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Modeling Bank Capital Adequacy Dynamics and Liquidity Risk Management, Empirical Evidence from the Nigeria Commercial Banks

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Abstract:

This study examines the effects of Capital adequacy on liquidity risk management practices in Nigeria. The secondary time series data were obtained from the annual reports of the fifteen (15) quoted commercial banks in Nigeria as compiled from the Nigeria Stock Exchange Fact book for the period 1989 to 2015. The independent variables capital adequacy are categorised under Tier I, Tier II to total risk assets, capital conservation buffer (CCB), Minimum total capital (MTC) and counter-cyclical Buffer (CCyB). The dependent variable Liquidity risk was modelled with the five variants of capital adequacy measures. The multivariate regression equation were specified and results obtained based on E-views version 9.0. The OLS and cointegration result shows existence of a short run and long run equilibrium relationship between LIQR and capital adequacy (CAR). The Unit root test shows that the variables were stationary at level and first difference i.e. 1(0) and 1(1). The VAR test indicates that fluctuations in liquidity risk are significantly influenced by capital adequacy measures. The granger-causality test shows a unidirectional link between liquidity risk and capital adequacy. The impulse response function (IRF) shows that liquidity risk responded negatively to capital adequacy measures. The variance decomposition results indicates that LIQR accounted for 78.73% of own shocks at the short run, while at the long run accounted for 14.76%, the rest of 86.34% were distributed among the capital adequacy measures with CCB accounted for the highest. This study concludes that transition to Basel III will further mitigate the concentration of liquidity risk and avert systematic failure in the Nigeria banking system. It is recommended that risk management should be a matter policy focus and priority among regulators and operators in Nigeria banking industry.

Key words: Liquidity risk, capital adequacy, capital buffer, financial fragility.

Introduction:

There is a need to bridge the misconception about what is adequate capital and what is liquidity in financial service industry and among economists and regulators. Bank management task strive among other things to strick a balance between profitability and liquidity objectives. Bank can only be liquid when they are capitally adequate. Banks meeting their nominated role of financial intermediation as well as depositors' demands can only be feasible when bank is liquid and capitally sound.

No wonder Ezirim (2005) argued that the normative approach to the role of banks suggest that it meet the expectation of its publics. In the same vein, Hearn, J. B. (2016) maintained that a bank liquidity is the ability to support its customers with cash on demand. He further asserts that without any rules and regulations a prudent bank should hold sufficient cash to satisfy everyday customers' demand (liquidity) and sufficient own funds (capital) to deal with bad debts.

In Nigeria for example, part one, section 7(2) of Banks and Other Financial Institution's Act (BOFIA) 2009 as amended requires banks to maintain capital unpaired by losses in such a ratio to all or any assets or to any liabilities or both its asset and liabilities of the bank and all its offices in and outside Nigeria as may be specified by the Central Bank of Nigeria (CBN).

Managing risk is one of the core activities in a bank and is critical to the long-term profitability and stability. A bank can only be said to be stable when it is liquid. Capital regulation by way of minimum capital requirement is one of the current banking regulation used globally. The relationship between Bank capital and risk taking is a burning issue in contemporary banking literature. Studies have shown that bank profitability, liquidity and stability is a function of its capital buoyancy.

Banking business by its nature are expose to risk of losses capable of endangering its survival and growth, hence the need for banks holding adequate capital commensurate with risk exposures. According to Bessis (2010) risks are uncertainties that potentially result in negative variations in profitability or in loss. Capital adequacy compliance is a critical bank management option that can leverage commercial banks against systemic and unsystemic risks.

According to Atik (2011) the Global Financial Crisis (GFC) of 2007/2008 was a consequence of bank illiquidity and credit crunch. In the contrary, Walter (2017) opined that a well-runed bank needs no capital and that no amount of capital can rescue a badly managed bank. Walter's view favours quality management and not capital adequacy. Santomero (1997) holds that recognizing liquidity risk leads banks to recognize liquidity itself as an asset, and that portfolio design in the face of illiquidity constitutes a challenge to banks.

After the global financial saga, the need for banks to effectively manage risk and be capitally adequate look a central stage. It was in recognition of the sensitivity of liquidity risk in bank management that the Basel Committee on Bank Supervision (BCBS 2008) in attempt to address the issue of liquidity mismatch that it included in the guidance/principles for sound liquidity risk management that banks should use stable sources of funding. Accordingly, this was to account for the lessons learned during the crisis and it was based on a fundamental review of sound practices for managing liquidity risk in banking organizations.

Globally, financial system fragility and crisis emanating from the risk taking behavior of the banking institutions has been a matter of concern and priority among regulators and management. Most work in this area dwell more on capital adequacy and performance or profitability but this work seek to model the effects of bank capital adequacy ratios on liquidity risk management. This work examine whether there exist any relationship between capital adequacy ratios as defined in Basel I, II & III and liquidity risk management practices among commercial banks in Nigeria. It is against this background that this study seek to provide answers to the question;

What is the relationship between capital adequacy measures and liquidity risk management?

To analyse the nature and direction of relationship between capital adequacy and liquidity risk management.

Conceptual /Theoretical Review:

The Buffer capital theory of Calem and Rob (1996) predicts that regulation to boost bank capital can reduce risk. The Bank for International Settlement (BIS 2011) reported that the counter-cyclical capital adequacy buffer provisions in Basel III stressed that

capital buffers are required for banks to restore confidence in volatile times. There is no gain saying that the conflicting management objectives of banks' liquidity, safety and profitability can only be reconciled when banks are capitally adequate to withstand and absorb both monetary and macroeconomic shocks in its operating environments.

This work therefore hinge on two main underpinning theoretical concepts; the liquidity management theories and the Buffer theory of capital adequacy. The liquidity management theories include;

The commercial loan theory; the commercial loan or real bill doctrine proposition holds that commercial banks should invest wholly in short-term self-liquidating productive loans to their customers. The theory assures appropriate degree of liquidity for bank and appropriate money supply in the economy. The theory is in consistent with the rationale for banks holding adequate capital or be liquid at all-time thereby avoiding risk of bad debts that trigger insolvency. However, this principle fails to recognize that the risk of failure or default on a loan is inherent whether self-liquidating or otherwise.

The shiftability theory; this holds that commercial banks should only invest in substantially in assets that can be moved (shifted) to other banks or central bank for cash without any loss of value. The principle posits that an asset is perfectly shifted (moved) or perhaps be transferred without any loss when bank is in need of capital or liquidity. The theorists suggested assets such as treasury bills or bills of exchange as assets that can be shifted for cash or capital when bank is in need of fund. In a nut shell, the theory posits that when banks need capital or liquid cash such assets can be shifted to the central bank as a Lender of Last Resort (LLR).

The Anticipated Income Theory; the theory holds that banks should plan the liquidation of a term loan from income anticipated or expected of the borrower. The theory favours the security of loan and repayment plans to compliment the solvency, safety and profitability objectives of banks.

Buffer theory of capital adequacy; The buffer capital adequacy proposition holds that banks are sensitive to monetary and macro-economic shocks, hence banks should prefer to hold buffer of excess capital to reduce the probability of falling under the legal capital requirements especially if there capital adequacy ratio is very volatile (Ikpetan 2013). Liquid assets as buffer tends to account for the short comings of earlier theorists as it considers the unpredictability of depositors' withdrawals as well as other factors affecting the uncertainties of flows in and out of the bank and the effects thereof. An insight, of this theory suggests that bank investing in liquid assets is purely for precautionary motives.

Empirical Evidence:

Admati and Hellwig (2013) theorized that larger capital buffers should reduce both the probability and cost of financial crisis just as higher, as higher levies protect flood. Andrea etal (2012) examined the impact of banks' capital adequacy regulation on the economic system. They found out that banks' survival has consequent on the real economy. Jordan etal (2017) confirmed this position in their later study titled "what has bank capital done for us".

Robert, Bichel and Jurgbium (2005) amplified the followings in support of bank capital regulation from economic view point that unregulated banks tend to hold too little capital, adding that the externalities in the banking system are especially severe such that it can cause disruption in the payment system and general loss of confidence in the banking system with possible contagious consequences of bank runs which will affects the economy as a whole. He concluded that reduction in credit extension to a banking crisis can slow economic growth thereby leading to cost in terms of reduction in GDP.

Jin Cao and Loran Chette (2014) examined capital adequacy and liquidity in banking Dynamics. They present a framework for modelling optimum capital adequacy in a dynamic banking context combing the capital framework of (Repull, 2013) with that of (Corhae & D Erasino, 2014). Their framework

ameliorates bankruptcy using both capital adequacy and liquidity requirements. They concluded that social cost of regulation may be reduced if regulatory capital requirement is accompanied with other tools such as liquidity buffer.

Aleksamdra, Z. B etal (2014) studied capital adequacy (solvency) and liquidity risk management; they analysed supervision, capital adequacy and liquidity prudential norms, limits and requirements of commercial banks operating in Lithuania as well assessed the quality of capital adequacy and liquidity risk management impact on the banking industry. The study revealed that the most important in banks' capital adequacy and liquidity risk management is quality control and the harmonization of bank assets and liabilities. Their finding confirmed Achmea Bank N. V Report of 2015 which stressed that banks implement internal processes to monitor and manage liquidity risk. The main trust of this objective was to manage liquidity within the bank to prevent situation whereby the bank can no longer meet its obligation. According to this report these processes are included in the Internal Liquidity Adequacy Assessment Process (ILAAP) manual.

Daniel, N. N (2015) examined the effects of capital adequacy requirements on liquidity of commercial banks in Kenya; He obtained data on 43 commercial banks in Kenya between 2010 to 2014 for the studied banks. The study adopted the descriptive statistics regression and correlation analysis. They found a strong significant correlation between bank liquidity ratio and capital adequacy requirements. They concluded that capital adequacy, bank size and GDP growth rate all have a significant effects on liquidity ratio of commercial banks in the studied country.

Saibal, G. (2014) studied risk capital and financial crisis of 100 GCC banks between 1996 to 2011, testing the relationship between risk and capital. The study employed a 3 SLS models in estimating the relationship between risk and capital. The result of the study unveiled that bank generally increase capital in response to an increase in risk and not vice versa.

Natalia, K. (2016) examined Basel III requirements of bank capital and liquidity. The trust of the study was the analysis of bank capital and bank liquidity. The work was intended to determine capital adequacy level and assessment of the financial strength of capital in Latvian commercial banks. The study revealed that tight or tough capital standards will lead to reduction in crediting and recession in bank activity.

Methodology:

This study used time series data from the annual report of fifteen (15) quoted commercial banks in Nigeria as compiled by the Nigeria Stock Exchange (NSE). The data on the dependent variable; liquidity (Risk) and independent variables (capital adequacy) are expressed in ratios spanning from 1989 to 2015. The study investigated whether there exist any dynamic relationship between capital adequacy and liquidity risk management. Studies have shown that macroeconomic monetary time series data usually exhibit stochastic trend that can be remove through differencing. We employed the Augmented Dickey Fuller (ADF) approach to test the order of the variables integration. We conducted both the short and long-run equilibrium relationship. Also the VAR model was conducted to establish the relationship among the variables of study. The granger causality test was carried out to analyse the statistical link between capital adequacy (CAR) and liquidity risk management (LIQR). The impulse response function (IRF) was conducted to analyse the response of liquidity risk management to capital adequacy. The variance decomposition test was conducted to show how much percentage of the total variance is explained by each component.

Data Specification:

Liquidity Risk; This is the risk of funding which is related to an unexpected event or currency crisis. This measures the inability of a bank to fulfill its financial commitments when its obligation fall due without incurring unacceptable losses. Under Basel III liquidity coverage ratio (LCR) ensures that banks having sufficient high quality liquid assets (HQLA)

to survive a significant stress scenario lasting 30 days. LCR =

$$\text{HQLA} / \text{days Total net cash outflows over next 30 calendar} \geq 100\%.$$

Independent variables; capital adequacy ratios; This is the capital to risk (weighted). Is the ratio of a bank's capital to its risk. Central banks track the ratio of a bank's capital adequacy ratio (CAR) to ensure that it can absorb a reasonable amount of loss and complies with statutory capital requirements. Its measures the ability of a financial institutions to pay its debts. CAR is a measure of a bank's available capital expressed as a percentage of a bank's risk weighted credit exposures.

$$\text{Capital Adequacy Ratio} = \frac{\text{Tier 1 Capital+Tier 2}}{\text{Risk Weighted Exposures}}$$

Under Basel III capital adequacy Ratio = Total Capital divided by risk weighted exposures.

$$\therefore \text{CAR} = \frac{\text{Tier I,Tier II+CCB1+MTC+CB}}{\text{Total Risk Weighted Exposures Claims}}$$

Total risk exposures = loans amount x risk weighted percentages. (Exposures)

Model Specification:

Specifying the model for this study, the following alphabets were used to denote the respective variables. LIQR = f(CAR)……...1

We disaggregating equation 1 above into equation 2 as;

$$LIQR = \beta_0 + \beta_1 \text{ Tier I} + \beta_2 \text{ Tier II} + \beta_3 CCB + \beta_4 MTC + \beta_5 CCyB + \mu i \ldots\ldots\ldots\ldots\ldots\ldots 2$$

Where
LIQR = Liquidity Risk
CAR = Tier I, Tier II, CCB, MTC & CCyB
Tier I = Tier I Capital to Total Risk Assets (core capital)
Tier II = Tier II Capital to Total Risk Assets
CCB = Capital Conservation Buffer
MTC = Minimum Total Capital Ratio
CCyB = Counter-cyclical capital Buffer

Results and Discussion:

The Unit Root Result.

Variables	**Augmented Dickey-Fuller test statistic**			
	Level	**Prob.**	**1st Diff**	**Prob**
LIQR	-2.302872	0.1785	-3.511412**	0.0108
TIER 1	-3.313864**	0.0212	-	-
TIER II	-3.385016**	0.0176	-	-
CCB	-1.973955	0.1564	-3.908302***	0.0011
LR	-4.192549***	0.0032	-	-
MTC	-1.986388	0.1609	-3.515495**	0.0256
CCyB	-3.893181***	0.0036	-	-

Note:*, **, *** statistically significant at 10%, 5% and 1% significant level

Source: E-view 9.0

Johansen Cointegration Result for Capital Adequacy Measures

Series: LIQR TIER1 TIER2 D(CCB,2) D(MTC,2) CCYB

Lags interval: 1 to 1

	Likelihood	**5 Percent**	**1 Percent**	**Hypothesized**
Eigenvalue	**Ratio**	**Critical Value**	**Critical Value**	**No. of CE(s)**
0.977607	236.9040	94.15	103.18	None **
0.936037	149.5271	68.52	76.07	At most 1 **
0.837360	86.28963	47.21	54.46	At most 2 **
0.698482	44.51670	29.68	35.65	At most 3 **
0.369081	16.94144	15.41	20.04	At most 4 *
0.241192	6.348151	3.76	6.65	At most 5 *

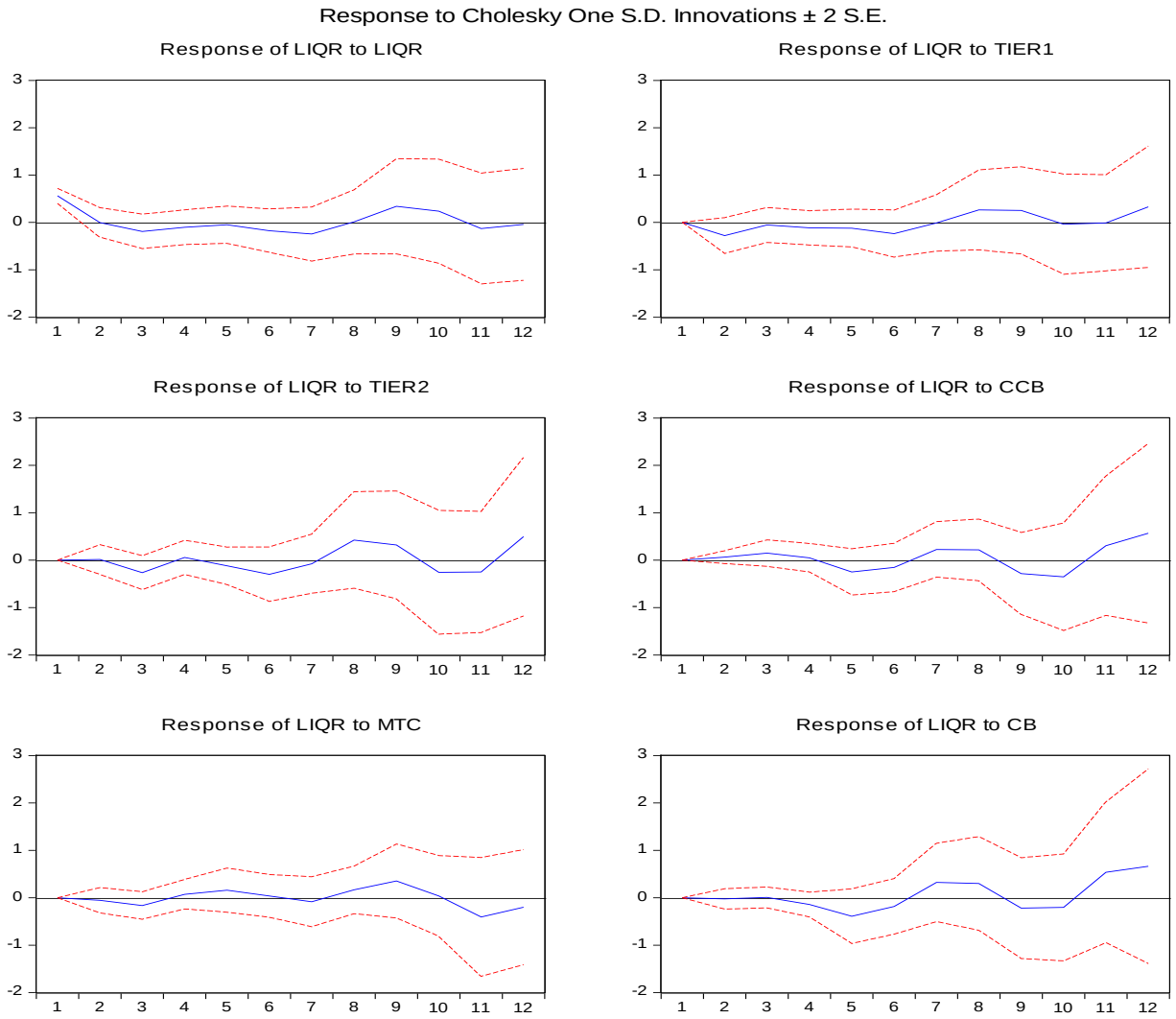
VAR model for Basel Capital Adequacy Measures and Credit Risk Management Practice

	C	**TIER1**	**TIER2**	**CCB**	**MTC**	**CCyB**
LIQR	5.464826	7.507993	2.397829	2.995746	5.933993	-41.38997
	(3.64702)	(2.84697)	(2.41200)	(1.40123)	(3.80931)	(25.4285)
	[1.49844]	[2.63719]	[0.99413]	[2.13794]	[1.55776]	[-1.62770]

Granger causality test result between Credit Risk Management Practice and Basel Capital Adequacy Measures

Null Hypothesis:	**Obs**	**F-Statistic**	**Probability**
TIER1 does not Granger Cause LIQR	26	0.56033	0.46171
LIQR does not Granger Cause TIER1		8.12377	0.00906

Impulse Response Function of Liquidity risk to Capital adequacy Measures



Variance Decomposition of Liquidity Risk by Selected Basel Capital Adequacy Measures

Period	S.E.	LIQR	TIER1	TIER2	CCB	MTC	CCyB
1	0.561181	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.632428	78.73804	19.30137	0.048259	1.012558	0.744101	0.155671
3	0.746969	62.85100	14.35169	12.65459	4.608316	5.416652	0.117750
4	0.783265	58.90837	15.20437	12.06936	4.615183	5.800278	3.402449
5	0.940592	41.12941	12.17956	10.01427	10.15680	6.903055	19.61690
6	1.056899	35.28559	14.61933	15.82946	10.16618	5.597600	18.50184
7	1.160086	33.75526	12.14063	13.55855	12.23980	5.184817	23.12092
8	1.327446	25.78702	13.22518	20.60635	11.99476	5.553970	22.83272
9	1.516549	24.86594	12.92230	20.27692	12.64116	9.698695	19.59499
10	1.609115	24.25331	11.53320	20.54559	15.98688	8.665128	19.01589
11	1.792856	20.04795	9.292952	18.49588	15.80525	12.08313	24.27484
12	2.091808	14.76593	9.337551	19.19650	18.97990	9.785208	27.93491
Cholesky Ordering: LIQR TIER1 TIER2 CCB MTC CCyB							
sssur							

The short run analysis shows that capital adequacy accounted for changes in liquidity risk management to the tune of 13 percentage indicated by the coefficient of the r^2 of 0.133855 while Tier I, Tier II, and CCyB shows a positive link liquidity risk capital conservation buffer (CCB) and Minimum Total Capital (MTC) shows a negative link.

The Unit root results allowed us to build our model on 1(0) and 1(1) models. The result obtained shows that all the variables were stationary at levels except CCB and MTC which were stationary after first difference. Using the Johansen and Juselius approach (1990) which contains likehood ratio of statistic, the maximum eigenvalue and the trace statistic to determine the existence of a long run relationship among the variables taking into consideration the effects of including intercept and trend in the models, the result unveils existence of a long run equilibrium relationship between capital adequacy and liquidity risk management.

The VAR result when we considered the six (6) variables as endogenous for the model, we confirmed that fluctuations in liquidity risk was positively significantly and statistically influenced by capital adequacy measures.

The bi-causality test shows that liquidity risk granger-causes Tier I capital to Total risk significantly given the probability value of 0.00906. the Impulse Response Function (IRF) result indicates that liquidity risk responded negatively to capital adequacy during the first six months later towards the third quarter responded positively. Though it respond to CCyB and MTC capital ratios were at the beginning but was insignificant. The variance decomposition result shows that liquidity risk accounted for 78.73%, 62.85%, 58.91%, 41.12% and 35.28% respectively of own shock in the first six months period.

Among the selected capital adequacy measures, Tier I, accounted for 14.61%, in the mid-year, Tier II 15.82%, CCyB 10.16%, MTC 5.59% while CCB 18.50% during the first six months. At the long-run, LIQR accounted for 14.76% of own shock. Capital conservation Buffer has the highest contribution to shock in liquidity risk of 27.93% , Tier I 9.33% and Tier II 19.19% respectively while CCyB contributed 8.97% and MTC 9.78%.

Our findings shows existence of both short and long run equilibrium relationship between capital adequacy and liquidity risk management. From the VAR, IRF result capital adequacy is a strong mitigant of liquidity risk in banks. While the causality result shows a unit direction link between liquidity risk and capital adequacy ratios.

Recommendations:

1. Based on our findings, liquidity risk management should be a matter policy focus and priority in bank management.
2. Regulators should as a matter of urgency, come up with policy statement framework to usher in Basel III proportion in the Nigeria banking system. This is so because capital components of the new proposal are found to be an effective measures to cushion bank risk factor.
3. Government should ensure adequate security measures to protect bank liquid asset since liquidity is critical to bank growth and stability in view of the increase wave of banks raiding.

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