectation.

3.0 Literature Review

The determinants of banks interest margin have been under the focus of several financial and banking literatures due to its crucial role in banks' profitability and stability which has a direct influence on overall economic activities. Most studies on individual country or cross country analysis consider bank's specific characteristics and financial industry as internal factors and macroeconomic environment as external factors.

Demirgüç-Kunt and Huizinga (1998) used bank level data for 80 countries in the period 1988-1995 to show that the variations in the interest margins of banks as well as in their profitability reveals a number of different determinants like bank characteristics, macroeconomic conditions, deposit insurance regulation, explicit and implicit bank taxation, overall financial structure, as well as several underlying legal and institutional indicators by the use of the regression analysis. By controlling for differences in bank activity, leverage and the macroeconomic environment, they found that the combination of a bigger bank Asset to GDP ratio and a market with lower concentration ratio resulted in lower interest margins as well as lower profits.

The results also showed that in developing countries foreign banks have higher interest margins and profits when compared with local banks, while the reverse is the case in advanced economies. Furthermore, they found evidence to infer that the corporate tax burden is fully passed on to bank customers.

Jude (2003) investigated the determinants of net interest margins (NIM) of banks in four Southeast Asian countries. The variables used are collateral, operating expenses, loan quality, capital requirements and liquidity. The study used the dealer model (Ho and Saunders, 1981) and conducted a two-step regression over a period of 1994 - 2001. The results obtained from the first step regression show that the NIM of banks in South-East Asia are partly determined by some bank-specific factors such as liquid assets, capital, collateral, quality of loans and operating expenses. The second regression estimates indicates that NIM of banks are explained mainly by the non-competitive structure that exists among them, though the NIM also display some degree of sensitivity to fluctuations in short-term interest rates. Lastly, the results show that there was a marked decline in NIM after 1997 which could be explained by the sharp decline in profits experienced by the banks in that region as a result of the rampant default in loan repayment following the Asian financial crises.

Husniet *al.* (2008) applied three alternative models; the Pooled Least Squares (OLS) model, the Fixed-Effect Model and the Random Effect Model (REM) on the time series cross-sectional bank's level data in the context of Jordan to estimate the parameters in their study model. The study involved thirteen commercial banks and made use of panel dataset spanning the period 1992 – 2005. The findings indicated that, with regards to bank-specific factors, banks that give more loans while maintaining lesser financial leverage tend to have a higher NIM. The study also reveals that clients of commercial banks are the ones who end up paying for the banks' overhead costs through higher lending or lower deposit rates or both. The results again show that the growth rate variable has a positive impact on net interest margin and this is an indication that policy of deregulation coupled with advances in bank-relevant technology creates a favorable environment for banks which will in turn lead to higher interest spreads and consequently higher net interest margins. The results also show that on its own part, inflation factor, has a positive relationship with higher NIM.

Folawewo and Tennant (2008) examined ex-ante spreads in the deposit-taking banking sector across 33 countries in Sub-Saharan Africa (SSA) grouped into Eastern, Central, Southern and Western regions by using annual data for the period 1988 – 2005. The dataset was divided into 1980-2005; 1980-1992; and 1996-2005 for the estimation of the IRS equations. Due to data constraints they adopted a macro approach to the investigation of interest spreads using aggregated banking sector data rather than bank-specific balance sheet data, which allowed them to focus more intensively on the industry or market-specific and macroeconomic determinants. In order to spotlight policy changes that will have the greatest and most direct impact in reducing interest spreads and increasing banking sector efficiency, the study investigated the effects of government policy like fluctuations in the Treasury bills and discount rates, public-sector crowding out, financing of deficits by government and money supply. The study deduced that “the extent of government crowding out in the banking system, public sector deficits, discount rate, inflationary level, level money supply, reserve requirement, level of economic development and population size are important determinants of interest spreads in SSA countries”. The overall results indicate that changes in IRS respond more to changes in policy variables than changes in market variables.

Roman (2009) examines the determinants of interest rate margins of Czech banks employing bank-level dataset with quarterly frequency from 2000-2006. Variables used are net interest margin, fees income to total assets ratio, capital adequacy, total loans to total assets ratio, administrative costs to total assets ratio, total assets to median assets ratio (size indicator) in the banking sector, concentration index (Herfindahl index), current inflation rate and real GDP growth. Their findings show that lower margins were associated with those banks that operated more efficiently and there was no empirical evidence that these banks charge higher fees in order to compensate themselves. Price stability positively impacted on interest margins. There are some economies of scale, as larger banks tend to charge lower margins. It was also observed that a higher capital adequacy of banks is associated with lower margins and this contributes to the overall stability of the banking system. Overall, the results showed that the factors that determine interest margins of banks in Czech Republic is in conformity with those reported in other studies for some other developed countries.

David *et al.*(2013) identified the key factors affecting interest margins in Ghana and examines how such factors impact on the spread, using panel Extended Generalized Least Squares (EGLS) with a cross-section weights. A yearly panel data from twenty one commercial banks in Ghana for the period 2005 – 2009 were used for the study. The dependent variable is the bank interest spread, which is calculated as the difference between interest income and interest expenses as a percentage of total assets. Interest spreads are hypothesized to be a function of bank specific, industry and macroeconomic variables. The results show that operating cost, market share and previous year's non-performing loans are sensitive to the definition of interest spreads. Concentration of the banking industry, GDP, inflation, treasury bills and exchange rate however do not have statistically significant influence on spread. It also inferred that commercial banks respond to increases in reserve requirements by increasing the margin between lending and deposits rates.

Akinlo and Owoyemi (2012) investigated the determinants of interest rates spread in Nigeria using panel data for the period 1986 – 2007, for 12 commercial banks. Their results suggested that average loans to average total deposits ratio, remuneration to total assets ratio, cash reserve requirements and gross domestic product impact on interest rate spreads positively. However their results also show that, non-interest income to average total assets ratio, treasury certificate and development stocks have a negative relationship with interest spreads. In summary, their results suggested that a reduction in cash reserve ratio, as well as a reduction in bank overhead costs amongst others will help to moderate high interest rates spreads in Nigeria.

Enendu (2003) provided empirical evidence on the determinants of interest rate spread in a liberalized financial system for the period 1989-2000 by estimating ex-ante interest spread with balance sheet and income statement data from thirteen banks in Nigeria in addition to some macroeconomic variables. It was found that macroeconomic as well as monetary policy/financial regulation factors were more important than banks' level factors. In fact, cash reserve requirement, GDP, risk premium, inflation rate, financial deepening, liquidity risk, loan asset quality, Treasury bill rate and non-interest expense were the most important factors that influenced commercial banks' interest spread during the period of the study.

4.0 Methodology

4.1. Data Sources and the Selected Variables

The study used quarterly panel data of individual banks sourced from the statutory returns rendered to the Central Bank of Nigeria (CBN) and Nigeria Deposit Insurance Corporation (NDIC) on the electronic Financial Analysis and Surveillance System (eFASS). The period spanned from 2010:Q1 to 2014:Q2. The starting point of the data range was informed by the aftermath of the global financial crisis, when Nigerian banks were gradually exiting from the effect of the crisis. A total of 18 banks were considered in the study to ensure a balanced panel data structure.

The bank-specific variables are interest rate spreads(IRS - broadly defined as a ratio of the difference between interest income and interest expense to total assets for individual banks), credit risk (CR - non-performing loans to total loans ratio), scale of operation (GRLA - growth rate in total loans), risk aversion (R_AV - share of equity to total assets), deposit rate (TD_TA - ratio of total deposit to total assets) and operational costs (OC_SW_TA - salaries and wages to total assets ratio), and occupancy and rental expenses to net fixed assets ratio(OC_ORE_NFA). The Herfindal-Hirscheman (HH) index is used as a proxy for sector-specific variable. Inflation rate (INF), interbank call rate (IBCR), money supply growth rate (M2) and GDP growth rate (GDP_G) entered the model as macroeconomic variables. These variables have been widely used in previous literature and conform to theoretical abstractions.

4.2 The Models

Balanced panel OLS model is employed given that our sample observations have complete data for both cross-sectional and time series dimensions. Panel regression provides information on individual behavior both across individual and over time. According to Nooman (2014), the analysis of panel data brings additional information, reduces the phenomenon of multicollinearity of the variables and increases the number of degree of freedom. Three prominent models are applied in panel regression - pooled OLS, fixed effect and random effects.

The pooled model specifies constant coefficients in equation 1 below, which is the usual assumption for cross-sectional analysis:

$$S_{i,t} = \alpha + \beta \mathbf{X}_{i,t} + \varphi \mathbf{Y}_t + \omega \mathbf{Z}_t + u_{i,t} \quad 1$$

$$i \sim 1, 2, \dots, 18; \quad t \sim 1, 2, \dots, 18$$

$S_{i,t}$ represents interest margin for bank i at time t ; $\mathbf{X}_{i,t}$ is a vector of bank-specific variables, which varies across banks and time; \mathbf{Y}_t is a vector of time varying banking sector specific variables and \mathbf{Z}_t is a vector of macroeconomic variables, which varies with time, but does not vary across banks. $u_{i,t}$ are the disturbances across individual banks and time, and it is assumed to be independently identically distributed (iid). α , β , φ and ω are constant coefficients for all banks. The fact that α does not vary across individual banks for pooled effect model makes it the most restrictive panel data model and it is not often used in literature. Thus, the pooled OLS denies the heterogeneity that exists among banks. Since, organizational goals and culture vary across firms; it becomes unrealistic to assume homogeneity in this study.

Fixed effect and random effect models allow for heterogeneity. According to Akinlo and Owoyemi (2012) the possibility of cross sectional effects on each bank or on a group of banks is very high. Thus, there exists an unobserved heterogeneity across individual banks which could affect interest margin. This heterogeneity was captured with α_i . A fixed effect model is established if α_i are correlated with the explanatory variables, otherwise random effect is established. A fixed effect model is specified in equation 2, which allows individual banks to have different intercept term but the same slope parameters.

$$S_{i,t} = \alpha_i + \beta\mathbf{X}_{i,t} + \varphi\mathbf{Y}_t + \omega\mathbf{Z}_t + u_{i,t} \quad 2$$

The variables are as defined in equation 1 above and α_i measures the individual bank's effect on interest margin. It is important to note that fixed effect estimator subtracts out all the intercepts (average fixed effect) prior to estimation.

The random effect model is specified as

$$S_{i,t} = \beta\mathbf{X}_{i,t} + \varphi\mathbf{Y}_t + \omega\mathbf{Z}_t + (\alpha_i + u_{i,t}) \quad 3$$

In the random effect model, the intercept parameter (α_i) accounts for that bank's effects, but each bank is randomly selected. Hence, individual bank's effect is treated as random rather than fixed by adding α_i to the disturbance term in equation 1 and assumed that α_i are distributed independently with the regressors. Thus, each bank has the same slope parameters with fixed effect

model, but a composite error term $(\alpha_i + u_{i,t})$, where $u_{i,t}$ is the usual regression error, such that $E(u_{i,t}) = 0$; $Var(\alpha_i + u_{i,t}) = \sigma_\alpha^2 + \sigma_u^2$ and $Cov(\alpha_i + u_{i,t}) = \sigma_\alpha^2$ since $u_{i,t}$ is independently and identically normally distributed. The σ_α^2 and σ_u^2 are cross section and idiosyncratic random, respectively. The interclass correlation of the composite error term is determined by the value of Rho (ρ), which is the correlation between two errors for the same bank in different time period is given as:

$$\rho = \frac{\sigma_\alpha^2}{(\sigma_\alpha^2 + \sigma_u^2)}.$$

Rho is the fraction of the variance in the composite error due to individual bank specific effect. The value of ρ approaches 1 if the individual bank effects dominate the idiosyncratic error. Random effects estimator is unbiased if effects are uncorrelated with the explanatory variables.

Hausman test is applied to the fixed effect and random effect models estimated using OLS to determine the appropriate panel model by testing significance of the *difference* between the two estimates. The Test is unbiased to truly cross sectional estimates and to ensure consistent and efficient estimates, only bank specific variables that are strictly cross sectional are applied to the Test. This implies ignoring \mathbf{Y}_t and \mathbf{Z}_t in equations 3 and 4 above. The Hausman test tests the null hypothesis (H_0) of no correlation between the random effect and explanatory variables and follows a chi-square distribution (with degrees of freedom equal to the number of parameters for the time varying regressors). The Null is rejected if the corresponding probability value of chi-square statistic is less than 5% significance level. The Hausman test statistic (HT) is given in equation 4

$$HT = [\hat{\beta}_{RE} - \hat{\beta}_{FE}]Var(\hat{\beta}_{RE}) - Var(\hat{\beta}_{FE})[\hat{\beta}_{RE} - \hat{\beta}_{FE}] \quad (4)$$

Where $\hat{\beta}_{RE}$ and $\hat{\beta}_{FE}$ are random and fixed effect estimates, respectively. The selected model is further re-estimated by incorporating \mathbf{Y}_t and \mathbf{Z}_t with a generalized least square (GLS) or weighted least square to account for heteroscedasticity problem. Heteroscedasticity is common in cross section panel data and the assumption of homoscedastic is implausible due to the fact that regression results with heteroscedasticity generate OLS estimates that have unacceptable properties. Again, the type of standard error of the

regression depends on the choice of coefficient variance method. For robustness of results, White period coefficient covariance method which allows for correlation over time for each bank is applied.

5.0 Empirical Results

5.1 Descriptive Statistics

The descriptive statistics of the variables employed in the study is presented in Table 2. The kurtosis for interbank call rate (IBCR), inflation (INF) and GDP growth (GDP_G) are below the threshold for normal distribution, which is 3. However, the kurtosis of other variables exceeded 3 showing that they are leptokurtic. The very small probability values of Jarque-Bera statistic for all the variables provide evidence for the rejection of the null hypothesis that the variables are normally distributed.

Table 2: Descriptive Statistics

	$S_{i,t}$	CR	R_AV	OC_SW_TA	OC_ORE_NFA	GRLA	TD_TA	HH	M2	IBCR	INF	GDP_G
Mean	1.31	13.00	1.52	0.63	0.61	3.95	68.27	49.53	3.69	10.17	10.84	5.81
Median	1.29	5.61	1.02	0.57	0.52	4.02	69.65	17.26	1.50	10.79	10.80	5.89
Maximum	10.57	263.92	7.14	3.33	4.49	78.01	106.71	295.93	16.39	15.50	14.81	8.60
Minimum	-2.25	0.03	0.19	0.10	-0.10	-79.48	27.70	0.81	-7.24	2.13	7.78	3.46
Std. Dev.	0.90	22.99	1.16	0.31	0.48	14.88	9.98	71.58	5.52	4.02	2.26	1.56
Skewness	3.46	5.34	1.82	2.73	2.82	-0.79	-0.16	1.91	0.78	-0.77	0.09	0.04
Kurtosis	41.52	47.89	6.65	20.21	18.15	13.86	4.65	5.63	3.68	2.65	1.72	1.86
Jarque-Bera	20681.83	28752.06	359.78	4402.29	3527.87	1625.88	38.42	290.63	39.47	33.44	22.49	17.59
Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum	424.55	4212.99	492.13	204.53	198.38	1279.84	22117.92	16049.17	1195.88	3294.36	3510.89	1881.84
Sum Sq Dev.	259.78	170780.10	434.31	31.42	75.32	71545.91	32197.78	1654802.00	9851.98	5229.82	1648.97	782.88
Observations	324	324	324	324	324	324	324	324	324	324	324	324

5.2 Correlation Matrix of the Selected Variables

From Table 3, apart from interbank call rate (IBCR), all other variables show low correlation. IBCR shows more than 50% correlation with inflation (INF) and GDP growth, which could be a potential source of multicollinearity. Staff operating cost, measured as the ratio of salaries and wages cost to total assets (OC_SW_TA), growth in total loans (GRTA), market concentration measured by Herfindahl-Hirschman index (HH) and interbank call rate (IBCR) are positively correlated with interest margin. However, all other variables have negative correlation with interest margin. It is important to note that the

association described here is from a bivariate form, which is different from the direction of impact of these variables on interest margin in a regression plane.

Table 3: Correlation Matrix

Variables	OC_SW_T			OC_ORE_NF		GRLA	TD_TA	HH	M2	IBCR	INF	GDP_G
	IRS	CR	R_AV	A	A							
IRS	1.000											
CR	-0.353	1.000										
R_AV	-0.067	0.216	1.000									
OC_SW_TA	0.160	0.404	0.400	1.000								
OC_ORE_NF					1.000							
A	-0.078	0.050	0.035	0.103	0.066	1.000						
GRLA	0.046	-0.327	-0.022	0.002	0.066	1.000						
TD_TA	-0.200	0.235	-0.133	-0.088	0.227	-0.062	1.000					
HH	0.110	-0.181	-0.411	-0.187	0.133	-0.010	0.261	1.000				
M2	-0.041	0.016	0.007	-0.031	0.018	-0.140	-0.046	0.001	1.000			
IBCR	0.090	-0.349	-0.104	-0.129	-0.045	0.039	-0.014	-0.015	0.069	1.000		
INF	-0.070	0.298	0.118	0.170	0.083	-0.030	-0.043	0.018	0.207	-0.546	1.000	
GDP_G	-0.016	0.276	0.105	0.076	0.044	-0.086	0.058	0.011	-0.225	-0.686	0.247	1.000

5.3 Panel Unit Root Tests

The results of the panel unit root tests for the variables using Levin, Lin and Chu (2002); Im, Pesaran and Shin (2003); ADF-Fisher Chi-square and PP-Fisher Chi-square procedure are as shown in Table 4. TD_TA, HH, INF and GDP_G are stationary after first difference, while other variables are stationary at level.

Table 4: Panel Unit Root Tests Result

	Levin, Lin & Chu t_Stat	Im, Pesaran and Shin W-stat	ADF - Fisher Chi- square	PP - Fisher Chi- square	Order of Integration
IRS	-3.437**	-3.215**	62.048**	135.009**	I(0)
CR	-5.809**	-3.093**	63.550**	92.233**	I(0)
R_AV	-9.67046**	-8.6591**	139.869**	391.041**	I(1)
GRLA	-5.894**	-6.602**	109.689**	333.382**	I(0)
OC_SW_TA	-5.379**	-4.145**	76.904**	128.858**	I(0)
OC_ORE_NFA	-5.707**	-6.295**	107.594**	172.280**	I(0)
TD_TA	-6.476**	-8.091**	131.189**	403.021**	I(1)
HH	-6.529**	-7.472**	122.207**	748.668**	I(1)
IBCR	-6.214**	-3.512**	62.722**	57.159*	I(0)
M2	-6.750**	-4.842**	80.977**	116.495**	I(0)
INF	3.644	-3.141**	58.054*	247.740**	I(1)
GDP_G	-2.267*	-3.955**	68.739**	255.439**	I(1)

Notes: Significance level are denoted as ** and * for 1% and 5%, respectively.

5.4 Estimated Regression Results

The results of the two estimated models and Hausman Test are presented in Tables 5a and 5b.

Table 5a: Determination of Appropriate Model with Bank Specific Variables²

Variable	Fixed Effect Model	Random Effect Model
Constant	0.700*** (0.134)	0.833*** (0.131)
Credit Risk	-0.020*** (0.002)	-0.020*** (0.002)
Loan Growth	-0.0083** (0.003)	-0.008*** (0.003)
Risk Aversion	-0.051 (0.113)	-0.063 (0.112)
Deposit Rate	-0.012* (0.006)	-0.011* (0.006)
Operating Cost_Staff	1.313*** (0.214)	1.250*** (0.178)
Operating Cost_Capital	0.123 (0.142)	-0.019 (0.111)
R-squared	0.370	0.240
S.E. of regression	0.741	0.750
Durbin-Watson stat	1.687	1.580
Cross-section random		0.0859 (0.227)
Idiosyncratic random		0.9141 (0.741)

Throughout this paper, ***, ** and * denote significant at 1%, 5% and 10% level, respectively. Values in bracket are standard error of the estimates.

The summary statistics of the model such as R-squared, standard error of the regression and Durbin-Watson Statistic in Table 5a suggest that the fixed effect model has a better fit. More so, the value of cross section random error is very marginal compared with the idiosyncratic random.

Table 5b: Hausman Test Result

Hausman Test Summary	
Chi-Sq. Statistic	12.729
Chi-Sq. d.f.	6
Prob.	0.048

The value of chi-square statistic for testing differences between all coefficients with degree of freedom of 6 is 12.729, as shown in table 5b. Its corresponding probability value of 0.048 suggests that the null hypothesis of no correlation between the explanatory variables and the random effect is rejected at 5% significant level. This implies that, within the sample period, fixed effect is a better model for determining interest margin in Nigeria.

² The variables used in the estimation entered the model at their order of integration

Table 6: Estimated Models of Interest Margin³

Variable	Weighted Fixed Effect Model	Unweighted Fixed Effect Model
Constant	0.600*** (0.123)	0.719*** (0.198)
Credit Risk	-0.013*** (0.004)	-0.019*** (0.002)
LoanGrowth	-0.004*** (0.001)	-0.009 (0.010)
Risk Aversion	0.007 (0.042)	-0.067 (0.064)
Deposit Rate	-0.005 (0.004)	-0.012 (0.015)
Operating Cost_Staff	1.431*** (0.197)	1.319*** (0.318)
Operating Cost_Capital	0.066 (0.044)	0.127 (0.156)
Herfindahl-Hirschman index	0.001 (0.001)	0.001 (0.003)
GDP Growth	0.022** (0.011)	0.022 (0.027)
Inflation Rate	0.017** (0.008)	0.001 (0.027)
Money Supply Growth	-0.005** (0.002)	-0.006 (0.004)
R-squared	0.768	0.373
Adjusted R-squared	0.746	0.312
S.E. of regression	0.706	0.745
F-statistic	34.166	6.131
Prob(F-statistic)	0.000	0.000
Durbin-Watson stat	1.733	1.694

Table 6 shows the results of the estimated model with bank specific, sector specific and macroeconomic variables using weighted and unweighted GLS. The fixed effect model in table 5a is not significantly different from the unweighted fixed effect model in Table 6. For instance, the values of R-squared are 0.370 and 0.373 for fixed effect model in table 5a and unweighted fixed effect model in table 6, respectively. However, more number of banks' specific variables in table 5a are found to be significant. None of the sector specific and macroeconomic variables is significant in the unweighted fixed effect model. The model is re-estimated using the cross-section weight of panel estimates of GLS, which ensures efficient and consistent estimators.

³ The variables used in the estimation entered the model at their order of integration

The weighted fixed effect model is the more robust in terms of standard error, model adequacy and number of significant parameters as well as their expected direction of impact. Thus, results of the transformed model in table 6 are analyzed.

The constant term represents the average of the fixed effects of the banks. It is positive and significant at 1% level, confirming the existence of individual bank heterogeneity and appropriateness of fixed effect model for this study.

Table 7: Redundant Fixed Effect Test Result

Effects Test	Statistic	d.f.	Prob.
Cross-section F	39.3590	[17, 278]	0.000

The result in table 6 is further validated by applying a redundant fixed effect tests shown in table 7 and the value of F-statistic for testing the null hypothesis of equal effects (No fixed effects) for all banks is 39.359. Its corresponding probability value of 0.000 provides substantial evidence to reject the null at 1% level of significance and infer that Nigeria banks have individual unique fixed effect on interest margin.

5.5 Discussion of Results

The results show that of the six bank specific variables included in the model, credit risk, growth in loans & advances and staff operating cost are significant. In line with Nooman (2014), but contrary to Koffie *et al* (2014) findings, our result reveals a negative impact of credit risk on interest margin. The level of impact is marginal as a unit increase in credit risk could lead to 0.013 unit decline in interest margin. Here, the direction of impact is contra-intuitive because innately, banks are expected to maintain positive returns through increase in interest margin by passing the cost of non-performing loans, in form of default risk premium, to borrowers. The reason for negative impact of credit risk on interest margin may not be unconnected to AMCON purchase of eligible banks assets in 2010/2011 which significantly reduced the level of non-performing loans of banks during the period. Scale of operation is a positive and significant determinant of interest margin. This result meets *a priori* expectation as increase in the scale of operation could result in increase

in non-performing loan, especially where risk taking appetite of bank operators/managers is high.

According to Norman (2014), deficient risk management functions and poor asset quality feed into a higher amount of non-performing loans. With all conventional significance levels, risk aversion and deposit rate measured as ratios of equity to total assets and total deposits to total assets are not found to be determinants of interest margin, although they maintain expected positive and negative correlation with interest margin, respectively. Essentially, banks with higher amount of equity (lower risk) than other sources of capital such as debt are adjudged more risk averse and low return is expected. Again, high volume of deposit will motivate banks to lend to customer at a competitive rate thereby reducing the interest margin. Staff operating cost has a positive effect on interest margin and it is highly significant at 1% level. In fact, a percentage point increase in staff cost would result to about 1.43 percentage points increase in interest margin. This result is theoretically consistent because a higher staff operating cost would amount to a larger interest margin to compensate for the high cost of operation. One unique characteristic of the staff operating cost is that, regardless of the version of the model, it is found to be highly significant and has the highest impact compared to other variables⁴.

The sector-specific variable proxied by Herfindahl-Hirschman index which measures the degree of concentration of banks is a significant determinant and positively related to interest margin. Theoretical expectation holds that banks with greater share of the market size may collude, thereby creating opportunity to charge higher lending rates and possibly lower deposits rate. Besides, the estimated coefficient of Herfindahl-Hirschman index is quantitatively marginal.

At 5% level, macroeconomic variables⁵ used in the model are statistically significant. Growth rate of real GDP exhibits positive relationship with

⁴Like most empirical studies such as Maudos and Fernandez (2004), Williams (2007), Maudos and Solis (2009) and Koffie et al (2014), operating cost is found to have the highest influence on interest margin and adjudged the most important determinant. However, interest margin is found to be insensitive to the cost of fixed capital in all conventional significance levels, although, the direction of impact is consistent with theoretical expectation.

⁵We first included interbank call rate (IBCR) in the model and was not significant. It also rendered GDP and INF redundant at 5% level. Overall, the inclusion of the variable reduced the robustness of

interest margin, which is contrary to intuition because if real GDP growth declines, banks faces increased credit risk and may charge higher lending rate consequently increasing the interest margin. On the other side of the coin, increase in the overall economy could encourage economies of scale, which aids higher competition in the industry thereby fostering competitive lending rate and low interest margin. Our result is similar to that of Akinlo and Owoyemi (2012) where they noted that the positive relationship between GDP and interest rate spreads contradicts business cycle effect, which was also examined by Randall (1998). Consistent with theoretical expectation and in line with the findings of Pineda (2010) and Koffie et al (2014), our results reveal that inflation is a significant determinant and positively related to interest margin. Inflation reflects the cost of doing business and could cause informational asymmetries in the financial market, thus stimulating increase in interest margin. Finally, growth in money supply is statistically significant and positively related to interest rate spread.

6.0 Conclusion and Policy Implication

Given the criticality of efficiency in the intermediation role of banks for economic development, this paper investigates the determinants of interest margins in Nigeria using a balanced panel OLS model. Bank specific variables that are strictly cross sectional were applied to Hausmantest. Based on the test result, interest margin of banks with fixed effect model in a generalized form (GLS) is estimated to account for heteroscedasticity common to cross sectional data. In terms of model adequacy, the weighted fixed effect model (cross sectional white) was more robust than the unweighted. The result of the weighted fixed effect model shows that fixed effects term, credit risk, growth in loans and advances, staff operating cost, GDP growth, inflation rate and money supply growth are significant determinants of interest margin in Nigeria over the sample period. Among these factors and consistent with previous studies, staff operating cost exacts highest impact on interest margin followed by fixed effects term.

Further analysis of the banks fixed effects reveals that seven banks control about 64%, which projects a policy concern for banks supervisors/examiners

the model. This may not be unconnected with it's high correlation with GDP and INF as observed in table 2. The result of the model was not reported.

regulators. The positive relationship between staff operating cost and interest margin shows that banks usually transfer their operating costs to customers by either imposing exorbitant lending rates or low deposit rates or both. So, the domineering impact of staff operating cost should be a major cause for concern for the regulators and banks major stakeholders. In fact policy options and strategies for reducing growing operating cost in the banking sector in the area of levels of compensation, employee turnover, redundancy, automation processes and outsourcing of non-critical tasks should be given considerable attention to ensure efficiency and competitive interest margin that can spur economic growth in Nigeria.

6.1 Policy Implications

The result of the analysis shows that inflation, GDP growth and staff operating cost have significant impact on the interest margin. The policy options available to the monetary authority therefore include:

- reducing the operating cost of the banks through the sustenance of the existing CBN/Bankers Committee shared services initiative;
- continuous pursuit of price stability with a view to pushing down the inflationary pressure; and
- extending financial services to broader segments of the economy. This has the potential to increase the deposit base of the banks which could translate to lower interest rates.

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