

Generating a Composite Index to Support Monetary and Financial Stability Analysis in Nigeria

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Abstract

Sere-Ejembi et al (2014, CBN Journal of Applied Statistics) developed a banking stability index for Nigeria. This paper extends their work using indicators of stability in the banking, insurance and capital market segments, to propose a composite financial system stability index for the Nigerian Financial System. The two indices proposed capture the episodes of stability and vulnerability in the Nigerian Financial System during the study period. The paper finds signs of instability in the Nigeria's financial system from Q2, 2008 at the wake of the global financial crisis. The crises became very severe around Q3, 2009 when the indices dropped below the indicative thresholds. The indices dropped further in Q3, 2010 indicating the height of the crises. However, stability was restored thereafter.

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1. Introduction

Financial System Stability is of utmost importance to policy makers in Nigeria partly because of the huge macroeconomic and financial costs of the previous episodes of instability. The effect of the 2009 banking crises on the economy was so severe that the authorities had to inject huge financial resources to recapitalize some banks. Efforts have therefore been intensified to ensure the stability of the financial system. As a result, renewed efforts have been made to complement micro-prudential analysis with macro-prudential analysis. With emphasis on the system as a whole, macro-prudential analysis and regulation seek to identify and mitigate risks to the stability of the system.

Macro-prudential analysis relies on indicators that can be used as a basis for monitoring the health, vulnerabilities and stability of the financial system. These indicators include aggregated micro-prudential indicators as well as macro-economic variables that impact on financial system stability. The Central Bank of Nigeria compiles both sets of indicators for the purpose of macro-prudential regulation. FSIs are compiled on quarterly basis and disseminated through the IMF – FSIs website and published in the Banks Financial Stability Reports. Other indicators are disseminated via other publications like the Statistical Bulletin and the Annual Report and Statement of Accounts. The current framework for the analysis of financial system stability involves the use of each of these indicators to monitor the strength or vulnerabilities of the system over time from different dimensions. Each indicator monitors a different aspect of risk arising from capital adequacy, asset quality, earnings and profitability or liquidity as the case may be. The corporate and real sector FSIs assess the risk to the system due to banking system exposure to these sectors.

Concerns have however been raised concerning the use of a wide range of indicators in macro-prudential analysis. The use of multiple indicators in financial stability analysis simultaneously could result in conflicting signals or some confusion. Efforts have therefore been made to collapse the many indicators into a single index. The Composite Index is a single indicator of the soundness of the financial system. Even though the overall stability of the financial system may be difficult to capture in a single measure, a composite Index could serve as a snapshot indicator of the strength of the system that is easily captured at a glance. Policy makers and other stakeholders could then disaggregate the composite index to identify sectors with risks and vulnerabilities for purposes of interventions aimed at financial stability. A composite indicator may give a clearer signal of direction than a wide range of indicators and make it easier to compare progress over time and space.

This paper attempts to generate a composite index for purposes of financial stability analysis in Nigeria. For this purpose the paper is structured as follows; following this introduction is Section 2 which presents an overview of the financial stability variables in Nigeria. Section 3 discusses the generation of the Financial Stability Index, while Section 4 reviews its applicability to policy. Section 5 summarizes and concludes the paper.

2. Indicators for Financial System Stability Analysis

A key issue in financial system stability analysis is the identification of the relevant variables or indicators. To identify these variables, one must take into consideration the definition of financial system stability and the structure of the financial system. The European central Bank (2007) defines financial system stability as “a condition in which the financial system – comprising financial intermediaries, markets and market infrastructure, is capable of withstanding shocks and the unraveling of financial imbalances thereby mitigating the likelihood of disruptions in financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities.” Central Bank of Nigeria (2013) defines financial stability as the resiliency of the financial system to unanticipated adverse shocks while enabling the continuing smooth functioning of the financial system intermediation process. These definitions and the structure of the system provide direction on what to consider when identifying the indicators of financial system stability.

2.1 The Structure of the Nigerian Financial System

The Nigeria financial system has grown rapidly over the years in terms of number of institutions and asset base. As of end-2013, gross financial system assets accounted for 61 percent of GDP. At the core of the system are banks, comprising 21 commercial banks, 2 merchant and one non-interest bank. Together they account for 80.3 per cent of total financial sector assets. The Insurance and Pension funds stand at 14.9 percent while the other non-bank financial institutions constitute the balance of 4.9 per cent of total financial market assets.

The Capital market remains relatively small with large sectors of the economy underrepresented. The only securities exchange operating in Nigeria is the Nigerian Stock Exchange (NSE). Its market capitalization dropped from ₦9,563.0 billion representing 30 percent of GDP at end-2008 to a low point of ₦7,030.8 billion, before recovering to ₦13,226.24 (12 percent of GDP) at the end of December 2013 (see Table 1).

2.2 Financial Stability Variables

The ability to conduct financial system stability analysis depends largely on the tools available for this task. With the liberalization of the financial systems and the evident systemic effects on the financial system stability, the identification and compilation of variables for monitoring this stability becomes paramount. The IMF working with other international bodies have developed a set of core and encouraged Financial Soundness Indicators. FSIs are calculated and disseminated to support macro-prudential analysis for the purpose of enhancing financial system stability. The FSIs Compilation Guide states that the FSIs are intended for use in monitoring the developments in positions (exposures) and flows that could indicate increased financial sector vulnerabilities and could help assess the potential resilience of the sector to adverse circumstances. However it is also accepted therein that FSIs are only one input into macro-prudential analysis. Also relevant are – indicators that provide a broader picture of economic and financial circumstances such as asset prices, credit growth, gross domestic product (GDP) growth, inflation

and external position; the institutional and regulatory framework for the economy; and the structure of the financial system and strength of the financial infrastructure.

3. Methodology and Data

3.1 Derivation of Financial System Stability Index (FSSI)

Sere-Ejembi et al (2014) develop the banking system stability index and we extend their study by including the insurance and capital market to derive the financial system stability index for Nigeria. Although banking sector dominates the financial system in Nigeria, neglecting other sectors of the financial system in determining early warning signals of financial crisis may be misleading. The data used in this study is obtained from the Statistics Database of the Central Bank of Nigeria and it spanned the period Q1, 2008 to Q4, 2013. The sample period is small mostly because of the limited information in the insurance sector.

In this study, we derive the financial system stability index (FSSI) by applying statistical normalization and empirical normalization methodologies to indicators of banking system soundness, equity market performance and insurance industry soundness as:

$$FSSI_t = w_2DCAR_t + w_3MCGDP_t + w_4ICAR_t \quad (1)$$

The capital adequacy ratio of the banking industry, measured as the ratio of regulatory tier 1 capital to risk weighted assets is used as a proxy for the banking system soundness indicator ($DCAR_t$). The capital market performance proxied by the ratio of equity market capitalization to gross domestic product ($MCGDP_t$), while the ratio of equity capital to total assets ($ICAR_t$) of the insurance industry measures its soundness at period t . w_j is the weighed assigned to individual indicator. The weight is obtained by using ordinary least square to estimate the responses of the change in total assets of the financial system to changes in the total assets of DMBs, Insurance sector and market capitalizations. These responses are further summed to obtain the proportion of each subsector in the financial sector with the view to ensuring that the combined weights for the subsectors sum up to one. Statistically, the weights are derived thus:

$$\Delta \log(TAF)_t = \beta_1 + \beta_2 \Delta \log(TAB)_t + \beta_3 \Delta \log(MC)_t + \beta_4 \log(TAI)_t + e_t \quad (2)$$

Where TAF represents the total assets of the Financial System, TAB is the total assets of DMBs, TAI is the total assets of the insurance companies and MC represents the equity market capitalization. Equation (2) is estimated at the level the variables were stationary. The estimated values of $\beta_i, i = 2, 3 \text{ and } 4$ measure the responses of changes in total assets of the Financial System to changes in total assets of DMBs, Insurance sector and market capitalizations. e_t are the residuals that account for the unexplained variation in total assets of the financial system and t is the time period.

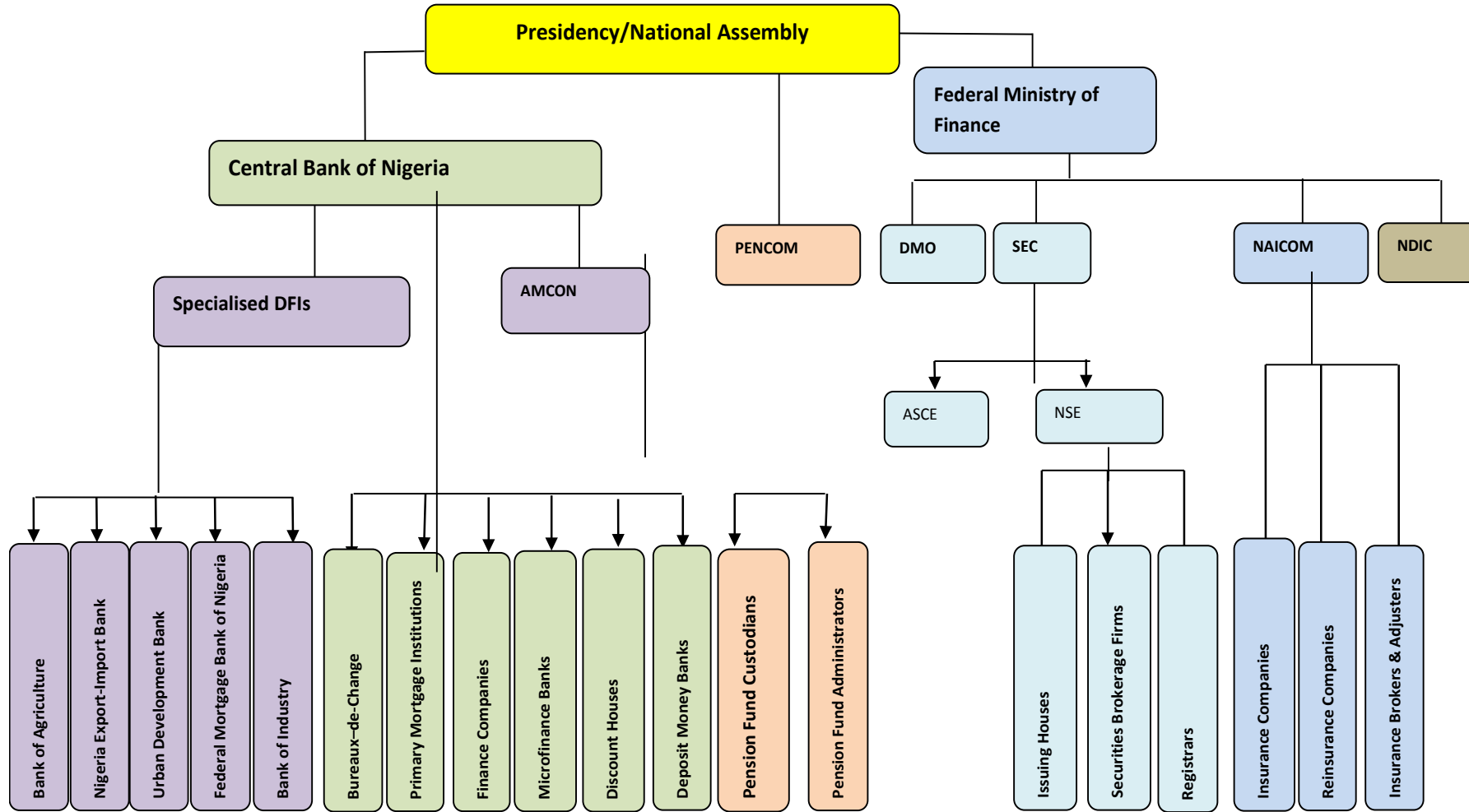
Structure of the Nigerian Financial System, 2013

₦'billion, unless specified otherwise

Table 1

	2006			2010			2011			2012			2013		
	Number	Assets	In percent of total assets	Number	Assets	In percent of total assets	Number	Assets	percent of total assets	Number	Assets	percent of total assets	Number	Assets	In percent of total assets
Deposit Money Banks	25	7,172.9	91.0	25	17,331.6	81.7	21	19,396.6	78.9	22	21,303.9	80.4	24	24,468.3	80.3
Commercial	25	7,172.90	91.0	25	17,331.60	81.7	21	19,396.6	78.9	21	21,288.1	80.3	21	24,301.20	79.8
Merchant	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	2	133.6	0.4
NIB	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1	15.8	0.1	1	33.5	0.1
Insurance/Pension Funds	128	300	3.8	99	2,595.2	12.2	100	2,844.1	11.6	84	3,736.5	14.1	92	4,527.0	14.9
Insurance Companies	107	n.a.	n.a.	61	565	2.7	61	393.7	1.6	57	586.4	2.2	59	468.9	1.5
Pension Funds	13	300	3.8	30	2,030.2	9.6	31	2,450.4	10.0	27	3,150.1	11.9	33	4,058.1	13.3
Unit Trusts	8	n.a.	n.a.	8	n.a.	n.a.	8	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Other Non-banks Financial Institutions	1,909	410.4	5.3	3,624	1299.5	6.1	3,483	2,340.3	9.5	3,318	1472	5.6	3,436	1,469.1	4.8
Financial Companies	112	54.3	0.7	108	113.8	0.5	108	114.9	0.5	67	109.5	0.4	61	103.1	0.3
Specialized Development Institutions	6	n.a.	n.a.	5	316.2	1.5	5	359.6	1.5	5	446.9	1.7	6	586.7	1.9
Securities Firms	581	n.a.	n.a.	580	n.a.	n.a.	254	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Fund Managers	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	136	1,085	4.4	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mortgage Institutions	90	114.5	1.5	101	336.8	1.6	102	342.1	1.4	82	348.1	1.3	82	374.6	1.2
Microfinance Banks	757	55.1	0.7	866	170.3	0.8	821	117.9	0.5	880	222.8	0.8	820	270.9	0.9
Discount Houses	5	186.5	2.5	5	362.4	1.7	5	320.8	1.3	5	344.7	1.3	2	133.8	0.4
Bureau De Change	352	n.a.	n.a.	1,959	n.a.	n.a.	2,051	n.a.	n.a.	2,278	n.a.	n.a.	2,464	n.a.	n.a.
Assets Management Companies (AMC)	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1	n.a.	n.a.	1	n.a.	n.a.	1	n.a.	n.a.
Other	6	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total Financial system	2,062	7,883	100	3,748	21,226	100	3,604	24,581	100	3,424	26,512	100	3,552	30,464	100

Source: CBN



Therefore,

$$w_j = \frac{\beta_j}{\sum_{i=2}^4 \beta_i}, j = 2, 3, 4$$

$$\text{With } \sum_{j=2}^4 w_j = 1$$

The weight attached indicates the relative importance of the subsector. We empirically estimated w_2 , w_3 and w_4 as 0.65, 0.34 and 0.01 for banking industry, capital market and insurance industry, respectively.

3.2 Statistical Normalization

The statistical normalization reduces the volatility of indicators ($DCAR_t$, $MCGDP_t$ and $ICAR_t$) and ensures that they are brought to a common scale with zero means and unit variances. This normalization process is expressed as:

$$Z_t = \left(\frac{X_t - \mu}{\sigma} \right) \quad (3)$$

Where X_t is the value of indicators X during period t ; μ is the mean and σ is the standard deviation. The zero average avoids introducing aggregation distortions arising from differences in the means of the indicators. The scaling factor is the standard deviation of the indicators. The $FSSI^{SN}$ for the statistical normalization analogous to equation (1) is then derived as:

$$\begin{aligned} FSSI_t^{SN} = & \omega_2 \left(\frac{DCAR_t - E(DCAR)}{\sqrt{Var(DCAR)}} \right) + \omega_3 \left(\frac{MCGDP_t - E(MCGDP)}{\sqrt{Var(MCGDP)}} \right) \\ & + \omega_4 \left(\frac{ICAR_t - E(ICAR)}{\sqrt{Var(ICAR)}} \right) \end{aligned} \quad (4)$$

3.3 Empirical Normalization

As implemented by Nicholas and Isabel (2010), empirical normalization converts all financial system stability indicators to an identical range of [0, 1] using

$$V_{tr}^n = \frac{V_{tr} - \text{Min}(V_r)}{\text{Max}(V_r) - \text{Min}(V_r)} \quad (5)$$

V_{tr} represents the value of indicator r in period t ; $\text{Min}(V_i)$ and $\text{Max}(V_i)$ represent minimum and maximum of indicator r across the sample period and V_{tr}^n is the indicator's normalized values using the empirical normalization method, which ranges from zero to unity, representing the most unfavorable value and most favorable value, respectively. Using this technique the $FSSI_t^{EN}$ is derived as:

$$\begin{aligned} FSSI_t^{EN} = & \omega_2 \left(\frac{DCAR_t - \text{Min}(DCAR)}{\text{Max}(DCAR) - \text{Min}(DCAR)} \right) \\ & + \omega_3 \left(\frac{MCGDP_t - \text{Min}(MCGDP)}{\text{Max}(MCGDP) - \text{Min}(MCGDP)} \right) \\ & + \omega_4 \left(\frac{ICAR_t - \text{Min}(ICAR)}{\text{Max}(ICAR) - \text{Min}(ICAR)} \right) \end{aligned} \quad (6)$$

The FSSI, using statistical normalization has zero as threshold. This implies that when FSSI for statistical normalization is above zero the system is stable and the reverse is the case, if the index falls below zero. Similarly, when the FSSI approaches unity, using the empirical normalization, it suggests improvement in financial

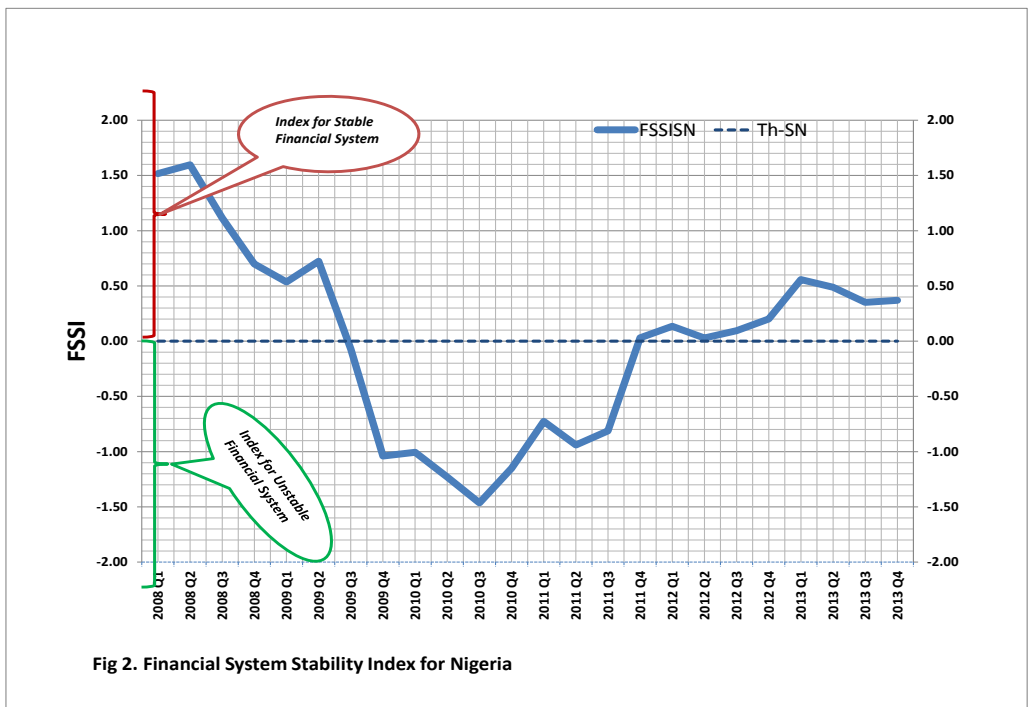
stability and as it tends towards zero, it indicates worsening of the financial system, with a threshold value of 0.5.

4. Data Analysis and Interpretations of Results

Table 2 and Figures 2, and 3 show the trend in financial system stability index constructed by subjecting the indicators of banking system, insurance sector and capital market stability to two different approaches namely statistical normalization, and empirical normalization method, respectively. Figure 2 shows signs of instability in the financial system from second quarter 2008, at the wake of the global financial crisis (GFC). The impact of the GFC on the system became very severe around the third quarter of 2009 when the index dropped below the indicative benchmark of zero. The index dropped further to -1.46 in the third quarter of 2010 indicating the height of the crisis.

Although there is no exact indicative benchmark for empirical normalization method in literature, however, as the FSSI approaches zero, the financial system gets weaker; and as FSSI tends towards one, the financial system gains more momentum. Now, using 0.5 as our indicative benchmark in Figure 3, the FSSI reveals a declining strength in the financial sector until the third quarter of 2009 when it dropped below 0.5. From figures 1 and 3, the FSSI reveals similar financial system status between Q3, 2009 and Q3, 2011. During the period, between second quarters of 2008 and 2009, there were tight liquidity conditions in the financial system and financial stability indicators were trending downwards. For instance, the assets quality of the banks, measure as the ratio of non-performing loans to industry total, deteriorated by 26.5 percentage points to 32.8 per cent at end-December 2009, exceeding the 20.0 per cent international threshold and the maximum prescribed by the Contingency Plan for Systemic Distress

Industry liquidity ratio was above the 25.0 per cent minimum threshold, but three banks failed to meet the requirement (CBN, 2009). The capital market was bearish throughout 2009 as a result of capital reversal occasioned by the GFC. Total market capitalization to GDP ratio fell to 28.5% in end 2009 from 39.7% in end 2008. Secondary market segment of the NSE recorded poor performance as there was significant capital reversal owing to low investors' confidence, following the global economic and financial crisis. There was a lull in the primary market as indicated by the decline in the number of applications received and issues offered for public subscription, reflecting the liquidity crisis and investors' waning confidence in the market (CBN, 2009).



In 2009, having noticed the contagion effect of the GFC that kick-started in the United States, the monetary and fiscal authority rolled out stimulus packages, as well as quantitative easing of monetary policy stance to cushion the effect. Examples of these stimulus packages are disbursement of N200 billion to DMBs under the Commercial Agricultural Credit Scheme, continuation of lower tariff under the “2008 – 2012 Nigeria Customs and Tariff Book” to encourage the importation of raw materials to stimulate domestic industrial production and manufacturing activities, earmarking of N361.2 billion for investment in critical infrastructure and; injection of about N100 billion multilateral loan in critical sectors of the economy.

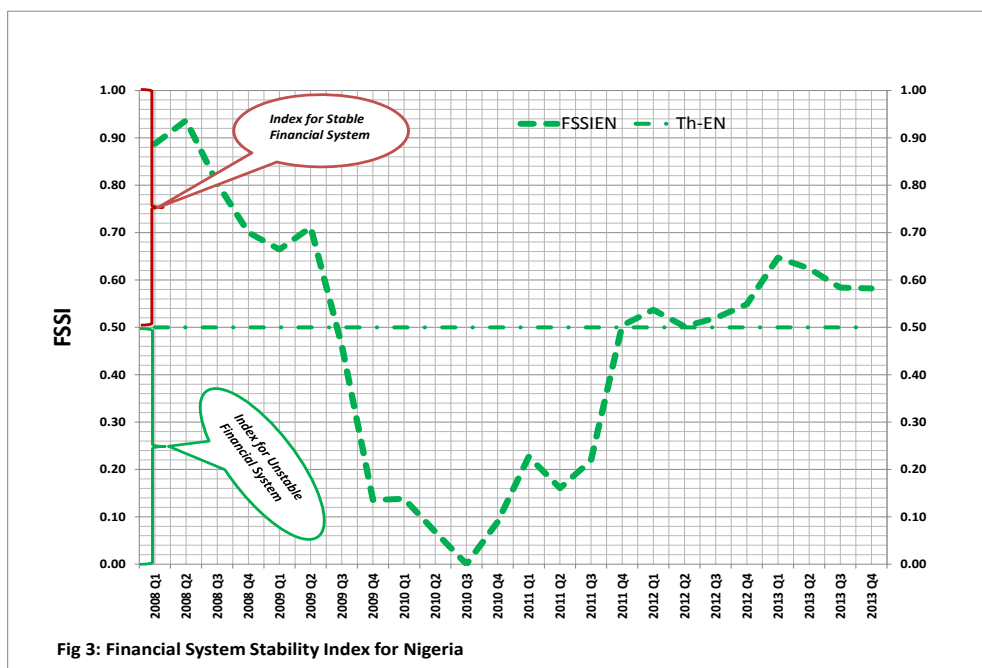
Table 2: Financial System Stability Index Constructed Using Statistical Normalization and Empirical Normalization Methods

Quarter	Soundness Indicators			Statistical Normalization					Soundness Indicators			Empirical Normalization			
	INS_CAR	MC/GDP	DMB_CAR	INS_CAR	MC/GDP	DMB_CAR	FSSI		INS_CAR	MC/GDP	DMB_CAR	INS_CAR	MC/GDP	DMB_CAR	FSSI
2008 Q1	9.813	2.190	0.198	0.56	3.10	0.70	1.52		9.813	2.190	0.198	0.37	1.00	0.84	0.89
2008 Q2	20.451	1.909	0.237	1.91	2.38	1.18	1.60		20.451	1.909	0.237	0.78	0.82	1.00	0.94
2008 Q3	18.273	1.522	0.220	1.63	1.38	0.97	1.12		18.273	1.522	0.220	0.70	0.57	0.93	0.80
2008 Q4	13.207	1.058	0.219	0.99	0.18	0.96	0.70		13.207	1.058	0.219	0.50	0.28	0.93	0.70
2009 Q1	10.06	0.82	0.23	0.59	-0.42	1.04	0.54		10.06	0.82	0.23	0.38	0.13	0.95	0.66
2009 Q2	26.14	1.02	0.22	2.63	0.09	1.03	0.72		26.14	1.02	0.22	1.00	0.25	0.95	0.71
2009 Q3	9.45	0.78	0.16	0.51	-0.54	0.17	-0.07		9.45	0.78	0.16	0.36	0.10	0.65	0.46
2009 Q4	15.31	0.73	0.04	1.25	-0.66	-1.27	-1.04		15.31	0.73	0.04	0.58	0.07	0.16	0.14
2010 Q1	0.70	0.85	0.03	-0.60	-0.36	-1.35	-1.01		0.70	0.85	0.03	0.02	0.14	0.14	0.14
2010 Q2	0.70	0.77	0.02	-0.60	-0.56	-1.59	-1.23		0.70	0.77	0.02	0.02	0.09	0.06	0.07
2010 Q3	0.65	0.62	0.00	-0.60	-0.93	-1.75	-1.46		0.65	0.62	0.00	0.02	0.00	0.00	0.00
2010 Q4	0.61	0.84	0.02	-0.61	-0.38	-1.56	-1.15		0.61	0.84	0.02	0.01	0.14	0.07	0.09
2011 Q1	0.66	0.92	0.06	-0.60	-0.17	-1.02	-0.73		0.66	0.92	0.06	0.02	0.19	0.25	0.23
2011 Q2	0.58	0.85	0.04	-0.61	-0.36	-1.25	-0.94		0.58	0.85	0.04	0.01	0.14	0.17	0.16
2011 Q3	0.56	0.66	0.08	-0.62	-0.84	-0.80	-0.81		0.56	0.66	0.08	0.01	0.02	0.32	0.22
2011 Q4	0.51	0.68	0.18	-0.62	-0.78	0.46	0.03		0.51	0.68	0.18	0.01	0.04	0.75	0.50
2012 Q1	0.30	0.72	0.19	-0.65	-0.69	0.58	0.14		0.30	0.72	0.19	0.00	0.06	0.80	0.54
2012 Q2	0.36	0.70	0.18	-0.64	-0.73	0.44	0.03		0.36	0.70	0.18	0.01	0.05	0.75	0.50
2012 Q3	0.27	0.76	0.18	-0.65	-0.59	0.47	0.09		0.27	0.76	0.18	0.00	0.08	0.76	0.52
2012 Q4	0.31	0.85	0.18	-0.65	-0.36	0.51	0.20		0.31	0.85	0.18	0.00	0.14	0.77	0.55
2013 Q1	0.31	1.13	0.20	-0.65	0.37	0.67	0.56		0.31	1.13	0.20	0.00	0.32	0.83	0.65
2013 Q2	0.32	1.12	0.19	-0.65	0.34	0.58	0.49		0.32	1.12	0.19	0.00	0.32	0.79	0.62
2013 Q3	0.26	1.04	0.18	-0.65	0.15	0.47	0.35		0.26	1.04	0.18	0.00	0.27	0.76	0.58
2013 Q4	0.22	1.15	0.17	-0.66	0.41	0.36	0.37		0.22	1.15	0.17	0.00	0.33	0.72	0.58
Mean	5.42	0.99	0.14	0.00	0.00	0.00	Min		0.22	0.62	0.00	0.00	0.00	0.00	
SD	7.89	0.39	0.08	1.00	1.00	1.00	Max		26.14	2.19	0.24	1.00	1.00	1.00	

The fiscal stimulus countered the effects of the GFC and curtailed the deceleration of Nigeria's economic growth (CBN, 2009). These efforts caused the declining financial system to moderate in second quarter of 2009, as noticed in figures 2 and 3. The effects of packages were short-lived, as the FSSI with the statistical normalization method showed unstable financial system from third quarter of 2009 to Q3, 2011. The financial system became unstable from third quarter of 2009 as revealed in the FSSI with empirical normalization and remained unstable till the end of the observation period. The stability recorded in the financial system during the second half of 2011 were attributed to concerted efforts made by the three sectors in 2011. For instance, in the insurance sector, the Market Development and Restructuring Initiative (MDRI) and the introduction of Micro insurance and Takaful insurance models were focused to address issues of low insurance uptake, financial and social inclusion, and the lack of insurance awareness, market deepening and insurance penetration in the Nigerian economy (NAICOM, 2011).

The index that has been developed is designed to incorporate the resilience in the banking, insurance and capital market into one composite measure. This composite index will capture the interconnectedness between the banking and capital market sectors. Most of the commercial banks operating in the country are listed on the stock exchange and as at end of Dec. 2013, the banking sector equities constituted 22 per cent of total market capitalization. It is instructive to note that the banking sector crises of 2008/2009 started from the capital market. The Nigerian banks were considered safe and sound after the recapitalization exercise in 2004/2005. In the course of the recapitalization exercise, many banks went to the capital market to raise funds to meet the benchmark. By the end of this exercise, the activities in the capital market had been reached unprecedented heights in terms of volume and value.

However, there was a crash in this market following the GFC which started in the US and led to the withdrawal of foreign institutional investors. This crash eroded the value of banking sector stocks resulting in virtual wiping out of the tier 1 capital of many banks. The margin loans granted by the banks with their equity shareholding as collateral became non-performing. This is the scenario that gave rise to the last banking crises in Nigeria. The Index here will give signals to developments in the entire financial system. Where a sign of bubbles or deterioration is observed, policy makers will disaggregate the index to identify sectors that require intervention.



5. Summary and Conclusion

A composite index is a single indicator of the soundness of the financial system. Even though the overall stability of the financial system may be difficult to capture in a single measure, a composite index could serve as a swap shot indicator of the strength of the system at a glance. Using indicators of stability in the banking, insurance and capital market segments, a composite index is developed for the Nigerian Financial System. The index captures the episodes of both stability and vulnerability during the study period. This index will be a useful tool as a one stop measure in financial system stability analysis.

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