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Financial soundness indicators and macroeconomic variables: an empirical investigation of the dynamic linkages

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FINANCIAL SOUNDNESS INDICATORS AND MACROECONOMIC VARIABLES: AN EMPIRICAL INVESTIGATION OF THE DYNAMIC LINKAGES[1]

ABSTRACT

The Financial Soundness Indicators compiled for Nigeria within the context of IMFs Financial Sector Assessment Programme has been proved to be capable of pre-empting financial crisis. Analysts, however, considered it imperative to further explore the characteristics of the indicators, particularity its relationships with other macroeconomic variables to enhance the understanding of its dynamics so as to improve on its usefulness. This study, as a maiden attempt, applies autoregressive distributed lag approach to investigate the dynamic linkages between the indicators and selected macroeconomic variables covering the period 2007Q1 to 2015Q4. The results indicate that macroeconomic events dictate the state of health of the Nigeria financial system. While changes in the level of economic activities inversely affects capital adequacy, it is directly related to asset quality and banks profitability. Asset quality deteriorates while inflation rises. Banks returns diminishes and asset quality wanes as exchange rate depreciates. The study, therefore, suggests immediate deployment of FSIs as a monitoring instrument in conjunction with the existing micro-prudential tools while effort should continue to improve the compilation process to enhance their accuracy.

Key Words: FSIs, financial crisis, macroprudential regulation, ARDL, Nigeria
JEL Classification: E44, G21, G28

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1. INTRODUCTION

The Asian financial crisis of the late 1990s demonstrated the need for additional data requirement not only for timely and efficient intervention of the regulatory authorities but also for effective and proactive oversight of member countries by the International Monetary Fund (IMF). The crisis, like most others before and after, was a fall-out of a set of interrelated problems ranging from financial sector weakness, easy global liquidity conditions as well as crisis in the external sector arising from contagion running from Thailand to other economies. This was later corroborated by the global financial crisis (GFC) that erupted in 2007 arising from the subprime crisis in the mortgage sector of the United States.

In an attempt at solving the problem, IMF launched some initiatives on data collection so as to expand the coverage of financial system, in order to have quick insight into potential financial and external vulnerabilities that are capable of instigating systemic crisis. These statistical initiatives includes; the introduction of templates on international reserves and foreign currency liquidity, external debt statistics and financial soundness indicators (FSIs). The FSIs measure the current financial health and soundness of the financial institutions in a country as well as their corporate and household counterparties (IMF, 2006). Although, IMF has been collecting monetary statistics from member countries before the introduction of FSIs, the data is less encompassing and does not provide enough information on the soundness, risk or vulnerabilities in the financial system (Armida, et al., 2006; Yaaba and Adamu, 2015).

The IMF started the process by inviting a group of experts, representatives of member countries, regional and international organizations as well as standard setters to a meeting in 2002 where an agreement was reached not only on the need for additional data but also on the critical indicators that is required for efficient monitoring of the financial system. This was followed by a survey of over 100 countries, on the use, compilation and dissemination of these indicators after which two sets of FSIs were agreed upon; namely: core and encouraged FSIs. While IMF member countries were obliged to compile the 'core FSIs', they are only urged to compile the 'encouraged set'[3] depending on national circumstances. The IMF in 2006 published a guide on FSI compilation procedure. However, following another consultation, the Guideline was modified in 2013. The FSIs list was expanded to cover money market funds,

[1] The views expressed herein do not represent or necessarily reflect that of Central Bank of Nigeria where I work.
[2] Mr. Yaaba is a staff of Statistics Department, Central Bank of Nigeria.
[3] Now referred to as "additional set"

insurance corporations, pension funds, other nonbank financial institutions, nonfinancial corporations and households. Five of the FSIs were dropped due to its non-comparability status, while nineteen others were added to the list. The nomenclature for 'Encouraged FSIs' was also changed to 'Additional FSIs'. Nigeria started the compilation of the FSIs in 2010 with the indicators dating back to the first quarter of 2007.

Although, various studies were conducted on the macroeconomic determinants of banking system soundness in Nigeria but to the best of my knowledge, none of the studies utilized the FSIs data compiled in line with the IMFs Financial Sector Assessment Programme (FSAP) initiated in the 1990s. Hence, this study is a maiden attempt to determine the long-run relationships between macroeconomic and FSIs compiled for Nigeria within the FSAP framework. To achieve this, the study is divided into five different sections. After this introduction, is section two which considers past literature on the topic, while section three details the methodology. Section Four analyses the results and the last section concludes the paper as well as offers an insight into further requirements that is capable of enhancing the usefulness of the FSIs data to Nigerian policy makers.

2. LITERATURE REVIEW

2.1 Theoretical Foundation of Monetary, Financial and Economic Stability

This section reviews relevant theoretical and empirical studies on the relationship amongst financial stability/fragility, monetary policy stance and the performance of the economy. In so doing it starts by providing insight into both the conventional and new environment hypothesis linking monetary policy to financial and economic stability. Thereafter, it presents a stylized fact on the trend of some selected FSIs for Nigeria and concludes with a summary review of related empirical literature.

2.1.1 The Conventional View

The conventional view linking monetary, financial and economic stability analysed herein derives from the work of Bordo et al., (2000). They are of the view that monetary policy framework that focuses and achieves stable prices is likely to, at least in the long-run, promote not only non-inflationary growth but also stable financial system. There seems to be a consensus amongst economists, that curtailing inflationary spiral which is the primary objective of monetary policy has no remarkable trade-off with the attainment of financial and economic stability[4]. The proponents of the conventional hypothesis are of the view that inflationary spiral, for instance, creates economic instability and consequently financial fragility. This is because, it is either largely accompanied by or resulted in information asymmetry, weak balance sheet of banks arising from falling assets prices, income redistribution and weak investment horizon, amongst others.

Schwartz (1995) hypothesizes that monetary and price stability could lead to financial stability. He emphasized that price stability is not only necessary but sufficient for financial stability. Although, Schwartz hypothesis is largely contested by economists, but some empirical studies, as will be review later, provides little support. For instance, while empirical evidences support the notion of price stability as a precursor of financial stability, it negates the notion of stable prices as a sufficient condition for financial stability. Opponents of Schwartz hypothesis cited the US financial crises of the 1920s, 1990s and 2000s as well as Japan in the 1980s. They opined that these are cases of financial instabilities that occurred in periods of stable of prices, hence the birth of "New Environment Hypothesis".

2.1.2 The New Environment Hypothesis

Contrary to the conventional view of a stable economic and financial system in period of stable prices, the new environment hypothesis (NEH) visualized a new set of emerging trends that constitute what they tagged NEH. According to the hypothesis, the new environment is characterized primarily by; low and stable prices arising from the proactive policy effort of central banks; financial markets liberalisation as well as business cycle moderation. The proponents of the 'new environment hypothesis' opined that the above listed three developments are consequences of the interaction between variations in monetary and financial policy regimes over time as spearheaded by most central banks across the globe. Hence, they canvass for the recognition of monetary and financial stability enhancing policies from the perspectives of the NEH (Crocket, 2003).

Based on the Japanese experience of financial imbalances in the 1980s as well as the South Korean experience of the 1990s, the NEH concludes that price stability may not necessarily be sufficient for financial stability. This is because price stability could be an end result of an anti-bias stance of the monetary authorities, hence inflationary spiral may be contained due to positive shocks in supply, expectation of falling prices in future or excessive competition that retards the pricing power of firms. It could also arise from

[4]See Schwartz (1995)

competitive financing posture of the financial system arising from financial sector deepening, development and liberalisation

2.2. Stylized fact on the Trend of some Selected FSIs for Nigeria

From Figure 1, the ratio of regulated capital to risk weighted assets (RWA) commonly refer to as capital adequacy ratio is within the acceptable international standard of minimum 8.0 per cent for most periods except between 2009Q4 to 2011Q3. This period coincides with the global financial crisis (GFC) that started from the mortgage sector of the United States (Sere-Ejembi et al., 2012, Yaaba and Adamu, 2015). Within this period, capital adequacy ratio was at its lowest of 0.2 per cent in the third quarter of 2010.

The implication of the industry wide capital adequacy falling far below the international minimum standard within the period, is the inability of the Nigerian banks to absorb shocks on their aggregate balance sheet. The situation must have been worst for some banks if considered individually, hence the need for intervention. Viewed differently, since capital adequacy ratio is a leverage ratio and leverage magnifies the variability of income, the sharp fall between 2009Q4 to 2011Q3 should have ordinarily send a strong signal to banks on the need to moderate their attitude towards risk.

Non-performing loans to total loan represented as qa (asset quality) in Fig. 1 skyrocketed from 10.2 per cent in 2007Q1 to 24.4 per cent in 2009Q3 and climaxed at 38.3 per cent in 2010Q2, thereafter; it declined continuously to 3.7 per cent in 2012Q4. This decline was largely attributed to the activities of Asset management Corporation of Nigeria (AMCON) that bought most of the toxic assets of the DMBs within the period. It increased to 4.0 per cent in 2013Q1 and with proactive effort of the CBN, it fell gradually until it reached the bottom of 1.5 per cent in the third quarter of 2015.

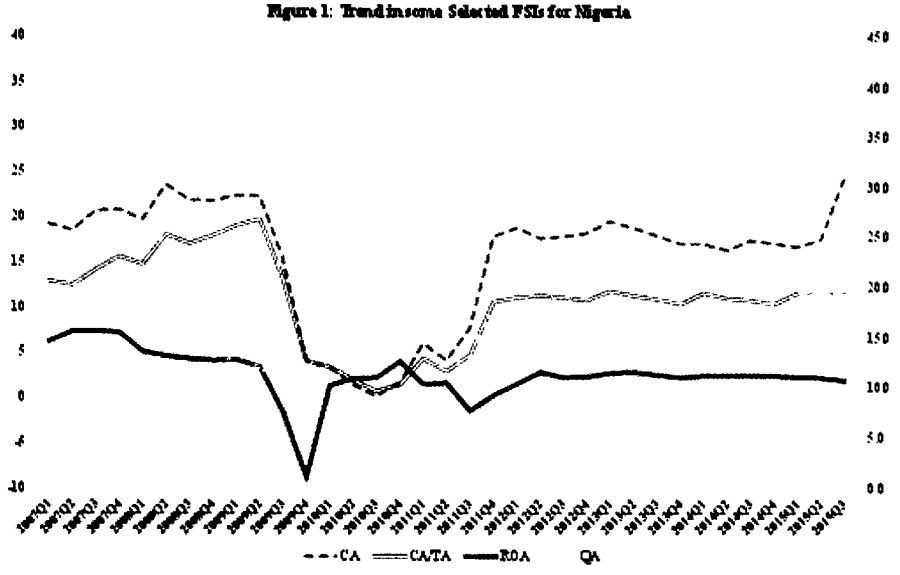
Profitability of the industry as proxy by return on assets (ROA) for most of the reviewed period was fairly impressive until when it coincidentally turned negative in the third quarter of 2009 as the asset quality drastically deteriorated. It was at its worst of -8.8 per cent in 2009Q4. However, with various interventions by the CBN, as highlighted earlier, ROA turns positive and remain so except for the third quarter of 2011 when it fell to -1.4 per cent.

2.3 Review of Related Empirical Studies

The relationships between the strength of the financial sector and the level of economic activities, as well as the general price level is well documented in literature. For instance, a strong link has long been established between boom and depression of business cycles and financial sector vulnerability and stability, respectively. It is acknowledged that credit grows sporadically during boom and fall drastically in periods of depression (Fawad and Bashir, 2013). The logic behind this is that credit growth during booms are consequence of stable cash flow streams for both banks and debtors which in-turn facilitates timely repayment, hence good credit scores and increasing credit worthiness and consequently the rising appetite of banks to lend more. On the other hand, with depression, cash flow streams for both banks and debtors become unstable, payment of due obligations becomes difficult leading to excessive caution from banks not only to escape default but also to avoid illiquidity, hence credit squeeze which in-turn fuels continuous depression and the cycle continues. View from the demand side, with economic boom, investors demand for more credit arising from optimism in future returns and the reverse also holds for recession.

Prior to the work of Fawad and Bashir 2013, Bordo and Waheelock (1998) in their study on US, UK and Canada conclude that price level instability contributes significantly to financial instability. In the same

Figure 1: Trend in some Selected FSIs for Nigeria



[5] The standard was set by the Basel Committee on Banking Supervision (BCBS).
[6] This is the period when CBN injected about N620 billion into five banks in the form of Tier 2 capital.

vein, Bordo et al., (2000) found a strong link for the U S, from price level shocks to financial instability particularly from 1790 to 1933 and 1980 to 1997. Issing (2003) reach a conclusion for the US, that banking crisis occurred during recessionary periods that usually coincides with inflationary spirals. Bourke (1989), Molyneux and Thornton (1992), Dimirguc-Kunt and Huizinga (1998) reported positive relationship between interest rate and banks profitability for the same US.

With economic boom in place, non-performing loans (NPLs) are expected to decline arising from high revenue profile of borrowers to meet credit obligations. The quest for higher income, however lures banks into more lending including to less credit worthy borrowers, hence repayment becomes extremely difficult during downturn, thus growth in NPLs. This link has long been confirmed by empirical studies. For instance, Marcucci and Quangliariello (2008) employed vector autoregression (VAR) technique to examine the impact of business cycle on loan quality in Italy from 1990 to 2004 and found that NPLs increase/decline during boom/recession. Similarly, Keeton and Moris (1987) assess the behaviour of NPLs of some banks in the US between 1979 and 1985 and found that economic boom increases banks appetite (particularly the larger banks) for lending to less credit worthy customers, hence an upturn in NPLs during recession. In the same vein, Sinkey and Greewalt (1991) apply a simple linear regression on the US banking data from 1984 to 1987. The result shows that both internal and external factors affects loan losses in the US. Internal factors, according to them includes volatile funds, excessive lending and interest rate.

Using Spanish data, Salas and Saurina (2002) employed a dynamic model on a panel data to investigate the determinants of NPLs. The study found that real GDP growth rate, the size of banks, market power, credit expansion and capital adequacy ratio are instrumental to variations in NPLs. This is partially substantiated by Jimenez and Saurina (2006) who submitted that GDP growth rate, soft terms of credit and high interest rate in real terms are the major determinants of NPLs in Spain.

In his study on sub-Sahara African countries Fofack (2005) adopted a pseudo-panel model and found real exchange rate, level of economic activities, net interest margin, real interest rate and interbank loans to be the key determinants of NPLs. Babihuga (2007) utilised data from Asia, Europe and Sub-Sahara Africa to determine the links between financial soundness indicators and macroeconomic variables using a generalised method of moment (GMM). The results reveal that capital adequacy ratio, profitability and asset quality indicators are strongly related to different phases of business cycles, inflation and real GDP. While business cycles and inflation rate are positively related to FSIs, real GDP is inversely related to NPLs and capital adequacy ratio. In the same vein, Valentina et al., (2009) studied 389 banks in 41 SSA countries using GMM. They reported positive relationship between inflation and banks profitability. They also established a positive relationship between the level of economic activities, the size of banks and profitability.

James et al., (2014) apply random effect model to investigate the influence of bank specific, industry specific and macroeconomic variables on profitability of Nigerian banks using data from 1998 to 2012. They reported a positive effect of capital adequacy, bank size, growth and deposit on profitability while inflation and interest rate yielded negative coefficients. Johannes (2015) used a VAR technique to determine the impact of macroeconomic variables on non-performing loans in Namibia from the first quarter of 2000 to the second quarter of 2014. The results reveal that the variables co-move in the long-run. The results also show a uni-directional causality from all the examined macro-variables to asset quality.

3. EMPIRICAL METHODOLOGY

In line with Babihuga (2007) but with substantial adjustments to not only the definitions of the parameters, but also to the constituents of the determinants of each of the selected FSIs as objective function as well as implementation methodology, the dynamic linkages amongst financial soundness indicators and macro-fundamentals is explored from three perspectives. The empirical exploration considers the capital, assets based and profitability based indicators in that order. This is due to their importance in determining banks stability or fragility. The study covers the period 2007Q1 to 2015Q4. The choice of the study period is informed by data availability. The Central Bank of Nigeria started compiling data on financial soundness indicators in the context of the IMFs Financial Sector Assessment Programme (FSAP) in 2010 with the indicators dating back to the first quarter of 2007.The equations take the form:

Capital Adequacy

$$\frac{rc_t}{rwa_t} = \vartheta + \gamma\left(\frac{rc_t}{rwa_t}\right)_{t-1} + \xi y_t + \pi if_t + \beta e_t + \omega r_t + \eta s_t + \Psi tl_t + \varpi asi_t + \theta_t \quad (1)$$

Where rc stands for regulatory capital, rwa is risk weighted assets (implying capital adequacy ratio), y is growth rate of gross domestic product, if denotes inflation rate, e represents exchange rate of the Naira, r is interest rate, s connotes growth rate of the size of the financial system proxy by percentage changes in total assets, tl is total

loan reflecting the risk appetite of the system, asi is all shall share index, Δ and are change and constant , respectively. The coefficients of the respective estimated parameters are represented by Y, ξ, π, β, ω, η, ψ and $\overline{\omega}$; and θ is the error term. The subscript t is the time dimension. is the error term.

Assets Quality

$$\frac{npl_t}{tl_t} = \vartheta + \xi y_t + \pi if_t + \beta e_t + \omega r_t + \rho pop_t + \Omega tt_t + \phi\frac{ca_t}{ta_t} + \theta_t \quad (2)$$

Where *npl* stands for nonperforming loans, pop is the growth rate of the population, *tt* connotes total trade, ca represents total capital, ta is total assets, θ is a constant term and ξ, π, β, ω, ρ, Ω and ϕ are coefficients of their respective variables. are as defined under equation (1)

Profitability Indicator

$$pr_t = \vartheta + \xi y_t + \pi if_t + \beta e_t + \omega r_t + \lambda dr_t + \delta nie_t + \gamma\frac{rc_t}{rwa_t} + \epsilon\frac{npl_t}{tl_t} + \phi\frac{ca_t}{ta_t} + \theta_t \quad (3)$$

Where pr stands for profit proxy by return on assets (ROA), dr is deposit rate, nie represents net interest income. All other variables are as defined under equations (1) and (2). It is well known that there are two common operating ratios used as proxy for profitability – return on assets and return on equity. The choice of ROA in this study is predicated on the fact that if banks leverage is mostly determined by regulation, as it were in Nigeria, using ROE as opined by Sundararajan et al., (2002) will disregard the risk associated with high leverage, thus places ROA as the best and most prefer measure of banks profitability.

Equation (1) to (3) are implemented using autoregressive distributed lag (ARDL) approach to cointegration developed by Pesaran et al., (2001). The choice of the ARDL approach is informed by numerous considerations. One, the model generates consistent estimates of the long-run coefficients irrespective of whether the underlying regressors are stationary at I(0) or I(1) or a mixture of both. In other words, it ignores the order of integration of the variables (Pesaran et al. 2001). Secondly, it provides unbiased estimates of the long-run model as well as valid t-statistics even when some of the regressors are endogenous (Harris & Sollis, 2003). Thirdly, It yields high quality results even if the sample size is small.

Following equations (1) and (2), if for the purpose of convenience

$\frac{rc_t}{rwa_t}$ and is denoted as ca and $\frac{npl_t}{tl_t}$

is represented as *qa*, the ARDL versions of equations (1) to (3) become:

$$\Delta lca_t = \vartheta + \sum_{\iota=1}^{\rho}\gamma\Delta lca_{t-\iota} + \sum_{\iota=0}^{\rho}\xi_\iota\Delta lX_{t-\iota} + \gamma lca_{t-1} + \xi_l lX_{t-1} + \theta_t \quad (4)$$

$$\Delta lqa_t = \vartheta + \sum_{\iota=1}^{\rho}\epsilon\Delta lqa_{t-\iota} + \sum_{\iota=0}^{\rho}\xi_\iota\Delta lX_{t-\iota} + \epsilon lqa_{t-1} + \xi_l lX_{t-1} + \theta_t \quad (5)$$

$$\Delta pr_t = \vartheta + \sum_{\iota=1}^{\rho}\tau\Delta pr_{t-\iota} + \sum_{\iota=0}^{\rho}\xi_\iota\Delta lX_{t-\iota} + \tau pr_{t-1} + \xi_l lX_{t-1} + \theta_t \quad (6)$$

Where Δ is a first difference term, l is natural logarithm, I is natural logarithm, X is a vector of the deterministic variables as represented in equations 1, 2 and 3, and ρ represents the optimal lag of the model. All other notations are as explained under equations (1) to (3).

In line with Granger representation theorem, the error correction versions of equations 4, 5 and 6 are formulated respectively as:

$$\Delta lca_t = \vartheta + \sum_{\iota=1}^{\rho}\gamma\Delta lca_{t-\iota} + \sum_{\iota=0}^{\rho}\xi_\iota\Delta lX_{t-\iota} + \zeta ECM_{t-1} + \theta_t \quad (7)$$

$$\Delta lqa_t = \vartheta + \sum_{\iota=1}^{\rho}\epsilon\Delta lqa_{t-\iota} + \sum_{\iota=0}^{\rho}\xi_\iota\Delta lX_{t-\iota} + \zeta ECM_{t-1} + \theta_t \quad (8)$$

$$\Delta pr_t = \vartheta + \sum_{\iota=1}^{\rho}\tau\Delta pr_{t-\iota} + \sum_{\iota=0}^{\rho}\xi_\iota\Delta lX_{t-\iota} + \zeta ECM_{t-1} + \theta_t \quad (9)$$

Where ECMs are error correction versions of the respective long-run equations. All other variables are as defined under equations (4) to (6).

4. EMPIRICAL RESULTS

4.1 Time Series Properties of the Data

The summary statistics of the variables used for the estimation reported in Table 1 shows that the distribution is asymmetrical. The lowest and highest kurtosis of 1.76 for ly and ldr, and 13.80 for lnie reveals a substantial Skewness in the data (Table 1).

Table 2 presents the correlation coefficient of the variables used for the estimation. Careful scrutiny of the Table reveals strong correlation among some variables. For instance, lca and lcata is 0.96, 0.95 for ls and ltl, 0.91 for le and lr and 0.91 between lr and ls. Other variables that are strongly correlated includes lr and ltl, ly and lr, le and ls, ly and ltt among others. These strong correlations among the variables presupposes the existence of serial correlation, hence necessitates post estimation diagnostic test.

The study adopted Augmented Dickey Fuller (ADF) based on Akaike Information Criterion (AIC), and Phillip Perron (PP) to examine the statistical properties of the data. Table 3 shows that the data is a mixture of I(0) and I(1) and

Table 1: Summary Statistics of the Variables used for the Estimations

	lca	*ly*	*if*	*le*	*lr*	*ls*	*lasi*	*ltl*	*ltt*	*lcata*	*lqa*	*lnie*	*ldr*	*roa*
Mean	2.50	15.92	10.22	5.02	3.12	30.44	10.37	29.62	15.39	2.19	1.99	26.29	0.90	26
Median	2.89	16.06	10.24	5.04	3.14	30.42	10.36	29.66	15.46	2.42	1.96	26.33	1.00	24
Maximum	3.19	16.26	15.06	5.28	3.30	30.92	11.05	30.17	15.76	2.99	3.65	27.04	1.46	74
Minimum	- 1.62	15.37	4.12	4.77	2.87	29.60	9.90	28.56	14.66	- 0.23	0.38	24.25	0.29	- 88
Std. Dev.	1.01	0.30	2.80	0.14	0.13	0.35	0.33	0.38	0.31	0.75	0.82	0.44	0.36	28
Skewness	- 2.47	- 0.59	- 0.05	- 0.04	- 0.58	- 0.64	0.35	- 0.95	- 0.87	- 1.67	0.63	- 2.57	- 0.37	- 16
Kurtosis	9.25	1.76	2.21	2.98	2.38	2.98	2.08	3.93	2.65	5.18	2.73	13.80	1.76	9.1
Jarque-Bera	95.35	4.36	0.94	0.01	2.59	2.45	2.01	6.72	4.77	23.93	2.52	214.58	3.14	723
Probability	-	0.11	0.62	0.99	0.27	0.29	0.37	0.03	0.09	0.00	0.28	-	0.21	-
Observations	36	36	36	36	36	36	36	36	36	36	36	36	36	36

Table 2: Correlation Matrix of the Variables used for the Estimations

	lca	**ly**	**if**	**le**	**lr**	**ls**	**lasi**	**ltl**	**ltt**	**lcata**	**lqa**	**lnie**	**ldr**	**roa**
lca	1.00													
ly	-0.11	1.00												
if	-0.44	-0.02	1.00											
le	-0.05	0.77	0.01	1.00										
lr	0.01	0.81	0.09	0.91	1.00									
ls	0.10	0.86	0.09	0.85	0.91	1.00								
lasi	0.42	-0.26	-0.65	-0.47	-0.42	-0.29	1.00							
ltl	-0.12	0.79	0.25	0.82	0.89	0.95	-0.34	1.00						
ltt	-0.18	0.84	0.13	0.55	0.58	0.70	-0.36	0.61	1.00					
lcata	0.96	-0.26	-0.38	-0.16	-0.08	0.00	0.46	-0.18	-0.33	1.00				
lqa	-0.73	-0.48	0.45	-0.38	-0.42	-0.55	-0.31	-0.31	-0.28	-0.64	1.00			
lnie	-0.06	0.08	0.06	0.01	0.11	0.12	-0.15	0.13	0.15	-0.09	-0.01	1.00		
ldr	0.43	-0.27	-0.42	-0.02	0.04	-0.04	0.59	0.00	-0.52	0.49	-0.25	-0.07	1.00	0.22
roa	0.28	-0.34	-0.42	-0.44	-0.50	-0.42	0.64	-0.51	-0.45	0.34	-0.24	-0.27	0.22	1.00

Table 3: Unit-Root Test of the Data used for the Estimation

Variable	Augmented Dickey-Fuller AIC		Phillip Perron	
	I(0)	I(1)	I(0)	I(1)
lca	-2.762***	-2.368	-2 120	-5.420*
ly	-0.660	-4.451*	-1.838	-9.158*
if	-2.284	-5.562*	-2.334	-5.616*
le	-0.899	-4.102*	-0.200	-3.978*
lr	-4.118**	-4.435*	-2.481	-5.248*
ls	-5.331*	-3.557***	-3.049	-4.901*
lasi	-3.138**	-5.167*	-1.788	-5.204*
ltl	-3.771**	-3.547**	-2.958	-3.504*
ltt	0.597	-5.859*	1.225	-6.061*
lcata	-3.419**	-2.597	-2.002	-4.668*
lqa	-1.136	-5.528*	-1.296	-5.641*
lnie	-6.641*	-7.802*	-6.701*	-25.948*
ldr	-0.688	-4.803*	-0.716*	-4.790*
roa	-2.345**	-6.712*	-2.125**	-8.216*

Notes: **, ** and *** significant at 1%, 5% and 10%, respectively.*

Table 4: Statistics for Selecting Lag Order of the Model

Capital Adequacy Model				
ρ	*0*	*1*	*2*	*3*
AIC	1.9639	2.2410	2.2391*	1.9128
SBC	2.2718	2.5521	2.8676	2.8651*
HQ	2.0714	2.3484	2.4534	2.2332*
Asset Quality Model				
AIC	0.7496	1.1185	0.8399*	0.2726
SBC	1.0575	1.4295	1.4684	1.2250*
HQ	0.8570	1.2259	1.0542*	0.5931
Profitability Indicator Model				
AIC	8.9877	8.8779*	8.8610	8.7615
SBC	9.3836	9.2778*	9.6691	9.9859
HQ	9.1259	9.0160*	9.1366	9.1734

Note: *ρ is the lag order of the model. * is the optimal lag length. AIC denotes Akaike Information Criterion, SBC is Schwarz Bayesian Criterion, HQ is Hannan Quinn Criterion*

Table 5: Long - Run Results

	Equation 4		Equation 5		Equation 6	
Dependent Variables	*ΔLCA*		*ΔLQA*		*ΔLPR*	
Regressors	*Coefficient*	*t-Statistics*	*Coefficient*	*t-Statistics*	*Coefficient*	*t-Statistics*
c	-41.364***	-1.866	0.576***	1.92	1.350*	3.92
lca					-5.660**	-2.31
ly	-1.126*	-3.556	2.084**	3.09	0.95	0.37
lr	0.70	0.27	6.921*	6.16	0.503**	3.34
if	0.04	0.65	-0.035***	-1.978	-0.21	-0.24
le	2.47	1.24	-1.764**	-2.90	-8.832**	-2.94
ls	6.769*	3.31				
ltl	-6.390*	-3.56				
lasi	1.07	1.64				
dlr					0.55	0.13
lnie			0.12	0.61	6.200*	3.49
lqa					0.51	0.43
lcata			-0.527*	-4.91	4.75	1.45
pop			0.12	0.61		
ltt			8.051**	2.53		
R^2	0.78		0.93		0.94	
Adjusted R^2	0.59		0.79		0.81	
AIC	1.465		-0.451		3.278	
SBC	2.191		0.546		4.321	
HQC	1.709		-0.116		3.629	
DW Statistics	2.504		2.496		2.529	

Note: *AIC is Akaike Informatin Criterion, SBC is Schwarz Bayesian Criterion, HQC is Hannan-Quinn Criterion and DW is Durbin Watson*

does not contain I(2) series, hence lend support for the use of bound test (Table 3).

The maximum lag length for the model was determined through Schwarz Bayesian Criterion (SBC) and Hannan Quinn Criterion (HQC) for capital adequacy model, Akaike Information Criterion (AIC) and Hannan Quinn Criterion (HQC) for asset quality equation and Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC) and Hannan Quinn Criterion (HQC) for profitability indicator model. The basis for selection is the consensus of the information criteria (Table 4).

4.2 Results of the Estimated Equations

4.2.1 Long Run Results

Table 5 reports the long-run results of the estimated equations. The long-run results yield adjusted R2,s of 0.59, 0.79 and 0.81 for capital adequacy, asset quality and profitability indicator equations, respectively. These shows that the overall models are well fitted. The Durbin Watson statistics of 2.504 for capital adequacy equation, 2.496 for asset quality equation and 2.529 for profitability indicator equation pre-supposes lack of evidence of serial correlation which was anticipated arising from the results of the correlation matrix.

The Wald test of all the three estimated equations as reported in Table 6 reveals that the calculated F-statistics are all higher than their respective upper bounds critical values as tabulated in Pesaran et al., (2001). For instance, the F-statistics of 5.898 and 10.826 reported for capital adequacy and asset quality equations are higher than the upper critical value of 3.79 for k equal to 7 at 1.0 per cent. In the same vein, the profitability indicator equation yields an F-statistics of 7.465 above the upper

Table 6: Wald Test for the Estimated Equations

	F-statistic	df	Prob. Value	Critical Values
Capital Adequacy Equation	5.898	(8, 17)	0.001	2.45 - 3.79
Asset Quality Equation	10.826	(7, 11)	0.000	2.45 - 3.79
Profitability Indicator Equation	7.465	(11, 10)	0.002	2.26 - 3.60

Note: *The critical values are obatined from Pesaran et. Al., (2001)*

critical bound of 3.60 for k equals 10 at 1.0 per cent. These confirm the existence of long-run relationships among the examined variables in all the three equations.

Considering the long-run result of the capital adequacy equation as reported in Table 5, while income and total loan portfolio of the banking system are significantly negatively related to capital adequacy, the size of the industry is positively related to capital adequacy. Interest rate, inflation, exchange rate and all share index return positive coefficients but statistically insignificant.

The negative relationship between income and capital adequacy and total loan and capital adequacy is in line with the work of Fawad and Bashir, (2013). This means that improvement in the level of economic activities sprouts additional request for loan facilities, hence increase in total loan and consequently decline in capital adequacy arising from excessive lending by the industry. Conversely, economic downturn brings about higher capital adequacy ratio. This is possible due to the reluctance of banks to create more assets arising from increase in default probability. Various studies (Wong, Choi and Fong, 2005; Babihuga, 2007; Yaaba, Dalhatu and Adamu, 2014) have proved that banks appetite for risk decline during recession and rise during boom. Higher loan also exerts negative influence on capital adequacy ratio. Excessive creation of assets is likely to eat up part of the required regulatory capital. This further corroborates the inverse relationship between the level of economic activities and capital adequacy. As the level of economic activities peak, quest for business financing rises, while probability of default declines, hence increase in credit creation by banks arising from confidence in the system and consequently fall in capital adequacy ratio.

However, contrary to the findings of Babihuga (2007)[7] as the size of the banking system grows so do capital adequacy naturally follows suit since capital adequacy is a ratio of the banks' capital to the risk weighted assets. This explains the positive and significant relationship between capital to assets ratio and capital adequacy ratio.

In case of asset quality equation, the long-run result reveals that the level of economic activities, as against capital adequacy equation, is positively related to the quality of asset at 5.0 per cent. Similarly, interest rate and total trade are directly related to asset quality at 5.0 per cent each. Conversely, quality of assets deteriorates as inflation rises, exchange rate appreciates and the ratio of capital to assets increases. Population growth returns a positive relationship but not significant.

The relationship between asset quality and the level of economic activities and total trade is in line with theory, most of the empirical literature earlier reviewed and conventional wisdom. Nigeria is a consumption economy that fares mostly on trade particularly external trade, increase in the volume of trade signifies rise in the level of economic activities which in-turn brings about increase lending as result of increasing quest for financing as well as credit worthiness of borrowers. With robust economic activities, the rate of default declines even in the face of increasing interest rate.

Return on assets establishes a positive and significant relationship with interest rate and net interest income, while exchange rate and capital adequacy ratio negatively affect banks profitability. This implies that the Nigerian banking system significantly benefits from high interest rate and the pass through to lending rate outweigh the pass through to deposit rate. This is true considering the fact Nigerian banks do not offer reasonable rate on deposit. In fact, some banks do not remunerate even saving deposits. The positive coefficient of net interest income points to the fact that interest income is the major sources of income to Nigerian banks and profitability of the system improves as it grows.

The negative relationship between capital adequacy and banks profitability indicates that as banks strive to meet the capital adequacy requirement of the CBN, their level of profit declines. In other words, the need for robust capital to satisfy regulatory requirement shrinks the assets creation capability of Nigerian banks, hence fall in the overall profit.

Astonishingly, however inflation yield a negative but insignificant relationships with profitability. This could probably be due the ability of banks to frequently adjust their lending rate even on the existing facilities as inflation rises, shifting the burden to customers. Moreso,

Table 7: Error Correction Estimates of the ARDL Models (Short-Run Dynamics)

Equation	Equation 7		Equation 8		Equation 9	
Dependent Variables	*ΔLCA*		*ΔLQA*		*ΔLPR*	
Regressors	*Coefficient*	*t-Statistics*	*Coefficient*	*t-Statistics*	*Coefficient*	*t-Statistics*
c	0.06	0.69	0.09	1.06		
Δlca(-1)	0.324**	2.40			-2.933*	-4.78
Δlca(-3)	0.429*	3.41			-4.933*	-3.58
Δly(-2)			-3.379*	-3.97		
Δif*(-2)*	-0.112**	-2.53	-0.05	-1.40	-1.049*	-3.30
Δif(-3)					-0.583**	-2.57
Δltl(-1)	-4.851*	-3.48				
Δltl(-3)	2.503***	1.92				
Δlasi*(-1)*	-0.813***	-1.80				
Δlasi*(-2)*	-0.906***	-1.97				
Δlasi*(-3)*	2.380*	5.38				
Δle(-1)			3.217*	2.20		
Δle(-2)			-3.739*	-2.26		
Δle(-3)					-80.407*	-5.94
Δroa(-1)					-0.301**	-2.15
Δroa(-2)					-0.852**	-4.45
Δroa(-3)					-0.762*	-4.45
Δldr(-1)					3.97	1.50
Δldr(-2)			3.810*	2.39		
Δldr(-3)					-5.298***	-2.03
Δlnie(-1)					-4.393*	-4.80
Δlnie(-2)					-8.131*	-5.52
Δlnie(-3)					-6.393*	-4.60
Δlqa(-2)			0.533*	2.63		
Δlcata(-3)					6.105**	2.62
Δltt(-2)			0.694***	1.95		
Δpop(-2)			-10.289***	-1.67		
ecm(-1)	-1.308*	-5.04	-1.260*	-2.50	-1.451*	-2.98
R^2	0.78		0.60		0.85	
Adjusted R^2	0.68		0.43		0.71	
DW Stats	1.655		1.990		2.022	

the level of economic activities and deposit rate, although return positive coefficients but statistically insignificant. This further buttressed the fact that Nigerian banks rarely remunerate deposits hence cost of funds does not determine their level of returns.

The result of the error correction model (ECM) as presented in Table 7 yield negative results, showing that equilibrium can be restored in case of distortion. This further corroborates the existence of long-run relationships among the examined variables (Sung-Hoon and Byoung-Ky, 2008) as obtained in the long-run equations.

Cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) of recursive residuals tests were deployed to test the stability of the estimated equations and parameters. Figures 1 to 6 shows the CUSUM and CUSUMSQ of all the estimated models. The graphs demonstrate the stability of the equations and parameters as all the recursive errors fall within the two critical lines of both techniques.

5.0 CONCLUSION AND POLICY REMARKS

Since the FSIs compiled for Nigeria shows that it is capable of pre-empting financials crisis (Yaaba, 2012; Yaaba and Adamu, 2015), it is imperatives to further develop methodologies that will make its application relatively easier as well as explore its relationships with other macro-variables so as to boost its usefulness. With the growing consensus among economist that the evolution of economies over time tends to cyclically move around certain trend, hence the boom-bust cycles. Understanding the cyclical pattern of those critical macroeconomic variables and how they relate to strength/weakness of the Nigerian banking system is critical for effective and efficient monetary policy decision making as well as implementation. This paper empirically examined the relationship between FSIs and macro-fundamentals in Nigeria.

However, considering the fact FSIs are still evolving and still being refined, it is difficult to make a strong conclusion based on the outcome of the study but given

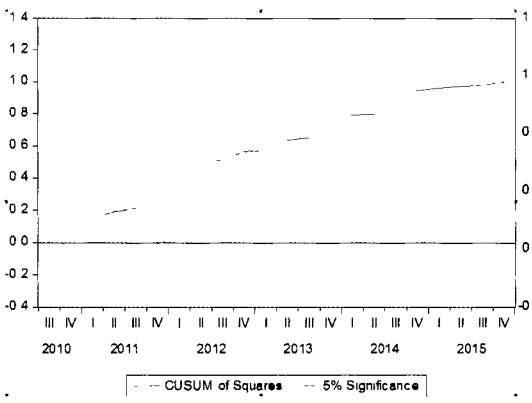


Figure 1: Cumulative Sum of Recursive Residual Test for Capital Adequacy Equation

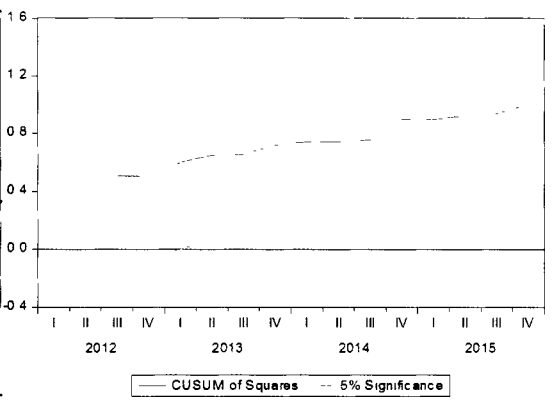


Figure 2: Cumulative Sum of Squares of Recursive Residual Test for Capital Adequacy Equation

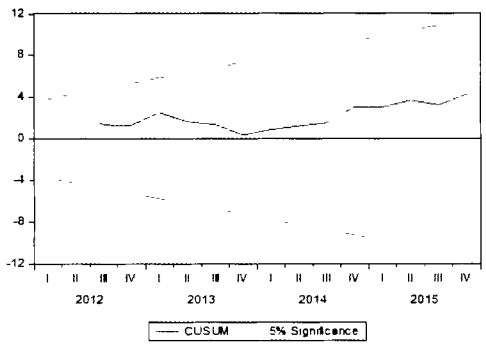


Figure 3: Cumulative Sum of Recursive Residual Test for Asset Quality Equation

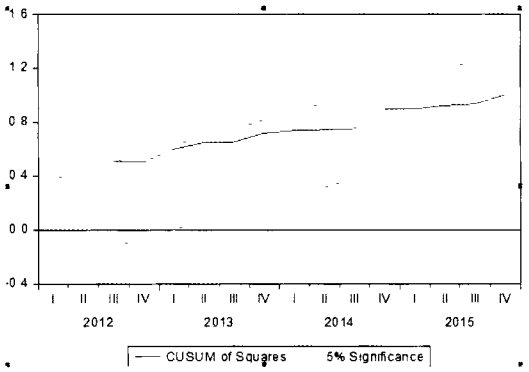


Figure 4: Cumulative Sum of Squares of Recursive Residual Test for Asset Quality Equation

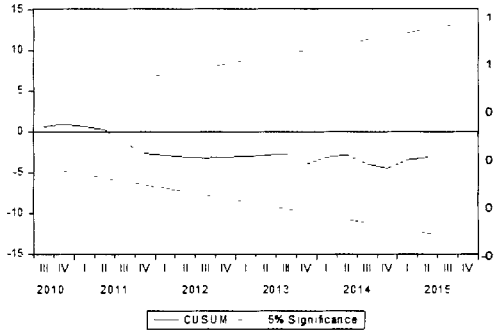


Figure 5: Cumulative Sum of Recursive Residual Test for Profitability Equation

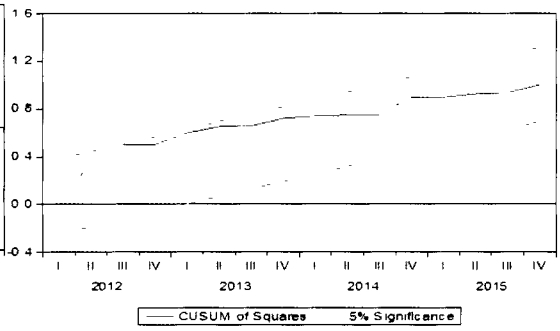


Figure 6: Cumulative Sum of Squares of Recursive Residual Test for profitability Equation

the theoretically coherent relationships established among FSIs, level of economic activity, inflation, interest rate and exchange rate, it follows that the soundness of the Nigerian banking system can be mirrored through happenings in the macroeconomy. Thus, the results provide an insight into the usefulness of the data as well as when the movement of macroeconomics variables should be of utmost concern to the policy makers. The results reveal not only when developments in the macro economy should signals the strength/vulnerabilities in the banking system but also show the magnitude of the strength/weakness that should be anticipated in the sector. Hence, serves as warning signal to policy makers to take proactive policy measures to avert impending crisis. Immediate deployment of the FSIs is, therefore, suggested as additional monitoring instrument, to be used side-by-side with the existing micro-prudential tools. Furthermore, in order to enhance the efficiency of the FSIs as a tool for macroprudential regulation, more effort should be geared towards improving the compilation process and the resultant FSIs thoroughly tested using varying methodologies to ascertain their correctness.

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