Analysing Risk Management in Banks: Evidence of Bank Efficiency and Macroeconomic Impact

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Abstract

The recent Global Economic meltdown triggered by the subprime mortgage crisis of United States in 2007 and its adverse effect on financial markets and participants in the financial industry worldwide have resulted in a capital management crisis in most financial institutions especially banks. This study is a case for the Nigerian banking industry, focusing on factors affecting risk management efficiency in banks. For empirical investigation, we employed Panel regression analysis taking a stratum of time series data and cross-sectional variants of macro and bank-specific factors for period covering 2003 to 2009. Result for panel regression indicates that risk management efficiency in Nigerian banks is not just affected by bank-specific factors but also by macroeconomic variables. This describes the pro-cyclicality of bank performance in the Nigerian banking sector. As it stands, the sufficiency of Basel principles for risk management is doubtful because asset quality varies with business cycles.

Keywords: Risk management, Nigerian banks, capital adequacy, Basel, cyclicality.
JEL Classification: E32, G21, G32

1. Introduction

The recent Global Economic meltdown caused by the subprime mortgage crisis in the US in July 2007 and its adverse effect on financial markets and participants in the financial industry worldwide has triggered a capital management crisis in most financial institutions, especially banks. In market-based countries where capital market dominates economic activities, banks have suffered a severe shock in their capital and liquidity status due to the unanticipated downturn in the financial market and a credit crunch experience in the financial industry. This made a number of banks go illiquid and some even closed down operations. For instance, total of 168 banks were reported to have closed down within the period spanning from 2007 to 2009 in US (FDIC, 2010).

Last year, Nigerian banking industry suffered an historic retrogressive trend in both profitability and capitalization. Just 3 out of 24 banks declared profit, 8 banks were said to be in 'grave' situation due to capital inadequacy and risk asset depletion; the capital market slummed by about 70 percent and most banks had to recapitalize to meet the regulatory directive (CBN, 2010). This drama in the banking sector eroded public confidence in banking and depositors' funds aggregately dropped by 41% in the period. Possibly due to financial liberalization and globalization, the fact is there has been a reckless abandonment of the essentials of managing risk in times of economic boom and recession; the volatility of bank earnings has been under-rated by bank managements. The central monetary

authorities also impacted negatively on stability of the sector. The auditing exercise was a very good one but the sanctity and policy implementation mode was bad considering the nature of the Nigerian economy.

Basically, bank objectives revolve around 3 directions: profitability, growth in asset and customer base. Aremu *et al.* (2010) pointed out that the major problem of bank management is the mis-prioritization of short term goals over its long term objectives. While the profitability centers on the quality of short term repriceable assets and liabilities, net worth expansion which is the equity capital, is a function of total asset and liability. In Nigeria, it has been observed that most bank managers have focused more on profitability (which usually is a short term objective), with little attention on risk managing the quality of assets which has better impact on the long term sustainability of a financial institution.

In June 2004, a new accord of capital management was proposed by the Basel committee on bank supervision and its focus was to establish an international standard that banking regulators can use when creating regulations about how much capital banks need to reserve in order to cover for credit and operational risks (BIS, 2004). Following this guide, in 2005, the Central Bank of Nigeria (CBN) raised the capital requirement for banks to N25 billion from N2billion. In addition, new prudential guidelines were set. At the end of the exercise, only 24 banks emerged out of 88. Some of the impacts of the exercise include: broadened scope of banking operations ranging from aggressive market expansion, increased capital assets, increased participation in the stock market, and increased investment in the petroleum and real estate sector. An overall implication of this is the increased 'unleveled' competition in the industry. They were constrained to offer loans and other forms of credit, providing loans to both the suitable and 'dubious' client. This resulted in increased risk assets and actual capital of most banks was eroded by the loan defaults.

In 2009, a new governor of CBN was appointed to oversee the affairs of the money sector. At inception, Mallam Lamido Sanusi, the new CBN governor, ordered a thorough stress-test for all commercial banks. At the end, the CBN had to inject N620billion to rescue 8 troubled banks. Five others were given ultimatum to recapitalize (CBN, 2010). The sector became unstable, many employees lost their jobs, investors lost their funds; some of the executive directors were arrested and charged to court for giving loans without due process. With the intervention of the Economic and Financial Crimes Commission (EFCC), it was discovered that most of the bad loans were used to finance private

businesses of the directors, their friends and family; a large proportion of the loan became classified as non-performing asset.

Although Basel II accord has been criticized for its inadequacy in defining what constitutes a bank's capital, it has extensively provided a basis for risk management in banks. The objective of this study is to analyze banking risk and how bank managers and central regulatory authorities have been able to mitigate the protracted inadequacies of bank capital and liquidity issues. It infuses the exigency of capital adequacy and gap management into a stylized propagation for managing bank risks, in addition to wedging macroeconomic determinants. Various indicators such as profitability ratios, liquidity ratios, leverage, and efficiency index are used to assess the risks undertaken by Nigerian banks. Macroeconomic components such as GDP growth rate and inflation are included in our modeling to determine whether efficiency in managing bank-specific risk is sufficient, especially the trend in an unstable business cycle.

A central focus of the BASEL guide has been on capital adequacy as a cushioning mechanism for risk exposure of bank assets. In other words, a higher exposure of a financial institution to credit and operation risk will require an augmentation of its capital to safeguard future operation in case of losses from such risk. For this purpose, we propose a dynamic financial statement analysis of various banks' balance sheet and income statements. Subsequently, a panel data analysis is used to check if risk management efficiency of a bank is sufficient to keep capital and liquidity, or other macroeconomic determinants which pose a systemic threat can be considered relevant as well in the case of Nigeria. This will help in showing the nexus between quality of capital, risk asset, and bank value (total asset). Macroeconomic indicators will also be considered in the model to reflect the cyclicality bank operations to economic changes.

Basic questions to be answered will include: What are the common risks faced by Nigerian Banks? Do these risks concord with those identified by the Bank for International Settlement? What is the direction for risk management of the banks taking cognizance of business cycles? How can banks sustain a regime of quality asset, high earnings and ensure capital adequacy with no recourse to capital market performance? To answer this course, this study will focus on 9 top Nigerian banks (based on total asset-base). Based on collected data, sourced from consolidated financial statements of each bank, it is clear that the selected banks account for about 78% of the total assets of commercial banks in Nigeria. The financial statement analysis will cover the period from 2003 to 2009. This period witnessed symbolic reforms, transformation, profit explosion and credit crunch.

Statement of the Problem:

As noted by Saunders and Wilson (2001), a common feature in banking industry around the world is the increasing number of insolvent banks. Emerging events have proved the weakness of the Basel Standards. The shortcomings of the Basel I led to a re-structuring of its tenets and a subsequent re-birth of the Basel II Accord. The recent world financial downturn also exposes the inadequacies of the Basel II which focus on capital adequacy. A new framework tagged Basel III has been proposed and the new banking guide has been scheduled to be implemented in the G20 economies starting from 31st of December 2011. A major concern of the Basel framework is its inability to explain systemic risk which could come as a result of economic changes. Its applicability to developing countries such as in the case of Nigeria has also raised more questions.

For a directional supposition of intent on this study, the following problems have been identified:

- Sharp practices in the capital market by managers of quoted Nigerian banks; the actual consequence of under-capitalization of banks
- Bad corporate governance from reckless spending by top management
- Leverage choice of capital and poor asset quality including the issue of duration management, financing long-term assets with short-term liabilities
- Risk quantification and mitigation
- Inefficiency of regulatory/supervisory authority
- Poor credit control which has escalated the incidence of counter-party risk;
- Large exposure of institutions to market risk, with huge amount of margin loans
- Cyclicality of the banking industry in Nigeria

Objectives of the Study:

The topicality of this research is from the prevailing argument of whether banks have been efficient in its goal of making profit for owners, matching repriceable assets with short term liabilities (liquidity management) and capital structuring and allocation. Risk management based on Basel convention; can we say it is sufficient framework for managing risk? Juan and Constantinos (2005) has rightly pointed out that implementation of Basel II requires an integration of a supporting financial system that can operate beyond banking supervision and establish the necessary institutional framework for easy functioning of the financial system. In developing countries, this complementary superstructure is unavailable or may involve high cost.

The aim of this work is to analyze the main components and quality of bank assets in Nigeria; also it examines the effect of risk-taking on bank value, cyclicality of the industry and the intrigues of risk management in Nigerian banking industry. The structure of work is as follows: first section is the introductory part which aims at giving a background of the study, statement of problems, objectives and the significance of the research. Section two reviews related literatures on risk management in banks. It provides a broad definition of the concept. It also provides an overview of bank regulation- reasons for bank regulation; its pros and cons. The third section describes the methodology for analyzing this topic. Section four analyzes results and findings. And section five gives a summary of our findings, policy recommendation and concludes the study.

2. Literature Review

It is a common practice that profit-maximising firms, including banks, consider operational miscalculation which could be as a result of macroeconomic risks, such as the effect of interest rates, inflation or even business cyclicality. Also, microeconomic risks like new competitive threats are inevitable and should be dealt with adequately. Bank-wide issues such as technological failures, commercial inefficiency of a supplier or customer, political manipulation, X-inefficiency and natural disaster are possible risks faced by banks and other financial institutions. Furthermore, the debacle in the financial and non-financial sector as a result of the contagious subprime crisis in US is a strong indication of the need for risk management. According to Pyle (1997), financial misadventure is not really a new phenomenon but the rapidity of economic downturn caused by this has necessitated the need for integrating an efficient risk management system. The past few decades has witnessed growing interest of experts in the field. While some writers have instituted an argument of what kind of risk management model should be adopted by deposit taking financial institutions, others have suggested more stringent regulatory options.

Risk management involves risk identification, risk measurement (and quantification), and mitigation. However, a point to note here is the perception of what constitutes risk to a firm may differ from institution to institution, time to time, and industry to industry. This section identifies the theoretical meaning of risk management as defined by different scholars.

The etymology of the word “Risk” can be traced to the Latin word “Rescum” meaning Risk at Sea or that which cuts (Raghavan, 2003). Risk simply implies a possibility of unexpected outcome. It creates the notion that future events may have some degree of

uncertainty, thereby exposing an institution to adversity. From Emmett (1997) definition, it is clear that risk is a condition of the real world; it crafts from an undesirable event. Undesirable event in this context is described as an adverse deviation from a desired outcome that is expected and hoped for.

As it is the major goal of a firm to maximize benefits from cash flows and market status, managers usually achieve their objective through series of activities ranging from product sales, deposit acceptance, provision of funds to clients, etc. For as long as profit is a goal, risk is inevitable for financial institutions. Industrial concerns and product companies are well characterized as risk averters. Thus, financial institutions are prompted to seek out risk to make money. The difference in taking reasonable risk is key to financial firms' profitability and asset growth. Risk permeates everything they do (Casserley, 1991). At the core of this, scholars are in accordance with the fact that risk in financial institutions cannot be fully eliminated. However, what stands as an argument is how efficient a bank can manage its risk exposures- minimizing risk, at the same time ensuring profit maximization. Should it be through capital augmentation, allocation, or aggressive asset pricing?

Ozturk (2007) defines risk management as the process by which managers satisfy their risk taking needs by identifying key risks, obtaining consistent, understandable, operational risk measures, choosing which risks to reduce and which to increase and by what means, and establishing procedures to monitor the resulting risk position. In other words, risk management is the process of assessing operational dangers of a particular position, measuring its magnitude, and mitigating such exposures in order not to deter the institutional goals of the banking firm.

Before the 1980s, risk management functions attracted little attention. This has changed in recent times, occasioned by an influx of mathematicians, actuaries, behavioral scientists and marketers which have developed new approaches to managing risk in banks. The changing dynamics of banking activities, the subjected environments within which banks operate, and the volatility of the world economy imply that risk analysis and management must also adjust with time (McNamee, 1997). Risk management is becoming more complicated with the trend towards an integrated global financial system. It is no longer sufficient for risk managers to be attentive to happenings in international markets; efficiency of overseas risk managers has become a co-factor. An example is the subprime mortgage crisis in US 2007 which turned to a global syndrome.

Risk Management is a course at the center of financial intermediaries' operations which entails identifying, measuring, and managing risks to ensure that:

a) Individuals understand the intrigues of taking and managing risks
b) Risk exposure of an institution is within an acceptable limit defined by the regulatory body
c) Risk taking decisions of an institution is in line with the business strategy and defined objectives of the Board of directors
d) Risk taken is worth its accruable benefits and is to the best interest of the institution;
e) Sufficient capital is available to cushion for possible losses from taking a risk.

3. Methodology and Variable Description

A core objective of this study as earlier stated is to check the efficiency of banks risk management usually determined by bank-specific factors indicated by profitability and other performance indices. Progressively, Panel analysis will be used to check the impact of macroeconomic indicators such as GDP growth and inflation rate, in addition to bank-specific factors on bank capital adequacy in Nigeria. The primary aim of risk management in banks is to avert situation of insolvency. Hence, efficiency of risk management in banks signals their solvency level. According to Saunders and Cornett (2006), insolvency has been characterized by prolonged liquidity issues and severe capital depletion. In this case, insolvency may result in 2 ways. Firstly, insolvency forced by liquidity, in the case of bankruptcy where short term obligations cannot be met and the bank is forced to liquidate part of its assets below their market worth. Secondly, we look at insolvency which results from capital inadequacy. In this case, liability of the bank may become greater than the asset thereby forcing the bank to close business. However, closing business is an extreme scenario this study will not be going deep into.

3.1 Capital Adequacy as Indicator of Risk Management Efficiency

It has been noted that Basel framework for risk management is centered on capital adequacy, where internal risk models are in a way that capital augmentation is suggested to cover for possible consequences of risk-taking (Ojo, 2008). In this case, the capital adequacy requirement forms the core of prudential regulation and supervision. In legal terms, capital adequacy is a term used to describe the adequacy of a bank's aggregate capital in relation to the risks which arise from its asset portfolio, off-balance sheet transactions, its common operations and all other risks associated with its business

(Hitchins *et al.,* 2001). Although Basel recognized capital buffer for level of risk-taking, it failed to consider a situation where risk is taken and capital value becomes affected by other unforeseen conditions like capital market downturn which evaporates equity capital of banks.

A nexus between the bank's equity capital and stages of economic cycle is a bigger part of an on-going debate regarding the pro-cyclicality of bank capital augmentation. During economic boom, banks augment capital base through plowback profits and increased participation in the capital market; while in periods of contraction, raising capital may be difficult because of high cost of funds. Moreover, rapidity of loan defaults which negatively affects banks' profitability and capital position is a common feature of cyclicality of the banking sector (Sathye *et al.*, 2003). In a similar outlook, Saunders and Wilson (2001) test for sensitivity of business-cycle in the relationship between bank charter value and capital for risk-taking incentives. A positive relationship between capital adequacy and economic cycles was established (see further examples in, Borio *et al.*, 2001; Nier and Zicchino, 2005; and Wu and Bowe, 2010). However, Berger *et al.* (2004) argue that banks may be faced with increasing demand for loans during economic expansion, but restrain supply during recession to avoid possible losses caused by economic downturn. Whether pro-cyclical or counter-cyclical, these studies have pointed out the effect of business-cycles on bank charter value as predicated on capital adequacy.

Emphasizing on capital requirements, Ahmad *et al.,* (2009) evaluated the core determinants of bank capital using an unbalanced panel data to promulgate the implications of the 1997 Asian financial crisis. They intensified their work further by setting capital adequacy ratio as a dependent variable, proxy on ratio of non-performing loan to gross loan, market risk index, net interest margin, ratio of total liquid asset to total deposit, and size of the bank which was taken as natural log of total assets. In a similar study, Altunbas *et al.* (2000) realigned bank prudential regulations as those essentially concerned with capital risk asset ratio as put forward by the Basel committee. Thus, capital adequacy regulation is fundamentally aimed at constraining imprudent risk behavior by linking bank's risk exposures to its capital position. The financial ratios which relate capital to the corresponding banking risks have been conventionally used to regulate bank capital adequacy (Altunbas *et al.*, 2000). For instance, Altunbas *et al.* (2000) on bank capital augmentation in Spain, specified a panel regression model for growth in bank capital as a function of expected rate of return on capital, portfolio risk (measured as ratio of public sector securities to total assets), liquidity, deposit growth rate, interest sensitivity gap, ratio

of non-performing loan to gross loan, ratio of off-balance sheet to total asset (as a measure of innovation), and operating efficiency of a bank (measured as ratio of total cost to total income).

3.2 Panel Data Methodology

Related studies such as Altunbas *et al.* (2000), Ahmad *et al.* (2009), and Fadzlan and Habibullah (2010), have applied panel data statistics to their work on capital adequacy in banks. Fadzlan and Habibullah incorporated GDP growth and inflation into their model to reflect sensitivity of bank performance to macroeconomic conditions. Flamini *et al.* (2009) proxy growth in bank capital as a dependent variable on other indicators such as liquidity ratio, earning to capital ratio, deposit growth rate, interest sensitivity ratio, among others. In a similar way, Konishi and Yasuda (2004) used panel data to empirically describe bank risk-taking operations in Japan where capital was used as a determinant of risk operation. For this study, application of the panel data method is tantamount to the fact that financial statements of banks in the same industry in most cases are correlated and may lead to multicollinearity. Therefore, analysis based on such findings could be spurious and misleading (Altunbas *et al*, 2000).

Panel data analysis is used to investigate if risk management efficiency of a bank is sufficient to keep capital and liquidity requirements of the bank. For instance, Oladunjoye (2006) identified macroeconomic determinants as possible systemic threat to industrial index of Mauritania. This could be a key element, relevant in the case of Nigerian banking industry. As we know, since the inception of the global financial crisis, questions have been raised regarding the effectiveness of Basel framework in managing risk. In our finding, cyclicality of the industry was completely omitted in the Basel framework for risk management in banks. Athanasoglou *et al.* (2005) identified a positive response of bank profitability in Greek banking industry to business cycles, with the cyclical output being significant only at the extreme phase of the cycle. Demirgüç-Kunt and Huizinga (1998) signified a positive linear relationship between bank suitability and the business cycle.

Altunbas *et al* (2000) repositioned a panel data model using stochastic cost frontier methodology for efficiency and risk in Japanese banking. Panel data regression methodology is applied because technical efficiency is better studied with panel construction (See Baltagi and Griffin, 1988). Other advantages of panel data methodology is that, by controlling for individual heterogeneity, our model estimators can be less biased since the degree of freedom will be increased.

The panel data approach is a combination of cross-sectional and time series statistical analysis. By pooling the time series and cross-sectional dimensions of our data, panel inputs can enhance identification of stationarity and uncorrelated shocks within a model. The econometric form of the panel regression is:

$$Y_{it} = \alpha + \beta' X_{it} + \pi_{it} \qquad (\pi_{it} = \mu_i + \nu_i) \tag{1}$$

where Y_{it} is the dependent factor of i^{th} component in time t, X_{it} is the explanatory variable of i^{th} component in the corresponding period t. X_{it} is said to be exogenous if it is uncorrelated with the disturbance π_{it}. μ_i is the unobservable individual effect, ν_i is the residual of disturbance; α denotes intercept, and β is our estimating parameter.

Panel data analysis may be in the form of general OLS, fixed effect model (FEM) or random effect model (REM). Under the FEM, unobservable disturbance terms (μ_i) are assumed to be fixed estimated parameter, with stochastic residual term (ν_i). FEM is suitable when considering individual effect of i^{th} component. Under this condition, β is assumed to be identical for all i^{th} components, but intercepts are different. The FE model can be stated as:

$$Y = \alpha_{1i} + \beta X_{it} + \pi_{it} \tag{2}$$

A common feature of the FEM is that it concentrates on micro-unit effects, neglecting variations in industry. This omission is corrected for in the random effect model (also known as the error components model). To statistically optimize available data, this study focuses on the random effect model. The random effect model is preferred to the fixed effect because of the random sampling pattern of the collated data. Baltagi (1995) suggests the fixed effects model would be more appropriate if we are focusing on specific set of observations. Although, using the fixed effects model for large number of observations may grossly lead to loss of degrees of freedom (Baltagi, 1995).

To strengthen our preference for the random effects modeling, the Hausman specification test will be used to compare the fixed and random effects under the null hypothesis that the fixed effects and random effects model estimators differ substantially. If this hypothesis is rejected, it means the individual effects are probably correlated with the other regressors in the model. Using the REM in this case may generate spurious results. But if the null hypothesis is accepted, the random effect model will be justified for this study, implying that the micro-unit effects and regressors are uncorrelated (estimators differ substantially); otherwise the fixed effect modeling becomes more appropriate. The

Hausman test is carried out using White (1980) modeling for controlling cross section heteroscedasticity of the variables.

3.3 Variable Description and Model Specification

A panel regression model is specified to show the relationship between risk management efficiency in banks and other determinants of bank performance such as bank specific indicators and business cycles (cyclicality). This study covers a period of 7 financial years (2003-2009), taking 9 largest banks in terms of asset base. These 9 banks account for 78 percent of total assets in the Nigerian banking industry.

3.3.1 Dependent Variable

Following Kwan and Eisenbeis (1997), Berger and Young (1997), Hitchins *et al.* (2001), Ojo (2008), and Ahmad *et al.* (2009) among others, this study sets capital adequacy as a dependent variable. In line with the Basel framework for risk management, capital adequacy stands as a prudential requirement for risk operations of a financial institution. In other words, the efficiency of the internal based risk models is based on capital sufficiency of the system. Chiu *et al.* (2009) analyzed a relationship between risk efficiency and bankruptcy taking capital adequacy ratio as proxy for risk management efficiency. If a bank's charter value in terms of its capital holding to risk portfolio falls short of the acceptable minimum, the system of internal risk management in that institution can be categorized as inefficient. Capital adequacy is defined in our model as a function of micro and macro determinants. The micro determinants are the bank-specific factors which are mainly influenced by the banking firm's policy. Such determinants include bank size (total asset), risk asset portfolio, interest sensitivity of assets to liability, management quality, and profitability. Others are the macro determinants which may include economic growth rate, inflation, and market interest rate.

3.3.2 Bank-Specific Determinants

The bank-specific determinants used in the modeling include credit to total asset ratio which is a measure for counterparty exposures of banks. Credit risk is a concept used to explain the default probability of a banking firm's loan portfolio. Interest sensitivity ratio is also included in the panel regression as a measure of sensitivity of bank's repriceable assets and liabilities to interest rate fluctuation. Otherwise referred to as "interest sensitivity gap", is used to provide a general overview of their interest rate risk profile. The effect of interest rate changes on the assets and liabilities of a financial institution may be

analyzed by examining the extent to which such assets and liabilities are "interest rate sensitive" and by monitoring an institution's interest rate sensitivity gap. An asset or liability is said to be interest rate sensitive within a specific time period if it will mature or be repriced within that time period.

Others determinants include profitability, measured by Rivard and Thomas (1997) as return on asset (ROA); operating efficiency, measured as net operating income divided by operating expense. The operating efficiency is also a good measure of management quality in ensuring that the assets are well priced to achieve a positive spread with cost of withholding liability. Market risk is taken as bank specific variable for this study because it is associated with operating leverage policy of the firm. When cost of fund is high in the market, the management may decide to liquidate portion of its assets rather than increasing its liabilities for financing its operation. Finally, liquidity as a bank-specific factor is included to show responsiveness of a bank to its short term obligation. It measures the ability of a bank to generate cash or turn quickly repriceable assets into cash.

Figure 2 shows a risk management framework under which efficiency is determined by macro variables and other micro modules.

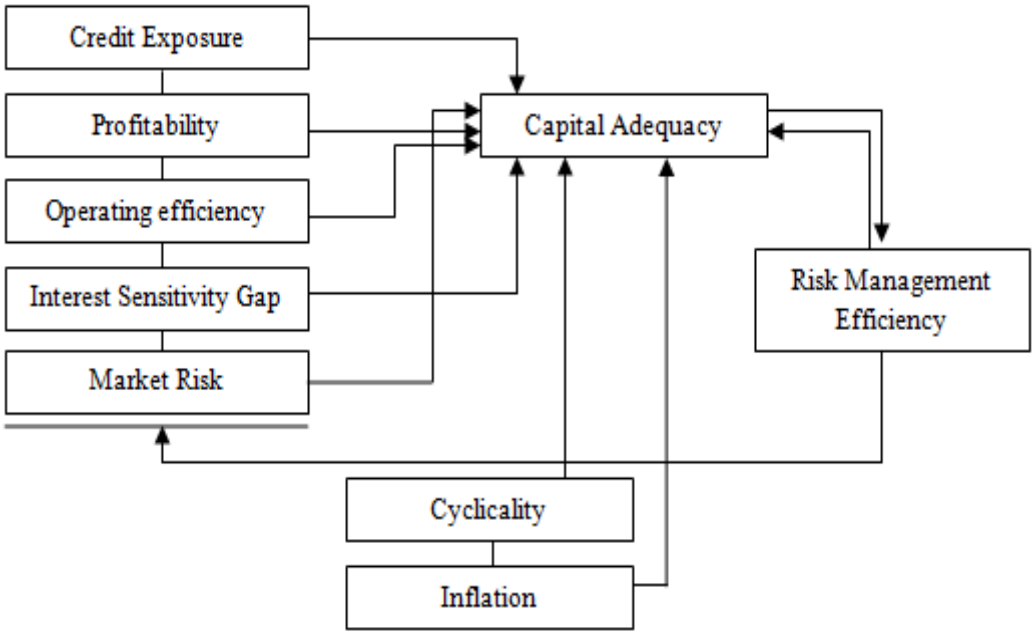

Figure 2: Risk management framework
Source: Author

3.3.3 Macroeconomic Determinants

In times of economic recession, loan defaults are more common. In this case, solvency position of a bank may be threatened because assets not performing in due course take

recourse to the capital of the bank. However, reaction of banks to changing risk environment is not uniform and depends on principles which are peculiar to individual banks, especially in terms of asset size and profitability. For the macroeconomic factors, significant changes in global financial markets adversely transits business cycles, slowing down business transactions in the money sector and making the social cost of funding bank assets high. Demirguc-Kunt and Huizinga (1998) and Bikker and Hu (2002) have shown that bank efficiency is susceptible to changing economic conditions despite the trend in the industry towards applying sophisticated financial engineering methods to mitigate risk that relates to economic cycle. Neely and Wheelock (1997) measured cyclicality of bank performance with GDP per capita. For this study, economic growth rate is proxy for cyclicality.

In addition to the growth rate, inflation rate is included as a control variable for macroeconomic risk. Demirguc-Kunt and Huizinga (1999); and Sufian and Habibullah (2010) identified a linkage between inflation and bank activities.

Table 1: Summary of Variables, description and measurement

Variable	Apriori	Explanation	Measurement
Regressand:			
CAR		Capital adequacy as a measure of solvency level forced by Capital depletion	Regulatory Capital divided by Total Risk Weighted Asset
Regressors:			
Bank-specific			
CRisk	(+)	Credit risk measures banks exposure to counterparty risk	Loan/Total asset
LQR	(+)	Insolvency risk forced by liquidity, in the case of bankruptcy where short term obligations cannot be met and the bank is forced to liquidate part of its fixed assets below their market worth	Liquidity ratio: liquid assets divided by current liabilities
ISR	(-)	Interest sensitivity ratio measures the sensitivity of banks to interest rate fluctuations based on its repriceable asset and repriceable liabilities	Interest sensitive assets divided by interest sensitive liabilities
ROA	(+/-)	Return on Bank's total assets	Net income divided by total asset
SIZE	(+/-)	This stands for total asset of the bank	Natural logarithm of total asset
MRisk	(+)	Risk exposure of the bank to capital market participation. This is a core determinant of bank's capitalization	Std dev of stock price divided by the mean for each 12 months period

			(i.e., coefficient of variation)
OPR	(+)	Operating efficiency as a measure of management quality	Operating expenses divided by net operating income
Macroeconomic			
GRT	(+)	Economic growth rate is proxy for cyclicality	Selected from the world bank database
INF	(+/-)	Domestic rate of inflation	Selected from the world bank database

3.4 Econometric Specification

As previously discussed, risk management efficiency of a bank is determined by both bank-specific and macroeconomic factors. The functional form of this relationship is specified for the purpose of this study as:

$CAR_{it} = f\,(CRisk_{it}, LQR_{it}, ISR_{it}, ROA_{it}, SIZE_{it}, MRisk_{it}, OPR_{it}, GRT, INF)$

Econometrically expressed as:

$$CAR_{it} = \alpha + \beta_1 * CRisk_{it} + \beta_2 * LQR_{it} + \beta_3 * ISR_{it} + \beta_4 * ROA_{it} + \beta_5 * SIZE_{it} + \beta_6 * MRisk_{it} + \beta_7 * OPR_{it} + \phi_1 * GRT + \phi_2 * INF + \pi_{it} \quad (3)$$

$$(\pi_{it} = v_{it} + u_i)$$

'i' is a notation for individual banking firm, 't' stands for time period, and π_{it} is the disturbance term. Decomposition of π_{it} is to capture error from unobserved bank specific variables (v_{it}), while u_{it} is the robust standard error (RSE); α is the intercept, β and ϕ are parameters for estimating bank-specific and macroeconomic variables respectively.

4. Empirical Analysis

4.1 Panel Results

We employ the panel econometrics to intensify a perspective of risk management efficiency in Nigerian banks. As noted by Kennedy (1998), estimation of panel data regression allows for controlling of individual heterogeneity, reduces generalized biasness, hence improving efficiency of our model by using data with more variability and reduced collinearity. Following the basic principles as stated in the methodology section, our specified regression model in eq(3) is estimated in different forms- panel OLS, fixed effect, and random effect. The ratios used to estimate our model were computed based on data collected from sample bank's annual reports; other proxies were collected from institutional database such as World Bank, and CBN.

4.1.1 Descriptive Statistics

Table 2 presents a descriptive statistics of panel data variables for the selected 9 banks. The essence of these statistics is to indicate what level of disparity exists among the cross sectional variants. Looking at the table, statistics- based on sample data, shows a minimum credit risk coefficient of 0.129 and maximum of 0.580 for the industry, with 0.274 coefficient of variation. The coefficient of variation shows the dispersion of cross section credit risk index away from the industry mean, which is estimated to be 0.346. The lower the coefficient of variation, the closer the unit credit risk index is to the industry average.

Similarly, there is a wide gap in liquidity position among the banks, with minimum liquidity ratio of 0.112, maximum of 0.837 and coefficient of variation as 0.304. Most variables have shown common statistical feature in the industry. This could be due to the randomness of our cross section variables, where strong banks are taken alongside weaker ones for empirical study.

Table 2: Descriptive statistics of panel data variants

Descriptive Statistics for Selected Banks									
	CR	LQR	ROA	LOGTA	MRISK	ISR	OPR	GRT	INF
Mean	0.346	0.555	0.031	12.71	0.426	0.540	0.073	0.073	0.120
Max	0.580	0.837	0.192	14.33	0.869	1.283	0.301	0.105	0.178
Min	0.129	0.112	-0.001	10.02	0.240	0.145	0.025	0.057	0.054
Std. Dev.	0.095	0.169	0.034	1.162	0.137	0.217	0.059	0.019	0.039
CV	0.274	0.304	1.096	0.091	0.321	0.401	0.808	0.260	0.325

4.1.2 Estimates for Panel Regression Model

We refer to Table 3 for panel regression results. The table presents three patterns of estimates: (i) the panel ordinary least square model; (ii) the fixed effect model estimates; and (iii) the random effects model estimates. To minimize the instance of weak estimating parameters, we ensure that the right model is chosen, interpreted and well analyzed. The Hausman test for correlated random effects is included to technically provide the best model estimates for our data (see Table 5 for result). Hausman test basically considers if the variance in the estimates of the random and fixed effect models are significant to cause biasness of the modeled parameters. Where the variance is statistically significant, there is a likelihood of unobserved individual heterogeneity being uncorrelated to the independent variables; that is, the micro-unit effects and regressors are uncorrelated, implying that the random effect model estimates are preferred.

Results for Hausman test (chi-sq statistics) failed to reject the null hypothesis that unobserved firm specific heterogeneity are uncorrelated with regressors and so, we would be concentrating our analysis on estimates provided by the random effect model. However, Table 3 presents all results from different procedures for a more comparative interpretation. Furthermore, we adjust for heteroscedasticity to ensure that variance in disturbance terms is consistent over time. According to Baltagi (1995), OLS model may become inefficient in the presence of heteroscedasticity. Therefore, we use a general least squares (GLS) estimator to estimate the error variance, with an assumption that disturbance in the model concedes to panel specific autoregressive process, allowing for heteroscedasticity across cross sections (Baltagi, 1995).

Consolidating on the Basel capital adequacy requirement for risk mitigation, share of bank capital to total asset is expected to stand in for risk position of the bank. Thus, apriori theoretical expectation for relationship between bank capital adequacy ratio and credit risk is positive. Results in Table 3 follow the apriori with a positive impact of credit risk on capital adequacy position of Nigerian banks. The standardized *t*-statistic shows that the parameter estimate is statistically significant at 0.01 level. Comparing the result of the random effect estimate with fixed and OLS, parameter holds same position for the coefficient and significance. Efficiency of risk managing a bank's loan portfolio through capital augmentation therefore is substantiated in the case of Nigerian banks.

In terms of Liquidity, it is important for a bank to ensure that its current assets are well matched with current liabilities. In other words, a bank with low liquidity is prone to having untimed operational misadventure whereby it cannot fulfill its short term obligations to customers. In a situation as one mentioned above, a bank may have to liquidate part of its asset or take from its capital to service such obligations. This means low liquidity will affect capital ratio negatively and so, has positive movement with capital adequacy ratio. From our empirical results, the random effect model estimate for LQR parameter is positive. This shows that Nigerian banks risk management practices are positively associated with their liquidity position. For all the models, LQR parameter is statistically significant and positive at 1 percent.

An important variable in our panel model is the ROA. The ROA is used to incorporate bank profitability as a bank-specific determinant of risk management efficiency. Saunders and Wilson (2001) prove a nexus between bank capital and bank charter value using bank profitability as a measure of future prospect of the banking firm. This points out that a better performing bank with good returns on asset and consistent management policies can

be well capitalized for future operations. Bodie *et al.* (2008) explained earning and pay-out policy of a firm, where financial managers try to ensure a smooth dividend payment over time. When returns are excessively high, managers usually decide to plowback part of it as capital. With these two cases, it is expected that a positive association exist between capital position and profitability of a bank as indicated in our study as ROA.

Empirically, we find a negative result for impact of ROA on CAR, going against the theoretical expectation and contradicting findings from Cebenoyan *et al.* (1999), and Saunders and Wilson (2001). We trace this unusual position to the Nigerian banking crises of 2009, after the industry had been previously hit by the global financial mishaps. During the crisis, bank assets declined significantly and the industry witnessed a high default on loans and declining interest income. In addition, the federal monetary authority ordered all banks to make provision for impaired loans and adjust their old financial records to provide for the loan losses. This cleared historical book returns of the banks, with some banks signaling unexpected losses in their revised book. Because of data problem which is peculiar to developing world, this study was subjected to using 9 out of 24 banks operating in the industry. A perception of total asset as a determinant of risk management efficiency using the available data shows that bank size is not a relevant factor.

Within the context of the Nigerian banking industry, exposure of banks to market risk has been found to be a significant bank-specific determinant of their risk management efficiency. An iteration of our proficient random effect model for market risk determinant shows a positive link of the variable on risk efficiency of banks. This follows the apriori reasoning earlier stated, suggesting that when a banking firm is exposed to price uncertainties, risk management would be efficient at the instance where sufficient reserve capital is on standby. Hence, well capitalized Nigerian banks are in better position to sustain operation at the windfall of the market. The market risk under this study is measured using the coefficient of variation to index price stability of bank equities.

Interest sensitivity ratio is the ratio of interest sensitive assets over interest sensitive liabilities. When interest-sensitivity ratio is greater than unity, increasing interest rate will have positive impact on bank earnings but there would be a negative impact on net worth of the bank because the value of assets would be declining faster than the liabilities. Consequently, the equity capital of the bank will forcefully decline. Our regression table shows a positive coefficient for the ISR parameter under the random effect model. This may be theoretically correct if the interest sensitivity ratio is less than unity; though fixed effect and panel OLS results differ. Under this uncommon circumstance as seen in the

random effects coefficient, the interest sensitive liability of the bank can be more than the interest sensitive asset, implying that increasing rate of interest will reduce net interest margin and increase net worth of the bank, since the liability side of the book will be decreasing at a faster rate than the asset. However, the Nigerian case is not synonymous with less than unity asset-liability position, but rather caused by poor asset-pricing and weak floating interest rate regime caused by market indiscipline and sharp practices of bank managers. The *t*-statistic for this parameter has proven to be statistically insignificant for the random effect model but significant for the fixed effects and general form models at 10 percent and 5 percent levels respectively.

Concerning operation efficiency as bank-specific determinant of risk management efficiency, plowing hypothetical inputs to substantiate our theoretical claims, we find a negative impact of OPR on efficiency. OPR has been computed as net operating income divided by operating expenses. If operating efficiency ratio increase, it means the management is better positioned for profit and the impact of this on capital is expected to be positive. Model estimator for this parameter is estimated at -0.1395, indicating a unit increase in management efficiency index will result in 0.1395 reduction in capital adequacy ratio and risk efficiency of the bank. Under the general OLS model, a null hypothesis is rejected implying that the parameter is statistically significant. Fixed and random effect model estimates hold sway to the conjured general OLS position but are both statistically insignificant.

On the macro-determinants of risk management efficiency in Nigerian banks, economic growth and inflation were proxies. Result in Table 3 shows that economic growth which is a proxy for business cyclicality has positive impact on capital adequacy of Nigerian banks. By implication, Nigerian banking industry is pro-cyclical to economic cycles. In times of economic boom, more capital can be easily sourced from the financial market to buffer for possible shocks from risk-taking operations of the bank, but on the other hand, recession period is a bitter experience for banks. During recession, cost of capital is high and default rate on loans are high as well, subjecting bank management to a difficult risk management task. Regarding inflation, the random effect estimate shows a negative coefficient. In recent times, inflation rate has remained very high in Nigeria, with double digits. Since Nigeria operates a floating interest rate and floating exchange rate regime, high inflation has caused interest rates to remain high. This makes financing decision more difficult task for banks, with high rates of interest, cost of funds are high and also equity holders usually demand for higher returns. In this case, capital augmentation is an expensive process due to

increasing inflation. Result from regression is consistent with this theoretical perspective, though *t*-statistic tells us the variable parameter is not significant in determining risk efficiency of banks in Nigeria.

Table 3: Estimates of Parameters for Panel Regression Model

Independent Variable	Regression Models		
	Panel OLS	**Fixed Effect (EGLS)**	**Random Effect (EGLS)**
Crisk	0.7523* (5.8946)	0.6110* (4.1744)	0.4533* (3.8049)
LQR	0.2161* (5.5747)	0.2501* (6.2299)	0.1711* (3.5216)
ROA	-0.9871* (-5.3091)	-1.0691* (-5.5845)	-1.1198* (-6.7044)
LOGTA[1]	0.0281 (1.4444)	0.0097 (0.6414)	-
MRisk	0.3134* (9.1429)	0.3631* (8.2703)	0.3608* (8.1312)
ISR	-0.1339** (-2.3779)	-0.0968*** (-1.7881)	0.0219 (0.4378)
OPR	-0.9018* (-3.8687)	-0.0093 (-0.0762)	-0.1395 (-1.1808)
GRT	0.9641** (2.0850)	1.0612** (2.0787)	1.1787** (2.3909)
INF	0.2332 (1.4820)	0.0058 (0.0273)	-0.1778 (-1.2204)
Constant	-0.7238* (-2.6104)	-0.4900** (-2.3330)	-0.3064* (-5.7619)
R-Square	0.881	0.870	0.809
F-statistic	31.752	17.755	28.736
Prob(F-stat)	0.000	0.000	0.000
Durbin Watson	1.94	1.89	2.03

The results shown in parentheses are absolute values of the *t*-statistic, with *, ** and *** implying rejection of the null hypothesis at the 1%, 5% and 10% levels respectively. The panel Regression results were carried out on E-VIEWS 6.0.

4.1.3 Robustness Test

Now we look at the sufficiency of the model by analyzing the coefficient of multi-determination, *F*-statistics, Durbin Watson test for autocorrelation and covariance analysis

[1] According to Baltagi (1995), estimation of random effects model requires that number of variables should be less than the number of cross-sections. To meet this condition, bank size (LOGTA) is omitted for the random effects model since it is insignificant under the fixed effects and the OLS models.

for multicollinearity. Durbin Watson result for autocorrelation shows there is no first order autocorrelation in the models. The autocorrelation result supports that error terms are not correlated and series could be adjudged stationary. The *F*-statistics test of the significance of the model has also strengthened the reliability of the model, significant at 1 percent level. The R^2 coefficient is used in determining the explanatory power of our independent variables as relate changes in dependent variable. For our model, R^2 is 0.809 under the random effect model. This means that about 80 percent variation in capital ratio is explained by changes in selected bank-specific and macroeconomic variants.

Table 4: Covariance coefficients for Multicollinearity Check

Covariance (Correlation)	Covariance Analysis								
	LOGTA	**CR**	**LQR**	**ROA**	**MRISK**	**ISR**	**OPR**	**GRT**	**INF**
LOGTA	1.329 (1.000)								
CR	0.038 (0.352)	0.009 (1.000)							
LQR	-0.017 (-0.086)	-0.007 (-0.427)	0.028 (1.000)						
ROA	0.007 (0.177)	0.000 (0.112)	-0.002 (-0.319)	0.001 (1.000)					
MRISK	0.024 (0.153)	-0.001 (-0.058)	-0.001 (-0.060)	-0.001 (-0.121)	0.019 (1.000)				
ISR	0.043 (0.174)	0.018 (0.467)	-0.014 (-0.389)	0.000 (-0.026)	0.001 (0.028)	0.047 (1.000)			
OPR	-0.043 (-0.633)	0.000 (-0.066)	-0.002 (-0.241)	0.000 (0.071)	-0.001 (-0.118)	0.001 (0.061)	0.003 (1.000)		
GRT	-0.017 (-0.763)	-0.001 (-0.377)	0.001 (0.242)	0.000 (-0.026)	-0.001 (-0.361)	-0.001 (-0.269)	0.001 (0.442)	0.000 (1.000)	
INF	-0.022 (-0.494)	0.000 (0.055)	-0.001 (-0.167)	0.000 (0.054)	0.000 (0.047)	0.001 (0.077)	0.001 (0.349)	0.000 (0.434)	0.00 (1.0)

Note:

a. The notations used in summarizing results as denoted on table 3, 4 & 5 are labelled as follows: CAR represents capital adequacy ratio; CRisk is credit risk estimator; LQR is liquidity ratio; ROA is return on asset; LOGTA stands for the natural logarithm of total asset; MRisk Proxy for market risk. In addition, ISR is label for interest sensitivity ratio; OPR as operation efficiency; GRT is a Proxy measure for economic growth, and finally INF is used to denote inflation.
b. The results shown in parentheses are absolute values of correlation matrix

Table 4 presents correlation coefficients and covariance of explanatory variables required for testing for multicollinearity. According to the assumptions of the classical regression model, when explanatory variables within a model are correlated, the model is not best. Correlation among regressors weakens the efficiency of our parameter estimates. The table above tells us none of the paired regressors are significantly correlated and the covariance coefficients all approximates zero. This implies there is no multicollinearity within the model and so, our model can be best estimate of the regression line.

Table 5: Hausman's test

Test Summary		**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
Cross-section random		0.281307	8	0.31093
Variable	**Fixed**	**Random**	**Var(Diff.)**	**Prob.**
CR	0.611045	0.453333	-0.004564	0.0492
LQR	0.250165	0.171127	0.000654	0.0021
ROA	-1.069112	-1.119840	0.002973	0.0728
MRISK	0.363112	0.360824	0.000094	0.2665
ISG	-0.096891	0.021962	-0.000328	0.0000
OPR	-0.009376	-0.139573	0.009464	0.2805
GRT	1.061222	1.178746	0.058749	0.1807
INF	0.005803	-0.177815	0.006679	0.2810

To check the impact of the financial crisis on capital adequacy of Nigerian banks, a test was further carried out. Since the main economic damage was more pronounced in 2007 and 2008, a dummy variable was included in a model to test the relevance of the crisis. But results show that the global financial crisis is not a significant factor. Hence we removed the dummy variable and base our findings on the general model specified in section~3.4.

5. Conclusion and Policy Recommendation

A core objective of this study is to empirically investigate what are the key determinants of bank risk management efficiency in Nigeria. We examine a long run equilibrium among financial ratios with uncertain coefficients, macroeconomic variables, and capital ratio which is proxy for risk management efficiency. Panel regression methodology was employed to envelope both bank-specific and macro-determinants. Considering our findings from the panel regression analysis, it has been established that macro-determinant-economic growth, has positive impact on risk management efficiency among Nigerian banks; inflation is negatively related to bank's capital adequacy, in accordance to apriori theoretical expectation.

Empirical findings based on this study suggest that risk management among Nigerian banks has not been efficient. Prior to introduction of Basel II rules to the system, banks where under-capitalized. The institution of the 2004 Accord ensued banks to recapitalize, with banks having to meet a new capital base of 25 billion naira (165 million US$) minimum. At that point, banks were perceived to be strong enough to absorb operational

shocks, but the financial crisis proved otherwise, with 5 out of the 24 banks being forced to a troubled position and 8 others were advised to recapitalize. Whereas, capital buffers for operational risk, it has its own determinants. Our scientific analysis shows that bank capital adequacy is positively associated with liquidity, bank size and market risk. Bank size from results is proven to be statistically insignificant.

As expected, credit risk shows a positive impact on capital position of Nigerian banks. By implication, an average Nigerian bank is efficient in managing its credit portfolio since evidence shows they have sustained adequate capital for exposures from credit activities. Management quality, which has been measured as operating efficiency of the banks, indicates a negative impact on risk management efficiency. We identify this to be caused by competition in the industry which makes loan availability a factor for attracting customers in Nigeria. This makes banks' written policy flexible, a feature of weak management. Also, risk performance in Nigerian banking industry has reiterated it is pro-cyclical considering the regression outcome for the economic growth parameter. This is contrary to the finding by Francis and Osborne (2009) in a study on UK banking industry which supports an argument that risk capital ratios are counter-cyclical. Economic growth is a significant determinant of bank stability, whereas inflation is not.

Juxtaposing the essence of risk management in banks, and the effectiveness of the Basel framework for risk management, there is a substantial argument against the efficiency of the framework itself. Empirical findings from several studies such as Francis and Osborne (2009), Borio and Drehmann (2009), and Clement (2010), including this has shown that risk management efficiency in banks is co-determined by macroeconomic factors which vary with cycles. These macroeconomic factors have not been well integrated into the Basel guide. Although credit ratings have been suggested to qualify sovereign risk, the core macro-determinant of performance such as economic growth has been omitted.

Saurina (2009) have suggested the use of through the cycle inputs rather than risk models. In addition, pro-cyclical risk process can be mitigated if monetary authorities at regular intervals examine the risk position of banking firms to avert extreme losses; prioritizing future expectations over present profitability.

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