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The predictive power of banks' liquidity on profitability in Nigeria

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Abstract

This study investigated the predictive power of banks' statutory liquidity on their profitability in Nigeria between 1990 and 2019. The vector autoregression and variance decomposition methodology were employed. The findings showed that a change in return on asset (ROA) was weakly associated with itself, with liquidity variables, liquidity risk and real gross domestic product growth rates. In a five-year prediction, a 100% change in ROA was explained by itself in the short-run. Other variables showed strong exogeneity with ROA, from short to long-run, an indication that banks in Nigeria face bleak future in using statutory liquidity to positively and significantly affect profitability. Understanding these findings would assist policymakers in their liquidity/profitability policy making, and the banks to re-strategize in their liquidity management.

Keywords: *Statutory Liquidity, Return on Asset, Prediction*

JEL Classification: *G29 G21 G32*

INTRODUCTION

Predicting bank performance is important for numerous reasons. It is important for banks because it aids banks in deciding how much liquidity will be needed to meet future demand. It is important for the central bank in deciding the stance of current monetary policy. It is important for the governments when forecasting budgetary surpluses and deficits. Banks' liquidity embodies expectations of their future profitability. Using statutory liquidity to predict bank profits, therefore, is fairly commonplace.

Idowu, Essien and Adegboyega (2017) point out that liquidity and profitability can be likened to two centrifugal forces with contradictory objectives which at all times threaten to pull the bank apart. Olugaunju, et al (2011) findings suggest that there is a significant relationship between liquidity and profitability. Also, Lartey, Samuel and Bodadi (2013) find that there is a positive and statistically significant relationship between liquidity and profitability of the listed banks. On the contrary, Obi-Nwosu, et al (2017), find that liquidity mechanism is not significantly related to Deposit Money Banks (DMBs) profitability in the short.

The problem with the above studies is that they focus on levels of liquidity rather than on the predictive contents of liquidity for future bank returns. In their study, Ogbulu and Eze (2017), using ordinary least squares, error correction method, vector autoregression and variance decomposition, find that liquidity has significant impact on DMBs' return on assets in the short-run, but insignificant impact in the long-run. In this study, the researcher hypothesizes that Nigeria's Deposit Money Banks' statutory liquidity has insignificant predictive effects on their future profitability, both in the short and long-run.

The motivation and relevance of this study lies in the fact that banks, all over the world, are evaluated on their liquidity creation or their ability to meet cash and collateral obligations without incurring substantial losses. This means that liquidity is crucial in arriving at sound banking decisions in any economy. Surprisingly, this is as far as theory goes. In practice a wide gap exists between theory and practice. There is thus the controversy as to whether banks in Nigeria actually rely on statutory liquidity and other controlled liquidity measures to make profit, both in the short run and long run.

This study is organized in sections. In addition to Section 1- Introduction – are Section 2 (Literature Review); Section 3 (Methodology); and Section 4 (Data Analysis and Interpretation). Others are Section 5 (Discussion of Findings); Sction 6 (Conclusion); and Section 7 – Recommendations.

2. LITERATURE REVIEW

According to Nwaezeaku (2006), liquidity in banks measures the availability of cash and the rate at which current assets are converted into cash to meet ordinary and extraordinary request. Liquidity management, from the view point of regulations, ensures that banks do not easily become insolvent. The availability of liquidity is particularly very important because lack of liquidity may provoke fear in depositors and uncertainty in banks. Therefore, there is need to strictly monitor and control liquidity by regulators.

Eljelly (2004) suggests that efficient liquidity management is associated with planning and controlling of current assets and current liabilities in an efficient manner so as to eliminate the risk of non-payment of dues for short term requirements and to also avoid excessive investment in these assets. The planning and control must be executed in compliance with monetary authorities' and supervisory policies.

Adequate liquidity serves as a veritable tool through which banks maintain the statutory requirements of the central banks as well as their liquidity creation and the risks involved. It reduces the incidence of bankruptcy in banks. It helps them to achieve some margin of safety for their customer's deposits. In other words, liquidity is the life blood of banks. Adequate liquidity helps to generate and sustain public confidence of the depositors and the financial markets. It is also needed to avoid forced sale of assets at unfavourable market conditions and at a heavy loss. Having adequate liquidity to meet a central bank's compliance, and also liquidity to meet all day-to-day obligations, is indispensable for the growth of banks.

Nwankwo (1991) opines that risks are created as banks manage their statutory liquidity. Such risks include funding risk-the ability to replace net outflows either through withdrawals of retail deposits or nonrenewal of wholesale funds; liquidity risk- the ability of banks to compensate for the non-receipt of inflow of funds if borrowers fail to meet their commitments; and credit risk, which arises from calls to debtors to honour mature obligations. When banks operate across multiple time zones, experience seasonal fluctuations in their incoming and outgoing cash flows and pulling together different information technology systems with heavy resources, liquidity risk, credit and other risks are created (Pyle 1997; Isa 2014; Kanchu and Kumar 2013). Any attempt by banks to downplay these risks in the management of liquidity can lead to a variety of problems which are very potent in pulling them into ill health.

2.1 Conceptual Framework

The conceptual framework of liquidity-bank profitability relationship in this study, follows the fact that banks manage their statutory liquidity, their internal liquidity creation, risks, in compliance with central bank's statutory cash reserve requirements, with a view to generating good returns for stockholders in the economy. Our conceptual framework is shown in chart 2.1

Chart 2.1 Author's concept of liquidity-bank profitability relationship

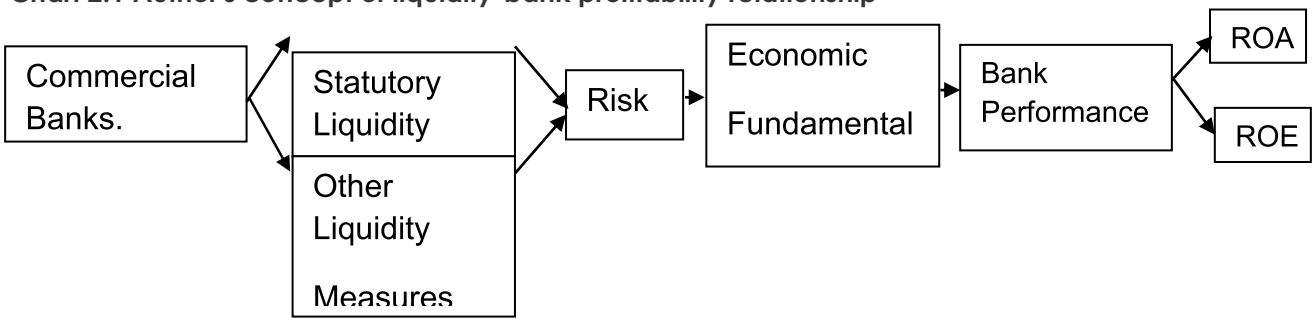

Chart 2.1, which represents the focus of this paper, shows that commercial banks' liquidity remains largely the use of their statutory liquidity to grant loans and invest in short-term securities. Banks must comply with the central bank's policy of maintaining cash reserves. In the process of granting loans and investing in short-term securities, banks create liquidity and liquidity risk in the midst of economic fundamentals. Adequate liquidity ensures that the banks can continue to serve their functions and make profit.

2.2 Theoretical Literature

The theories of liquidity and liquidity management include the following:

Anticipated Income Theory

This theory was developed by Prochanow in 1944. The theory holds that a bank's liquidity can be managed through the proper phasing and structuring of the loan commitments made by a bank to the customers.

Here the liquidity can be planned if the scheduled loan payments by a customer are based on the future of the borrower. According to Nzotta (1997) the theory emphasizes the earning potential and the credit worthiness of a borrower as the ultimate guarantee for ensuring adequate liquidity.

Shiftability Theory

This theory was propounded by Moulton in 1944(see Nwakwo,1991). It is an approach to keep banks liquid by supporting the shifting of assets. When a bank is short of ready money, it is able to sell its assets to a more liquid bank. The approach lets the system of banks run more efficiently with fewer reserves or investing in long-term assets. Under shiftability, the banking system tries to avoid liquidity crises by enabling banks to always sell at good prices.

Liability Management Theory

This theory states that there is no need to follow old liquidity norms like maintaining liquid assets and investments. Banks have focused on liabilities side of the balance sheet. According to this theory, banks can satisfy liquidity needs by borrowing from the money and capital markets. The fundamental contribution of this theory was to consider both sides of a bank's balance sheet as sources of liquidity.

Commercial Loan Theory

This theory was proposed by Prochanow (1960). It states that the liquidity of the commercial bank achieved automatically through self-liquidation of loan, which being granted for short periods and to finance the working capital, where borrowers refund the borrowed funds after completion of their trade cycles successfully. This theory has been subjected to various criticisms (see Dodds,1982). From their various points of view, the major limitation is that the theory is inconsistent with the demands of economic development especially for developing countries since it excludes long term loans which are the engine of growth. The theory also emphasizes the maturity structure of bank assets (loan and investments) and not necessarily the marketability or the shiftability of the assets.

2.3 Empirical Review

Empirical reviews on liquidity management–bank performance relationships are numerous. Many are on selected banks in one country; many are on aggregated averages of a country – specific; and others are on regional aggregated averages. Arif and Anees (2012) showed in their study that there was a strong liquidity risk factors on banks profitability. The researchers used a sample of 22 Pakistani banks to investigate the impact of liquidity risk factor on the Pakistani banks during the period of 2004 to 2009. Akter and Mahmud (2014) appraised the existence of a relationship between liquidity and banks profitability in Bangladesh. The data for the study were taken from the specific commercial banks' income statements and balance sheets as published in the website of the banks. The overall finding was that insignificant relationships exist amongst banks' liquidity and profitability in all categories of banks in the country.

Khan and Ali (2016) showed that there was a positive association between banks' liquidity and profitability. The current ratio and quick ratio were considered as measures of liquidity, while net profit margin ratio was considered as a measure of profitability. The data was taken from the annual account of Habib Bank Limited for the last five years, (2008-2014). Nedunchezhian and Premalatha (2015) showed in their study that there is no significant relationship between the cash at bank and return on assets (ROA). Also, in the same study, they found that there was no significant relationship between total assets and return on assets (ROA). The sample size was taken from five banks out of twenty in India. Alshatti (2015) conducted a study to find the impact of liquidity management on commercial banks' profitability in Jordan. In the study liquidity management was the independent variable, while return on assets (ROA) and return on equity (ROE) was the dependent variables that measure the profitability of the banks. Quantitative approaches and ratio analysis were used to analysis the data. The findings show quick ratio (QR) was positively related to return on equity, while capital ratio was positively related to return on assest (ROA), and other independent variables had negative impact on the profitability measures return on assets (ROA) and return on equity (ROE). Agbada and Osuji (2013) investigated the impact of effective liquidity management on banks performance in Nigeria. The outcomes of this research showed significant link amongst effective liquidity management and banks performance/ soundness.

Adebayo et al. (2011) examined liquidity management and commercial banks' profitability in Nigeria. Findings of this study indicate that there is a significant relationship between liquidity and profitability. That means profitability in commercial banks is significantly influenced by liquidity and vice versa.

2.4 Gap in Literature

The various empirical studies reviewed here showed mixed results and conclusions. In some studies, strong positive relationship was found to exist between liquidity and bank performance,

and in some, weak relationship existed. This mixture of findings and conclusions emanate from the different

methodologies, variables used, and the period of study. This study adopted some of the variables in the empirical studies reviewed. However, a novel was added when the study considered purely the predictive content of statutory liquidity and control variables. In terms of methodology, this study, in contrast to the reviewed empirical studies, employed Vector Autoregressive (VAR),Vector Error Correction Method (VECM) (a multiple-equation mechanism which links long-run behaviour with short run adjustment behaviour of independent variables on the target, dependent variable), and Variance Decomposition method (error forecast method) meant to check the long run shocks being exerted on banks' profits by liquidity variables). This is in contrast to the commonly used Error Correction Method (ECM) – a single equation method of establishing a link between the long run and short run behaviours.

3 METHODOLOGIES

3.1 Research Design

This study is aimed at establishing the long-run, dynamic predictive relationship among liquidity variables and profitability variable of the Nigerian deposit money banks (DMBs). Specifically, the study investigates the long-run predictive power of DMBs' statutory liquidity on their return on assets. The relationships due to future shocks (innovations) are determined. The sample of this study is confined to DMBs. Data were collected from CBN annual reports and Statistical Bulletins.

3.2 Theoretical Framework of Methodology

Vector Autoregression (VAR) models were made popular by Sims (1980). A VAR is an n-equation with n-variable linear model in which each current value of a variable is explained by its own lagged value and lagged values of other variables. In a VAR model, all variables are endogenous. The simple framework of VAR provides a systemic way to capture rich dynamics in multiple time series. As Sims (1980) and others argue, VAR held out the promise of providing a coherent and credible approach to data description, forecasting, structural inference and policy analysis. In this study, we assess how well VARs have addressed these four macroeconomic variables of interest. In data description and forecasting, VARs have proven to be powerful and reliable tools that are now, commonly adopted in empirical analysis (Ukwuoma and Imandojemu, 2019). There are three varieties of VAR. They are reduced form, recursive and structural VARs. This study adopts the reduced form. A reduced form VAR expresses each variable as a linear function of its own past values, the past values of other variables and a serially uncorrelated error term. The reduced form VAR is: $Xt = a0 + \sum_{t=1}^{p} \beta 1\, X_{t-1} + \epsilon t$ **Eq. 1**

In the above equation, Xt is a vector of endogenous variables.a0 is a constant (intercept). β1 are (n x n) coefficient matrices and $\epsilon t$is an (n x 1) white noise vector error term (serially uncorrelated or independent) with time invariant covariance matrix, which is also known as innovation or shock. Vector Error Correction Method (VECM), in theory, is just a restricted VAR designed for use with non-stationary series that are cointegrated. The cointegrated term is the error correction term since the deviation from the long- run equilibrium is corrected gradually through a series of partial short run adjustments. VECM restricts long- run behaviour of endogenous variables to converge to their cointegrating relationships while allowing for short run equilibrium. The generalized VECM equation is:

$$\Delta y_t = \beta_0 + \underbrace{\sum_{t-1}^{n} \beta 1 \Delta y_{t-1} + \sum_{t-1}^{n} \delta 1\, \Delta X_{t-1}}_{A} + \underbrace{\phi z_{t-1} + \mu}_{B} \qquad \textbf{Eq. 2}$$

The A part of VECM is the short run restricted VAR while the B part is the long run error correcting co-integrating equation. The coefficients are $\beta 1$, $\delta 1$and ϕ. The long run equilibrium error correction equation is:

$$Z_{t-1} = ECT_{t-1} = \phi\,(y_{t-1} - \beta_0 - \beta_1 X_{t-1}) \qquad \textbf{Eq. 3}$$

VECM, a long run equilibrium multiple equation model based on a restricted VAR, is more efficient than VAR estimates because it has a long run VAR representation while a reduced form VAR does not take this into account. The variance decomposition (VD), a forecast error variance method, is adopted in this study to indicate which variables have short run and long run impact on another variable on a fitted VAR. It is used to indicate how much of the variability in Y is explained by lagged Y and lagged X overtime. The forecast error variance is calculated from a vector moving average (VMA) representation of a VAR variable as (The Horizons, 2019):

$$[y_t] = [\,\bar{y}\,] + \sum_{i=0}^{\infty} [\phi 1\ \phi 2]\ [\varepsilon y_{t-i}] \qquad \textbf{Eq. 4}$$

Shown in a standard form as:.

$$y_t = \bar{y} + \sum_{i=1}^{\infty} \phi 1\, y_{t-i} + \sum_{i=1}^{\infty} \phi 12\, \varepsilon_{Zt-i} \qquad \textbf{Eq. 5}$$

The above equations emphasize that deviations from the long run averages only occur because of shocks (innovations) to either the y or z error term.

3.3 Model Specifications

The VAR variables specified in log form are as follows:

$$LROA_t = \alpha 1 + \Sigma \pi 1 LROAAt - 1 + \Sigma \beta 1 LLQRt - 1 + \Sigma \varrho 1 LCRRt - 1 + \Sigma \zeta 1 LLTRt - 1 + \Sigma \upsilon 1 LRGDPGt - 1 + \varepsilon t1 \qquad \textbf{Eq. 6}$$

$$LLQRt = \alpha 2 + \Sigma \pi 2 LLQRt - 1 + \Sigma \beta 2 LROAt - 1 + \Sigma \varrho 2 LLTRt - 1 + \Sigma \zeta 2 LRGDPGt - 1 + \Sigma \upsilon 2 LCRRt - 1 + \varepsilon t2 \qquad \textbf{Eq. 7}$$

$$LLTRt = \alpha 3 + \Sigma \pi 3 LLTRt - 1 + \Sigma \beta 3 LROAt - 1 + \Sigma \gamma 3 LLQRt - 1 + \cdots + \varepsilon t3 \qquad \textbf{Eq. 8}$$

$$LRGDPGt = \alpha 4 + \Sigma \pi 4 LRGDPGt - 1 + \Sigma \beta 4 LROAt - 1 + \Sigma \gamma 4 LLQRt - 1 + \cdots + \varepsilon t4 \qquad \textbf{Eq. 9}$$

$$LCRRt = \alpha 5 + \Sigma \pi 5 LCRRt - 1 + \Sigma \beta 5 LROAt - 1 + \Sigma \gamma 5 LLQRt - 1 + \cdots + \varepsilon t5 \qquad \textbf{Eq. 10}$$

In the models, statutory liquidity ratio (LQR) and cash reserve ratio (CRR) are the indices for liquidity

(independent variables) and return on assets (ROA) standing for bank profitability (dependent variable). ROA is chosen in this study because it is a measure of the total performance of a firm, and is associated with a privately owned firm, financed by individuals/groups whose interests are to maximize profits. Since DMBs are privately owned firms, ROA seems to be the best measure of profits. In the course of compliance to CBN monetary policy and statutory reserve requirements, the banks create liquidity and liquidity risk (LTR). Since the CBN uses the banks' cash reserve requirement (maintained by it, not by the banks, and banks do not manage the cash reserves) to control inflation, money flows and liquidity in the economy, cash reserve ratio (CRR) comes into the model as a control variable. The proxy for the economy is real GDP growth rate. LQR is maintained by the bank and used by the bank to earn interest on investments. Both CRR and LQR are used to control banks' capacity of lending.

3.3 Variables and Apriori Expectation.

(a) Dependant Variable		**Apriori Expectation**
ROA	ROA as a measure of firm profitability is associated with privately owned firms financed by individuals/groups whose interest is to maximize profit. Since DMBs are privately owned firms with strong interest to maximize profit, ROA is chosen as bank profitability index.	With efficient liquidity and credit management ROA is expected to increase
(b) Explanatory Variables		**Apriori expectation**
CRR	THE cash reserve ratio is the compulsory ratio of cash deposits that banks keep in CBN which is maintained by CBN. Banks do not maintain cash reserves and do not earn interest on it	An increase in the ratio tends to decrease bank capacity to lend, hence increase interest rate, making borrowing expensive, decreasing flow of money, liquidity and inflation in the economy. The reverse is the case when the ratio is decreased.
LQR	A liquidity ratio is a measure of the ability of the bank to maintain enough cash to meet immediate obligations and day to day operations. It is the compulsory part of deposits that banks must maintain in the form of cash, gold and other securities prescribed by CBN. Banks earn interest on statutory deposits	A fall in the ratio leaves a bank with less cash to meet immediate obligations, and a rise is the opposite.
RGDPG	The real domestic product growth rate (inflation-corrected or constant naira GDP) is a macroeconomic statistic that measures the real percentage change in prices of all goods and services produced in an economy. RGDP is calculated by dividing nominal GDP over a GDP price deflator (investopedia.com/terms/r/realgdp.asp).	A fall in real GDP means less loan investments in the economy. A rise means more loan investments by banks, creating opportunities for profitability.
LTR	A liquidity risk is a probability that over a specified period, the bank will become unable to settle obligations with immediacy (Adusei, 2015). In this study, it is proxied by DMBs unclassified current assets or cash and due from balances held at other institutions, divided by banks' total assets.	A fall in the risk leaves banks with more ability to lend and make profit. The reserve is the case for a higher risk ratio.

4. DATA ANALYSIS AND INTERPRETATION

Table 4.1 Data for regression

	LCRR	LLQR	LLTR	LRGDPG	LROA
1990	1.131402	3.790985	3.781914	0.336472	0.262364
1991	1.064711	3.653252	3.864931	0.000000	0.095310
1992	1.481605	3.370738	3.566712	1.360977	0.095310
1993	1.791759	3.742420	3.443618	0.095310	0.182322
1994	1.740466	3.881564	3.277145	0.182322	0.336472
1995	1.757858	3.499533	3.054001	0.587787	0.095310
1996	2.014903	3.763523	2.995732	1.410987	0.741937
1997	2.054124	3.693867	3.194583	0.875469	1.064711
1998	2.116256	3.845883	3.254243	0.875469	0.336472
1999	2.459589	4.110874	2.928524	0.095310	0.182322
2000	2.282382	4.160444	3.068053	1.686399	0.955511
2001	2.379546	3.968403	2.917771	1.887070	0.262364
2002	2.360854	3.960813	2.766319	2.687847	0.095310
2003	2.302585	3.929863	2.653242	2.230014	0.470004
2004	2.151762	3.921973	2.580217	2.351375	0.182322
2005	2.272126	3.916015	2.667228	2.001480	0.693147
2006	0.955511	4.019980	2.740840	1.887070	0.993252
2007	2.415914	3.887730	2.879198	1.987874	1.280934
2008	2.208274	3.788725	2.985682	1.974081	0.875469
2009	0.832909	3.424263	2.844909	1.902108	0.095310
2010	0.095310	3.414443	2.687847	2.424803	1.360977
2011	2.079442	2.884801	2.990720	1.667707	0.405465
2012	2.302585	3.877432	3.353407	1.435085	0.955511
2013	2.484907	4.570579	2.844909	1.704748	0.788457
2014	2.564949	3.645450	3.303217	1.774952	0.405465
2015	3.122365	3.744787	2.821379	1.029619	0.832909
2016	3.113515	3.828641	3.095578	0.470004	0.405465
2017	3.020425	4.003690	3.725693	0.095310	0.336472
2018	2.734368	4.195697	3.658420	1.526056	0.741937
2019	3.139833	4.225373	3.430756	1.589235	0.916291

Key: LCRR=Log of cash reserve ratio; LLQR=Log of statutory liquidity; LLTR=Log of liquidity risk; LROA= Log of return on assets; LRGDPG= Log of real gross domestic product growth rate
Source: Computed from Central Bank of Nigeria Statistical Bulletins, 2015 –2019
In this study, we employed log- linear models in which both regressand and regressor are logged. A log is used to measure a growth rate of a variable. In this case, a 1% change in a regressand is associated with (or influenced by) a 1% change in a regressor.

Table 4.2 ADF Unit Root Test

First Difference							
Variable	**Critical Value**	**1%**	**5%**	**10%**	**p-Value**	**Order of Integration**	**Remark**
LROA	-6.737463	-3.699871	-2.976263	-2.627420	0.0000	I(1)	Stationary
LLQR	-5.960660	-.3699871	-2.976263	-2.627420	0.0000	I(1)	,,
LLTR	-6.545443	-.3.689194	-2.971853	-2.625121	0.0000	I(1)	,,
LRGDPG	-4.902778	-3.711457	-2.981038	-2.629906	0.0006	I(1)	,,
LCRR	-5.726222	-3.699871	-2.976263	-2.627420	0.0001	I(1)	,,

Source: Arrangement from E-View by the author

For the five tests of the logged values of the variables in table4.2, the critical values are higher than those of 1%, 5% and 10% significance levels. The probability values are less than 1% and 5% significance levels, an indication that the variables are integrated of order 1 or I (1) and stationary at first differences. In this case the study applied the VAR and VECM.

Table 4.3 Johansen Cointegration Test

Series: LCDR, LCRR, LLDR, LLQR, LLTR, LROA				
Log interval (in first differences) : 1 to 1				
Sample (adjusted) : 1992, 2019				
Tests	Statistics	0.05 critical value	Probability	Cointqn (s)
Trace Rank	142.4368	95.75366	0.0000	1
Max – Eigenvalue	73.79728	40.07757	0.0000	1

Source: Arrangement from E-View by the author

The results of the co-integration tests in table 4.3 show that there is one co-integrating equation in both the trace test and the max-eigenvalue test at 0.05% level. This denotes rejection of the hypothesis at the 0.05% level.

Table 4.3 Johansen Cointegration Test

Series: LCRR, LLQR, LLTR, LRGDPG, LROA
Log interval (in first differences): 1 to 1
Sample (adjusted): 1992, 2019

Tests	Hypothesized No. of CE(s)	Statistics	0.05% Critical Value	Probability	Cointqn(s)
Trace Rank	None*	70.35964	69.81889	0.0452	1
Max-Eigenvalue	None*	34.09512	33.87687	0.0471	1

Source: Arranged from E-View by the author

The results of the cointegration tests in table 4.3 show that there is one co-integrating equation in both the trace test and the max-eigenvalue test at 0.05% level. This denotes rejection of the hypothesis at the 0.05% level.

Table 4.4 VAR Lag Order
Selection Criteria
Endogenous variables: LROA LLQR LCRR
LLTR LRGDPG
Exogenous variables: C
Date: 04/05/21 Time: 18:31
Sample: 1990 2019
Included observations: 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-74.02824	NA	0.000195	5.644875	5.882768*	5.717601
1	-39.39484	54.42392*	0.000101*	4.956775*	6.384136	5.393133*
2	-27.02391	15.02185	0.000301	5.858851	8.475681	6.658842

* indicates lag order selected by the criterion
Note: FPE=Final prediction error; AIC=Akaike information criterion; SC=Schwarz information criterion; HQ=Hannan-Quinn information criterion
In this study, the researcher adopts the AIC in the VAR lag order selection because it is more encompassing and of higher precision than the other selection criteria

Table 4.5 VAR(OLS) estimates

	Variable	lroa (-1)	lroa(-2)	llqr(-1)	llqr (-2	ltr(-1)	lltr(-2	lcrr (-1)	lcrr(-2	lrgdpg(-1)	Lrgdpg(-2)	C
1	LROA											
	Coeffi	- 0.054	- 0.001	-0.063	-0.111	0.044	- 0.506	- 0.073	0.060	0.018	-0.047	2.76
	t-stat	-0.192	0.003	-0.144	-0.313	0.100	-1.126	-0.449	0.308	0.105	-0.248	1.12
	p-value	0.8481	0.9970	0.8855	0.7551	0.9204	0.2635	0.6546	0.7588	0.9167	0.8049	0.27
	R^2	0.154										
	DW_1	2.142										
2	LLQR											
	Coeffi	-0.272	-0.053	0.396	-0.437	0.407	-0.458	0.274	-0.025	0.074	-0.027	3.73
	t-stat	-1.820	-0.388	1.714	-2.312	1.758	-1.922	3.175	-0.245	0.835	-0.273	2.85
	p-value	0.0722	0.6989	0.0902	0.0232	0.0823	0.0579	0.0031	0.8074	0.4063	0.7857	0.006
	R^2	0.662										
	DW_2	2.065										
3	LLTR											
	Coeffi	0.178	0.099	-0.144	-0.080	0.238	0.119	0.094	-0.031.	-0.134	-0.074	2.816
	t-stat	1.156	0.700	-0.605	-0.415	0.998	0.485	1.061	-0.296	-1.455	-0.711	2.085
	p-value	0.2509	0.4860	0.5468	0.6794	0.3213	0.6289	0.2919	0.7677	0.1494	0.4789	0.040
	R^2	0.629										
	DW_3	1.965										

4	LCRR											
	Coeffi	0.456	-0.161	-0.037	0.111	0.159	0.007	0.611	-0.053	0.049	-0.127	0.136
	t-stat	1.067	-0.407	0.056	0.206	0.240	0.010	2.477	-0.180	0.192	-0.442	0.036
	p-value	0.2891	0.6849	0.9556	0.8371	0.8112	0.9922	0.0152	0.8576	0.8485	0.6595	0.971
	R^2	0.403										
	DW_4	1.999										
5	LRGDPG											
	Coeffi	-0.449	0.050	1.233	0.261	0.387	-0.698	-0299	-0.131	0.405	0.159	-2.97
	t-stat	-1.123	0.136	1.996	0.518	0.626	-1096.	-1.299	-0.478	1.699	0.591	-0.85
	p-value	0.2647	0.8921	0.0492	0.6059	0.5327	0.2760	0.1975	0.6335	0.0928	0.5558	0.398
	R^2	0.561										
	DW_5	2.027										

Source: Arrangement from E-View by the author

Table 4.5 shows the five VAR (OLS) system endogenous models. In the study's target model 1, a 1% change in banks' current return on assets (ROA) is weakly and negatively associated with 0.06% and 0.11% changes in statutory liquidity lag 1 and 2 respectively. Also, it is weakly associated with itself at lags 1 and 2 respectively, and other variables, except with liquidity risk at 0.51%. In summary, ROA is weakly associated with LQR at both lags.Although, only about 15% of the regressors explains the variation in ROA, and there is no serial autocorrelation in the model as the Durbin- Watson (DW) is 2.142.

In model 2, a 1% change in LQR- a target variable- is weakly, insignificantly and negatively associated with 27% and 0.1% of ROA at lags 1 and 2 respectively. However, LQR is significantly but negatively associated with itself (about 44%) at lag 1 and positively (27%) at lag 2. In summary, a1% change in LQR showed a weak endogeneuity with other variables. About 66% of the variation in LQR is explained by the other variables, and there is no autocorrelation in the model as shown by DW of 2.1Model 3 shows that a 1% change in CRR- a target variable- is weakly associated with other variables, except with itself (61%) at lag 1. About 40% of the variations in CRR is explained by other variables, with no autocorrelation in the model as DW is 2.

Model 4 shows that a 1% change in LTR is weakly and insignificantly associated with other variables and itself. About 63% of variations in LTR is explained by other variables. There is no serial correlation in the model as DW is 1.965. In model 5, a 1% change in RGDPG is negatively and insignificantly associated with ROA (45%) at lag 1. It is negatively and insignificantly associated with about 70% change in LTR. That is, as RGDP is growing LTR is declining. About 56% of variations in the model is explained by the other variables, with no autocorrelation(DW=2.0).

Table 4.6 VAR Diagnostic Tests

1	Residual Serial Correlation LM-Test	Lag	LM-Statistic		Probability
		1	25.98700		0.4083
		2	19.04867		0.7948
2	Normality Test	Component	Jarque-Bera	Df	Probability
		1	1.699605	2	0.4275
		2	1.457378	2	0.4825
		3	3.099002	2	0.2124
		4	0.009429	2	0.9953
		5	0.713054	2	0.7001
		Joint	6.978468	10	0.7275
3	Residual Heteroskedasticity Test	Chi-sq		Df	Probability
		306.7081		300	0.3825

Source: Arrangement of E-View results by author

Table 4.7 VECM

	Coefficients						
		LROA (-1)	LLQR (-1)	LCRR (-1)	LLTR (-1)	LRGDPG (-1)	C
Cointegrating Equation (long-run model)	ECT (-1)	1.000	63.637	-20.064	15.597	-0.870	-248.20
Vector Error Correction Estimates		D(LROA)	D(LLQR)	D(LCRR)	D(LLTR)	D(LRGDPG)	
	ECT (-1)	-0.005	-0.014	0.007	-0.005	0.024	
	D(LROA(-1))	-0.468	-0.099	0.409	0.081	-0274	
	D(LLQR(-1))	0.001	0,344	-0.453	0.114	-0.021	
	D(LCRR(-1))	-0.208	0.002	-0.034	0.010	0.130	
	D(LLTR(-1))	-0.063	0.433	-0.032	-0.321	0.308	
	D(LRGDPG(-1))	-0.002	0.045	0.042	-0.064	-0.394	
	C	0.049	0.017	0.074	-0.018	0.075	
	R^2	0.287	0.615	0.169	0.218	0.348	

Source: Arrangement from E-View by the author

VECM ESTIMATION

(A) The cointegrating equation (long-run model) is:

ECT_{t-1} = 1.00LROA(-1) +63.637LLQR(-1) -20.064LCRR(-1) +15.597LLTR(-1)
-0.870LRGDPG(-1) - 284.195 **Eq. 11**

(B) The Error Correction Cointegrating Equation (Short-run models) is:

$\Delta y_{t-1} = \phi ECT(-1) + \sum_{t=1}^{n} \beta 1 \Delta Y_{t-1} + \sum_{t=1}^{n} \delta 1 \Delta X_{t-1} + \ldots\ldots + et$ **Eq.12**

The VECM error correcting system equation of the target, dependent variable, [D(LROA)], of model 1 is:

D(LROA) = - 0.005ECT(-1) - 0.468D(LROA(-1)) + 0.001D(LLQR(-1)0.208D(LCRR(-1))
- 0.063D(LLTR(-1)) - 0.002D (LRGDPG(-1))+ 0.049 **Eq.13**

Other variable target equations can be derived from table 4.7 above. The A section of VECM estimation shows the long-run cointegrating equations. ECT is the OLS residual from the long-run cointegrating regression. The term, ECT, relates to the fact that last period's deviation from long-run equilibrium (the error) influences the short-run dynamics of the dependant variable. Section B of VECM estimation, shows the coefficients of ECT. The coefficients show the speed of adjustment because they measure the speed at which one dependant variable (target variable) returns to equilibrium after a change in the independent variable.

Taking our target dependant variable, (LROA), the previous period's deviation from long- run equilibrium is corrected in the current period at an adjustment speed of 0.005 or 0.01%. A % change in current ROA is associated with 0.468% decrease in itslf at lag 1, on average, ceteris paribus. Others are 0.001% increase in LQR; 0.208% decrease in CRR; 0.063% decrease in LTR; and 0.002% decrease in RGDPG. None of the other variables has a significant impact on changes in ROA.

It is not surprising that statutory liquidity significantly and statistically does not impact on banks' return on assets. Today banks, as private firms, are able to meet their loan funding and investment needs from a much wider array of financial instruments and institutions than before. Deregulation has allowed banks to move into insurance, pensions and investment banking to provide bigger services. Technological innovations have allowed better management and transfer of risks in financial markets (Genay and Halcomb, 2004).

Table 4.8 VEC Diagnostic Tests

1	Residual Serial Correlation LM-Test	Lag	LM-Statistic		Probability
		1	25.56890		0.4309
		2	21.08487		0.6879
2	Normality Test	Component	Jarque-Bera	Df	Probability
		1	1.022631	2	0.5997
		2	0.711859	2	0.7005
		3	1.952729	2	0.3767
		4	0.050205	2	0.9752
		5	0.695194	2	0.7064
		Joint	4.432618	10	0.9257
3	Residual Heteroskedasticity Joint Test	Chi-sq		Df	Probability
		187.2738		180	0.3397

Source: E-View, arranged by author

Table 4.8 shows the results of VECM residual diagnostic tests. There is no serial autocorrelation in the VEC residuals as indicated in the p-values of 0.4309 and 0.6879 at the two lags being greater than 0.05% significance level. The Jarque-Bera normality test shows that the residuals are normally distributed as the joint p-value is 0.9257, greater than 0.05% significance level. The homogeneity of residuals is assured by the residual Heteroskedasticity test with the p-value of 0.3397, a value greater than 0.05% significance level.

Table 4.9 Variance Decomposition

LROA						
Period	S.E.	LROA	LLQR	LCRR	LLTR	LRGDPG
1	0.444	100.000	0.000	0.000	0.000	0.000
2	0.448	98.382	0.426	1.104	0.035	0.053
3	0.465	91.906	0.683	1.539	5.344	0.528
4	0.472	89.437	0.666	3.287	5.669	0.942
5	0.477	87.840	1.006	3.939	5.545	1.670

Source: E-View 10 results

Generally, in a 5-year prediction into the future, consisting of 1-2 years (short-run) and 3-5 years (long-run), a 100% forecast error variance decomposition in ROA is explained by itself in the short-run, and the index decreases marginally into the future. LQR, CRR, LTR, and RGDPG show strong exogenous (weak endogenous) influence on ROA both in the short and long-run into the future.

Specifically, ROA decreases as LQR increases marginally into the future. ROA decreases on marginal increase in CRR into the future. ROA decreases on marginal and insignificant increase in LLTR in the short run and into the future. ROA decreases as RGDPG marginally increases into the future. In summary, only ROA strongly predicts itself in the future. Other variables showed weak endogeneity (strong exogeneity) with ROA in the future.

5 DISCUSSION OF FINDINGS

The inability of statutory liquidity to stimulate growth in ROA of deposit money banks in the last 30 years in Nigeria is consistent with known theories. For example, the liability management and shiftability theories tell us that banks look beyond maintaining liquid assets and investment to borrow from money and capital markets. In other words, the banks consider other sources of liquidity to invest for profitability.

The insignificant increase in forecast error variance of LQR as ROA progressively decreases is not consistent with a apriori expectation in this study. Rather, it is

consistent with the findings of Lartey, Samuel and Bodadi (2013), Akter and Mahmud (2014), and Nedunchezhian and Premalatha (2015).

The insignificant rise in the forecast error variance of LTR to progressive decrease in ROA is consistent with apriori expectation. Although not strong, it is inconsistent with the works of Arif and Anees (2012) which work found strong impact on Pakistani banks. Liquidity risk exposes banks to financial hardship. Now, we are in the period of post- coronavirus disease, 2019 and financial crisis, banks are exposed to higher liquidity risk which can leave them with fleeing investors, depositor runs, rating downgrades and tougher financing.

The insignificant rise in forecast variance of CRR to a progressive decrease in ROA tends to confirm this study's apriori expectation that a rise in CRR limits available liquidity to banks, adversely affecting liquidity, inflation and flow of money in the economy. The response of CRR to ROA is consistent with the work of Maccarthy (2016), in which the author found a statistical, insignificant effect on the long-run (also see Bawa, Akinniyi and Njarendy, 2018). Steven (1993) sees cash reserve as a non-interest bearing deposit in the central bank waiting for overnight borrowing by banks. This confirms our result of very weak response of CRR to ROA.

RGDPG's rising response to decreasing changes in ROA, though insignificant and marginal, is not consistent with apriori expectation which states that a rise in RGDP results to an increase in ROA (see Ejoh and Acquah, 2014). As can be observed, this finding implies that banks are not consistent in their effective deposit mobilization and loan investment strategies, and are not stable. This accords with the empirical literature that low loan investment and deposit mobilization limit loans to investing public and earnings to the banks (Adusei, 2015, Perry 1992).

6. CONCLUSION

In this study, effort had been made to examine the long-run and dynamic relationship between bank profitability and statutory liquidity variables, using reduced VAR, VECM and VD analysis techniques in accordance with Sims (1980) and Luktepol (1991). The reduced form VAR models help us to estimate the intertemporal variations between banks' liquidity and their profitability. The VAR results showed that there existed insignificant short-run relationships between banks' return on assets (ROA) and their statutory liquidity. To tie the short-run behaviour of ROA to liquidity measures efficiently, we applied VECM-a restricted VAR representation, which is more efficient than VAR estimates. The 0.01% error correction was quick enough to restrict long-run behaviour of all endogenous variables to converge to their cointegrating relationships while allowing for short-run equilibrium between ROA and liquidity. This implies that the stationary process in the relationships among the endogenous variables does not drift too far away from their respective mean values. This has made it possible for us to study the behaviours between the dependent and independent variables for a longer period.

With the forecast error variance decomposition, we established the future shocks (innovations) existing between bank profitability and their explanatory liquidity variables. In a 5-year forecast, 100% of forecast error variance in logged ROA was explained by itself in the short-run and insignificantly by other variables into the long-run period.

7. RECOMMENDATIONS

In this study, statutory liquidity's rising responses to ROA are insignificant. Since the future looks bleak for these banks to significantly create liquidity and manage statutory liquidity to improve profitability, we suggest that banks be more transparent, raise the confidence of customers by accumulation of deposits from the financial markets. If they can easily access other sources of funding, then they may be liquid enough and be able to fund loan growth at lower interest rates.

The fact that liquidity risk insignificantly rises in response to changes in ROA, we suggest that banks should control their risk factors by balancing cash inflows and outflows and possibly hold liquidity cushion for strategic purposes. In mitigating the risks banks should apply the best practices in the management of risk. Some of the best practices are risk revaluation and improvement in credit granting processes. They should begin to restructure credit lines for existing obligors, especially in the post-COVID 19.

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