Measuring and Managing Systemic Risk in the Nigerian Banking System: By Research Department

Executive Summary

Backdrop and objectives: The failure of systemically important financial institutions, or SIFIs, (also referred to as too big to fail financial institutions or large complex financial firms) generate large, undesirable externalities that include disruption of the stability of the financial system and its ability to provide credit and other essential financial services to individuals and businesses. When this happens, not only is the financial sector disrupted, but its troubles cascade over into the real economy.

A financial institution can be regarded as systemically important due to the financial functions it provides to the economy. Some systemically important functions are payment operations, deposits to ensure access to liquidity for payment transactions and loans and credits to non-financial firms. All other functions carried out by SIFIs that might have systemic importance can also be considered.

Institutional perspective of systemic importance refers to firms who due to the services they perform to the economy cannot be easily substituted by other companies within a short time period. In Nigerian context, the financial sector is dominated by banks and constitutes the majority of the financial system. This therefore limits the measurement and management of systemic risk to only the banking sector.

It is the task of national supervisory and regulatory agencies as well as standard setting agencies like Bank for International Settlement (BIS) and International Association of Deposit Insurers (IADI) to identify risks to financial stability due to the activities of big financial firms and respond appropriately. Consequently, the issue of SIFIs is of great importance to Nigeria. The Central Bank of Nigeria (CBN) and Nigeria Deposit Insurance Corporation (NDIC) as the banking sector regulators are charged with the responsibility of developing framework for regulating Syemically Important Banks or SIBs. The goal of this initiative is in line with Basel III and other global initiatives where each jurisdiction designs a policy framework

for the identification and regulation of their domestic SIFIs (in addition to global, if any)so as to limit the economic impact of crisis in the financial system and promote financial stability.

Identification of SIBs (Systemically Important Banks) and accurate measurement of systemic shortfall is of significant benefit to regulators because by identifying SIFIs or SIBs posing big threats to financial stability, measures and targets can help in targeting increased supervisory standards. For example, by indicating that the potential for financial instability is rising (i.e., providing early warning signals), metrics can signal to policymakers a need to tighten so-called macroprudential policies.

However, the task of measuring systemic risk is difficult because there is no agreed definition of such an important risk by the key participants. This is because it is difficult to manage what cannot be measured. And before we can measure systemic risk, we need to define or characterize it. Policymakers, regulators, academics and practitioners have given different definitions to systemic risk.

This paper is therefore concerned with the identification of SIBs and measurement of their contribution to systemic shortfall. We measure the systemic risk contributions of Nigerian banks based on several approaches advocated by BIS, regulators and academics. The paper also discusses the tools used in management of systemic risk.

Identification of SIBs/SIFI: There are several methods of categorizing SIFIs/SIBs. In this paper, we consider the categorisation of systemic risk measures based on Benoit et al (2012); supervisory approach that relies on data supplied to regulators by the banks and based on BIS (BIS Indicator approach) and approach that relies on market data such as stock returns and market capitalisation(SRISK approach).

The *Basel indicator-based measurement* approach considers the following factors in the classification of SIFIs/SIBs: Size, Interconnectedness, Substitutability and Complexity. We obtained Total Assets, Net-Interbank Transactions, Total Credits and Total Deposits, branch network and number of foreign subsidiaries from eFASS in order to determine the Nigerian SIBs. In the CBN and NDIC SIB Framework, size

and substitutability factors were assigned weight of 30% each, while complexity and interconnectedness were weighted 25% and 15%, respectively. The determinants within complexity were assigned 12.5% each whereas determinants under substitutability were each assigned 15% weight.

The *market data-based systemic expected shortfall and systemic risk (SRISK)* measures systemic risk as the amount by which a bank is undercapitalized in a systemic event in which the entire financial system is undercapitalized. This concept is appealing as it uses market data that are readily available to regulators and market participants, at a daily frequency. A financial firm will be unable to function when the value of its equity falls to a sufficiently small fraction of its outstanding liabilities. In good times, such a firm will likely be acquired, may be able to raise new capital or may face an orderly bankruptcy. If this capital shortage occurs at a time when the financial sector is already financially constrained, then the government faces the question of whether to rescue the firm with taxpayer money as other avenues are no longer available. Consequently a firm is systemically risky if it is likely to face a capital shortage just when the financial sector itself is weak.

Observations:

- The recent financial crisis has shown that no single Financial Safety Net participant can resolve systemic crisis alone. All the members should participate and collaborate to manage systemic risk. The near-financial crisis of 2009 that involved the collaboration of CBN and NDIC in special examination of all the universal banks, establishment of bridge-banks by NDIC and capital injection of N620 billion involved the coorperation of most FSN players in the country.
- The necessary tools to prevent a systemic crisis by deposit insurers include the information-sharing framework with other FSN players, appropriate level of coverage, public awareness, early detection of risk and timely intervention. Public awareness is essential in preventing bank runs in crisis times by enhancing public confidence in the deposit insurance system. Equally important is early detection of risk and timely intervention when a bank (s) is deemed to be in a problem. The CBN created the Financial Policy and Regulation Department (FPRD) with the key responsibility of macroprudential regulation

and supervision in Nigeria. The NDIC carries out several public key awareness campaigns, improved its payout process, extended scope and level of coverage and has strengthened its early warning signals to identify weak banks early and intervene appropriately. Both CBN and NDIC carry out routine stresstesting of the economy to identify systemic vulnerabilities and act accordingly.

- As it is already established, size is not the only criterion to determine systemic importance. We observe that banks identified as systemically important change in terms of weight or degree of importance from one month to the next and also different methods rank the systemic importance of the banks differently.

- A major advantage of the market-based approach and its appealing feature of calculating systemic risk surcharge is that it makes it possible to understand systemic risk in terms of an individual bank and the broader context of banking subsectors. This implies that it is possible to compute the systemic risk surcharges of a regional banking sector against another region, etc.
- The necessary tools to prevent a systemic crisis by deposit insurers include the information-sharing framework with other FSN players, appropriate level of coverage, public awareness, early detection of risk and timely intervention. Public awareness is essential in preventing bank runs in crisis times by enhancing public confidence in the deposit insurance system. Equally important is early detection of risk and timely intervention when a bank (s) is deemed to be in a problem. The CBN created the Financial Policy and Regulation Department (FPRD) with the key responsibility of macroprudential regulation and supervision in Nigeria. The NDIC carries out several public key awareness campaigns, improved its payout process, extended scope and level of coverage and has strengthened its early warning signals to identify weak banks early and intervene appropriately. Both CBN and NDIC carry out routine stresstesting of the economy to identify systemic vulnerabilities and act accordingly.

- The new market-based systemic risk measures have demonstrated that CBN and NDIC should develop SIB regulatory framework that includes market data

and perspective instead of eFASS-based bank returns or supervisory view alone.

Findings

- An advantage of the SRISK market data-based approach over the BIS Indicator approach is that market data is available at a daily frequency and therefore can capture the changing condition of banks at a daily frequency. The BIS Indicator approach can at most be updated at a monthly frequency and can only capture conditions of banks with a month's lag. Financial firms' risks, especially banks' can change very quickly. This implies that the BIS indicator approach needs to be augmented with a model that usesmore up-to-date information like the SRISK approach.

- Applying SRISK market data-based and BIS Indicator approaches to the Nigerian DMBs unambiguously establishes the six banks as systemically important: Bank 1, Bank 2, Bank 3, Bank 4, Bank 5 and Bank 6. Most banks in Nigeria currently hold capital levels in excess of amounts required to be well capitalized. The exception, according to SRISK approach is Bank 7, Bank 8, Bank 9 and Bank 10 that should raise additional equity capital.

- The recent financial crisis has shown that no single FSN participant can resolve systemic crisis alone. All the members should participate and collaborate to manage systemic risk. The near-financial crisis of 2009 that involved the collaboration of CBN and NDIC in special examination of all the universal banks, establishment of bridge-banks by NDIC and capital injection of N620 billion involved the cooperation of most FSN players in the country.
- All banks identified as systemically important have to be subjected to higher capital and other regulatory requirements than those that are non-SIBs. This is due to the burden they can place on the financial system and the economy when they fail. The CBN/NDIC SIB Framework has recommended higher capital requirement SIBs.

- Bank 1, Bank 3, Bank 4, Bank 2, Bank 6 and Bank 5 have featured as SIBs under the two approaches within the first 8 highest ranked banks, each month from December 2012 to September 2013 using both SRISK and BIS Indicator approaches. This shows that these 6 banks should be designated as SIBs without any other due consideration. However, Bank 11 has also featured within the first 8 highest banks, at different months, inconsistently, under either SRISK or BIS Indicator approaches, but not together at the same time. Bank 12 also consistently features as SIB under SRISK approach but hovers around 9-12th position under BIS Indicator approach. Bank 7 and Bank 13 on the other hand, are categorised as SIB under BIS Indicator approach but are rated around 9-13 SIBs under SRISK approach. Bank 14 and Bank 15 are rated within 10-12 range under the two approaches. Therefore, Bank 14, Bank 15, Bank 12 and Bank 11 should be on SIB watch list (to be created by CBN/NDIC) because the failure of any one of them could also have ramifications beyond other non-SIBs and they can also easily fall into the category of SIBs.

Recommendations

- The Corporation should assess its status in terms of systemic risk management as well as examine the legal framework for the resolution of this risk. International Association of Deposit Insurers (IADI, 2012) stated that a coordinated financial safety net (FSN) and legal framework are essential for promoting financial stability. The Association also stated that governments, central banks or deposit insurers are the leading agencies in systemic crisis management.
- The Corporation, in collaboration with CBN and other FSN players, should establish a legal framework for systemic risk management. Effective systemic risk management requires that a crisis response mechanism should be specified in advance, and a speedy resolution of failed financial institutions should be carried out under the mechanism.
- The Corporation shares failure resolution responsibility with CBN. While, resolution of SIB can be quite tedious and demanding, international best practice requires the SIBs to submit resolution plans to resolution authorities at a predefined

frequency, usually yearly. The NDIC/CBN SIB Framework requires all Nigerian banks designated as SIBs to develop and submit resolution and winding-down plan ("Living Will") annually to CBN. The Corporation should also be a recipient of the SIBs' annual Living Wills given its responsibility in failure resolution. Guidance should be issued to the identified SIBs on how to submit their respective plans including their strategy for rapid and orderly resolution in the event of failure of the bank.

- The Corporation should equally examine and if necessary strengthen its resolution processes for large complex financial institutions or SIBs. The Corporation should develop a resolution mechanism to safely wind down failing, systemically important banks in line with recent global financial reforms.
- Payment of funds for resolving systemic crisis can be ex ante or ex post fund. The recent financial crisis has led to the formation of ex-ante and ex-post fund for systemic crisis management under various names such as the resolution fund and bank levy. In Nigeria, the financial stability fund is established for the systemic risk management as an ex-ante fund in line with global best practice. However, the contribution of each bank to the financial stability fund should be based on individual bank's systemic risk capital surcharge. Systemic risk surcharge of each bank should be used in computing the bank's contribution to bail-out cost in crisis situations.

1.0 Introduction

It is the task of national supervisory and regulatory agencies as well as standard setting agencies like BIS and AIDI to identify risks to financial stability due to the activities of big financial firms and respond appropriately. To reliably accomplish these tasks, systemic risk has to be accurately measured and regulated. Measuring and regulating systemic risk is important because of the externalities associated with the failure of an institution, that is, the costs due to deposit insurance, bailout costs and a loss of intermediation to the

real sector. The recent financial crisis has therefore focused widespread attention on systemic risk in the global financial system.

Moreover, policymakers want to know when problems in financial institutions and markets more broadly are likely to become "systemic." Being able to identify systemic events at an early stage enhances policymakers' ability to take necessary (and perhaps exceptional) steps to contain the crisis. Similarly, being able to detect when those pressures may be easing would help to determine when to initiate exit strategies. In addition, increased focus on systemic risk is considered to be a key aspect of macroprudential policy and surveillance with a view towards enhancing the resilience of the financial sector. The ability to identify policies that are not performing and having unintended consequences quickly is one of the most effective ways of improving regulation, and measurement is the starting point. Systemic risk measures can facilitate the monitoring and regulation of the overall level of risk to the system. In addition, prevention is better than management when it comes to systemic crises.

However, the task of measuring systemic risk is difficult because there is no agreed definition of such an important risk by the key participants. This is because it is difficult to manage what cannot be measured. And before we can measure systemic risk, we need to define or characterize it. Policymakers, regulators, academics and practitioners have given different definitions to systemic risk.

In addition, the first component of systemic risk management is the assessment of systemic risk by identifying the systemically important institutions, based on accepted criteria. The second component is the management of systemic risk through imposition of specific regulatory policies and systemic capital surcharge, if applicable.

Systemic risk has been defined as the probability that a series of correlated defaults among financial institutions, occurring over a short time span, will trigger a withdrawal of liquidity and widespread loss of confidence in the financial system as a whole (Billio et al, 2010).The European Central Bank (ECB,

2010) view systemic risk as a risk of financial instability so widespread that it impairs the functioning of a financial system to the point where economic growth and welfare suffer materially. Acharya et al, 2010 define this risk in terms of correlated exposures, Mishkin(2007) focussed on information disruptions, Moussa (2011) defined this risk with respect to contagion and in terms of negative externalities by (Financial Stability Board, 2009). Systemic risk occurs if and only if there is an aggregate shortage of capital in the financial sector such that a reduction in lending by the failure of one bank cannot be offset by other financial institutions (Acharya and Steffen, 2012). However, systemic risk can simply be defined as any broad-based breakdown in the financial system

This could be due to the complexity of the financial system and the sheer variety of products that are traded. The financial system is very big and complicated comprising various market and participant characteristics, legal and institutional constraints, and exogenous factors driving the system at any given time. This leads to the simple conclusion that there is no perfect methodology that precisely measures the systemic risk contribution of individual financial institutions. The various definitions suggest that more than one risk measure will be needed to capture the complex nature of the financial system. Relying on a single approach runs a risk of errors, and therefore, various approaches need to be considered when implementing policy geared at managing systemic risk.

This paper is concerned with the identification of SIFIs and measurement of their contribution to systemic shortfall. We measure the systemic risk contributions of Nigerian banks based on several approaches advocated by BIS, regulators and academics. Specifically, we identify and analyse systemically important Nigerian banks during the 2007 to 2009 financial crisis using the systemic expected shortfall (SES) introduced by Acharya et al. (2010), marginal expected shortfall (MES)introduced by Acharya et al. (2010) and BIS Indicator Approach (BCBS 2011 & 2012). A major goal of this paper is to provide a

comprehensive comparison of the above systemic risk measures by considering the Nigerian Deposit Money Banks (DMBs) over the period 2009-2013. For a concise summary of systemic risk measures, the reader should consult Bisias et al (2012).

We seek to answer the following questions: How much capital should have been raised by banks in crisis situations to cover their expected capital shortfall? Do the different risk measures identify the same SIFI or SIB? And if not, what are the reasons? We use the various methods not only to identify systemic institutions but also to rank the banks according to their systemic risk contribution and to construct future risk rankings.

Our empirical analysis reveals that applying SRISK market data-based and BIS Indicator approaches to the Nigerian DMBs unambiguously establishes the six banks as systemically important: Bank1, Bank 2, Bank 3, Bank 4, Bank 5 and Bank 6. We also find that most banks in Nigeria currently hold capital levels in excess of amounts required to be well capitalized. The exception, according to SRISK approach is Bank 7, Bank 8, Bank 9 and Bank 10 that should raise additional equity capital.

In Section 2 we look at the definition of systemically important financial institutions (SIFIs) and the categorisation of their key characteristics. In Section 3 we focus on the methods that can be used to identify SIFIs and apply some of them to the Nigerian banking sector. Section 4 focuses primarily on the data used in identifying SIBs as well as the empirical analysis of the proposed approaches. Section 5 discusses tools used to manage systemic risk and SIBs in Nigeria. The final section concludes and offers recommendations.

2.0 Definition and categorisation of SIFIs

Billio et al (2010) view systemic risk as "any set of circumstances that threatens the stability of or public confidence in the financial system". A systemic crisis is

defined as an episode of stress in the banking sector followed by significant policy intervention. IMF and BIS defined systemic risk as the risk of a disruption to financial services that is caused by an impairment of all or parts of the financial system; and has the potential to have serious negative consequences for the real economy. Blancher et al (2013) define systemic risk as s risk that originates within, or spreads through, the financial sector (for instance due to insufficient solvency), with the potential for severe adverse effects on financial intermediation and real output[1].

Categorisation of Systemic Risk Measures

Acharya et al. (2010) categorise the recent approaches of measuring systemic risk, mostly related to the financial crisis of 2007-2009, into two categories, one based on a structural approach using contingent claims analysis of the financial institution's assets and the other on a reduced form approach focusing on the tail behaviour of financial institutions' asset returns. These two approaches treat systemic risk in a portfolio context in which the portfolio is the financial sector, and individual assets are the financial institutions. The key variable in these two approaches is the comovement between financial firms when the system as a whole is distressed.

Bisias et al (2012) categorise systemic risk measures into Microprudential Measures-Securities and Commodities, Microprudential Measures-Banking and Housing, Microprudential Measures-Insurance and Pensions, Microprudential Measures-General Applications, Macroprudential Measures and Macroprudential Regulation based on whether the measure is micro or macro-prudential in nature. The authors further classify systemic risk measures according to the by event/decision time horizon of the risk. This could be Ex Ante Measures-Early Warning, Ex Ante Measures-Counterfactual Simulation and Stress Tests, Contemporaneous Measures-Fragility, Contemporaneous Measures-Crisis Monitoring, Ex Post Measures-Forensic Analysis and Ex Post Measures-Orderly

[1] The objective of macroprudential policy is to limit system-wide financial risk

Resolution. In addition, Bisias et al (2012) categorise systemic risk measures by research method as follows: Probability Distribution Measures, Contingent-Claims and Default Measures, Illiquidity Measures, Network Analysis Measures and Macroeconomic Measures.

In this paper, we consider the categorisation of systemic risk measures based on Benoit et al (2012). The authors categorisation divide the measures into supervisory approach that relies on data supplied to regulators by the bank or firm (BCBS 2011 & 2012) and approach that relies on market data such as stock returns and option prices (Acharya et al. (2010) and Huang et al (2009)).

Properties associated with systemic risk

General properties that are usually associated with systemic risk include:

- Negative externalities. Financial economists have long believed that the failure of certain large, interconnected financial institutions could have spillover effects on the financial system as a whole. Since the costs of failure do not fall exclusively on the failing institution, there is an incentive for firms to take excessive risk and to invest less in risk management than is socially optimal.
- Breakdown of key parts of the financial system (e.g., the collapse of the asset-backed commercial paper market in 2008–2009).
- Large multiplier on shocks. In the 2008 crisis $2 trillion subprime loss generated a $20 trillion hit to the household balance sheet.
- Shared belief in an erroneous risk measurement, and herd behavior following such beliefs (e.g., housing prices will only go up).
- Asset price bubbles. Such bubbles are not well defined and extremely hard to detect inreal time. Important facets to consider include:

Why should policy makers and regulators be interested in systemic risk?

In the wake of the global financial crisis, there has been increased focus on systemic risk as a key aspect of macroprudential policy and surveillance with a view towards enhancing the resilience of the financial sector.

Alexander (2010) provide four distinct policy applications of systemic risk measures:

(a) by identifying individual institutions (SIFIs or systemically important banks (SIBs) posing big threats to financial stability, measures and targets can help in targeting increased supervisory standards;

(b) by identifying specific structural aspects of the financial system that are particularly vulnerable, measures and targets can help policymakers identify where regulations need to be changed;

(c) by identifying potential shocks to the financial system posing big threats to stability metrics may help guide policy to address those threats; and

(d) by indicating that the potential for financial instability is rising (i.e., providing early warning signals),metrics can signal to policymakers a need to tighten so-called macroprudential policies

3.0 Methods used to identify SIFIs

BIS Indicator-based measurement approach

Systemic risk is a risk of disruption to financial services that is caused by an impairment of all or parts of the financial system, and has the potential to have serious negative consequences for the real economy. Fundamental to the definition is the notion of negative externalities from a disruption or failure in a financial institution, market or instrument. All types of financial intermediaries, markets and infrastructure can potentially be systemically important to some degree.

Three key criteria that are helpful in identifying the systemic importance of markets and institutions are:

- Size

The volume of financial services provided by the individual component (banks in this case) of the financial system.

- substitutability

  The extent to which other banks can provide the same services in the event of a failure. The systemic impact of a bank's distress or failure is expected to be negatively related to its degree of substitutability as both a market participant and client service provider.

- interconnectedness

  Its linkages with other components of the system. Financial distress at one institution can materially raise the likelihood of distress at other institutions given the network of contractual obligations in which these firms operate. A bank's systemic impact is likely to be positively related to its interconnectedness with other financial institutions.

- Complexity

  The systemic impact of a bank's distress or failure is expected to be positively related to its overall complexity – that is, its business, structural and operational complexity. The more complex a bank is, the greater are the costs and time needed to resolve the bank.

BETA

The beta (β) of a stock or portfolio is a number describing the correlated volatility of an asset in relation to the volatility of the benchmark that the asset is being compared to. This benchmark is generally the overall financial market and is often estimated via the use of representative indices. Beta measures systematic risk based on how returns co-move with the overall market.

A high beta implies a stock price grows dramatically when the market is up, and falls dramatically when the market goes down. Small values of beta mean the stock's return is relatively unaffected by the swings in the overall market's return.

- A beta of 1.0 implies that the security's returns have the same volatility as the market's returns and their correlation is +1.0, or that the relative volatility is 2.0 and the correlation is +0.5, or that the relative volatility is 5.0 and the correlation is +0.2. It is certain that the volatility of the security's returns is at least as great asthe volatility of the market's returns, and that the correlation of returns between the security and the market is positive.
- A beta higher than 1.0 means that the security's returns have been more volatile than the market's returns, and that the correlation of returns is positive. The value of beta gives a lower limit to the relative volatility of the security's returns compared to the market's returns.
- A beta lower than 1.0 implies that the security's returns are less volatile than the market's returns, or that the security's returns and the market's returns have a low correlation.
- A beta of 0 means that the correlation of returns of the security and the market is 0.0; i.e., they tend to move independently.
- A negative beta means that the security's returns tend to move opposite the market's returns; i.e., their correlation of returns is negative.

Marginal Expected Shortfall

A firm's marginal expected shortfall (MES) is defined as the average return of its equity during the 5% worst days for the overall market return. Marginal expected shortfall (MES) and leverage metrics are used as early warning indicators of Systemic Expected Shortfall (SES).MES corresponds to the partial derivatives of the system Expected Shortfall (ES) with respect to the weight of firm *i* in the economy.

$$MES_{it}(C) = E_{t-1}(r_{it} | r_{mt} < C)$$

Where *i* is any firm, *t* is the period of time and *C* is any given threshold.

Similarly, the long-run marginal expected shortfall (LRMES) is given as

$$LR \approx 1\text{-}\exp(18 \text{ X } MES)$$

Systemic Expected Shortfall and Systemic Risk (SRISK)

Acharya et al (2010) measure systemic risk as the amount by which a bank is undercapitalized in a systemic event in which the entire financial system is undercapitalized, and they call this concept the systemic expected shortfall (SES). This concept is appealing as it uses market data that are readily available to regulators and market participants.

The Systemic Risk Analysis applied in this paper is based on the SES framework of Acharya et al (2010). A financial firm will be unable to function when the value of its equity falls to a sufficiently small fraction of its outstanding liabilities. In good times, such a firm will likely be acquired, may be able to raise new capital or may face an orderly bankruptcy. If this capital shortage occurs at a time when the financial sector is already financially constrained, then the government faces the question of whether to rescue the firm with taxpayer money as other avenues are no longer available. Consequently a firm is systemically risky if it is likely to face a capital shortage just when the financial sector itself is weak.

This calculation takes three steps. First we estimate the daily drop in equity value of a firm that would be expected if the aggregate market falls more than 5%. This is called Marginal Expected Shortfall or MES. The measure incorporates the volatility of the firm and its correlation with the market, as well as its performance in extremes. In a second step this is extrapolated to a financial crisis which involves a much greater fall over a much greater time period. Finally, equity losses expected in a crisis are combined with current market value of equity and book value of debt to determine how much capital would be needed in a crisis in order to maintain an 8% capital ratio to asset value.

The Systemic Risk Contribution, SRISK%, is the percentage of financial sector capital shortfall that would be experienced by this firm in the event of a crisis.

Firms with a high percentage of capital shortfall in a crisis are not only the biggest losers in a crisis but also are the firms that create or extend the crisis. This SRISK% is the Systemic Risk Ranking of the Nigerian Banking sector.

$$\text{SRISK} = k\,[D + (1- \text{LRMES})\,E\}- (1- \text{LRMES})\,E,$$

Where k is a prudential standard ratio of equity to assets = 8%, D is the quarterly book value of total liabilities and E is the daily market capitalisation or market value of equity

4.0 The Data and Descriptive Statistics

The sample used in this paper can be grouped into two categories. The first sample comprises eleven (11) banks that are listed on the Nigerian Stock Exchange (NSE). The total assets of these banks as at September 2013, represents over 90% of Nigeria's total banking assets. Daily closing equity prices and market capitalization of these banks are recorded on a daily basis from 8th August 2008 to 23rd October 2013, obtained from Reuters. Quarterly book values of liabilities are obtained from on monthly and quarterly basis from eFASS (the regulatory database) starting2009.

Statistics on market capitalization is reported in Table 1 for the banks that trade on NSE.

The second group of data is obtained from regulatory agencies stored in the eFASS database system. The Basel indicator-based measurement approach considers the following factors in the classification of SIFIs: Size, Interconnectedness, Substitutability and Complexity. We obtained Total Assets, Net-Interbank Transactions, Total Credits and Total Deposits, branch network and number of foreign subsidiaries from eFASS in order to determine the Nigerian SIBs.

4.1 Empirical Analysis

In this section, we implement the MES, SRISK, beta (Market data-based models) and Indicator-based approaches (based on regulatory data) and compare the identified banks based on these approaches. Specifically, we rank firms/banks based on their contribution to system risk and then calculate the systemic risk surcharges that banks should pay in the event of financial crisis.

The main goal of systemic risk surcharges are to incentivize firms to limit systemic risk taking or to be well capitalized against systemic risk in order to reduce the cost of these surcharges. In the following section, we implement several approaches to rank SIFIs and then calculate systemic risk surcharges.

For the market data-based models, we estimate MES at the standard risk level of 5% using daily data of equity returns from Reuters DataStream (as suggested by Acharya et al 2010). We then estimated SRISK. In implementing the Basel recommended Indicator-based approach, we used the guidelines and weights of the NDIC/CBN SIFI framework. We considered total assets as principal determinant in the assessment of size, the determinant of interconnectedness is net-interbank transactions and total credits and total deposits of a bank are the determinants of its substitutability. Finally, to represent complexity factor, we considered the branch network and number of foreign subsidiaries of a bank.

The main objective of any systemic risk analysis is to rank firms according to their systemic risk contribution and, in turn, identify the SIFIs. The key question is then to determine whether the different systemic risk measures lead to the same conclusion. A natural way to answer this question is to analyse the SIFIs. The goal is then to identify the top tier banks in terms of contribution to the risk of the overall banking system so as to subject them to additional capital requirements and/or liquidity buffers.

Table 2 ranks the 15 Nigerian banks categorised as SIBs and contributing the greatest fraction to expected aggregate capital shortfall of the largest Nigerian

banks from December 2012 to September 2013. In the CBN and NDIC SIB Framework, size and substitutability factors were assigned weight of 30% each, while complexity and interconnectedness were weighted 25% and 15%, respectively. The determinants within complexity were assigned 12.5% each whereas determinants under substitutability were each assigned 15% weight. Table 1 shows the yearly market capitalization average of all NSE-listed banks. While the Table mimics the ranking obtained using SRISK, there are however a few differences. All banks categorized as SIBs (Bank 3, Bank 2, Bank 1, Bank 4, Bank 5 and Bank 6) appear in Table based on having the largest market capitalization, Bank 12, Bank 11 and Bank 14 are also listed as more systemically important than Bank 7 and Bank 13. Rankings of SIBs based on market capitalization therefore closely follows the SRISK approach than the Basic Indicator approach. This is because SRISK is related to market capitalization because it measuresthefractionofthecapitalrequirementthatisnotcoveredbythecurrentmarketcapitalization

We also observe that the most improved bank in terms of increasing its share of market capitalization from 2011 to 2013 is Bank 11 (appreciated by more than 150% since 2011), followed by Bank 3 (100% increase in market capitalization), and Bank 8 (64%), Bank 5 (59%), Bank 2 (53%) and Bank 6 (52%). Similarly, the bank with decreased market capitalization since 2011 average value is Bank 15 (lost 33%), followed by Bank 7 (25%) and bank 12 (11%) decrease in market capitalization.

Analyzing Banks categorized as SIB

The SRISK approach of Acharya et al (2010) rated Bank3 as highest (1) in contribution to systemic risk for the month of December 2012 with 30% of the whole banking sector risk. Bank 2, Bank 1 and Bank 5 are then rated 2nd(with 29%) , 3rd (16%) and 4th (with 8%) by this approach. Bank 6 and bank 11 are the 5th (with 5%) and 6th (with 3%) in terms of highest contribution to system. However, the BIS Indicator approach as implemented by NDIC/CBN ranked Bank 3 as 4thhighest contributor to systemic risk with 7.7% of the whole

systemic risk weight, Bank 2 as 3rd with 10%, Bank 1 as 1st with 12.64% and Bank 5 as 5th with 7.54%. Full details of systemic risk ranking and contribution of the Nigerian banks for month of December 2012 and January 2013 is shown in Table 2a.

It should be noted that ES, MES, and VaR are typically negative whereas SES and SRISK are typically positive. A financial institution is more systemically risky that another if it has a higher MES, SES or SRISK. In addition, banks with positive SRISK value have to their market capitalisation or equity capital.
Bank 4is 2ndwith 11.7% under the BIS indicator approach but is 8th under the SRISK method. The two methods rank the banks differently and assign different weight to the identified SIB. The higher the ranking of bank in terms of systemic risk in the financial system implies that the bank would be required to pay the greater fraction of systemic risk surcharges.

For the month of Janaury 2013 as shown in Table 2a right pane, Bank 2 contributes the most to systemic risk using SRISK approach with 21% weight while the same bank as 3rd with 11% weight under the BIS Indicator approach. First Bank as 1st with 12.64% based on BIS Indicator approach but ranked 2nd under SRISK approach with 19% weight of the whole systemic risk.

We therefore see that banks identified as systemically important change in terms of weight or degree of importance from one month to the next and also different methods rank the systemic importance of the banks differently.

It should be noted that Bank 1, Bank 3, Bank 4, Bank 2, Bank 6 and Bank 5 have featured as SIBs under the two approaches within the first 8 highest ranked banks, each month from December 2012 to September 2013 using both SRISK and BIS Indicator approaches. This there shows that these 6 banks should be designated as SIBs without any other due consideration. However, Bank 11 has also featured within the first 8 highest banks, at different months, inconsistently, under either SRISK or BIS Indicator approaches, but not together

at the same time. Bank 12 also consistently features as SIB under SRISK approach but hovers around 9-12th position under BIS Indicator approach. Bank 7 and Bank 13 on the other hand, are categorised as SIB under BIS Indicator approach but are rated around 9-13 SIBs under SRISK approach. Bank 14 and Bank 15 are rated with 10-12 range under the two approaches.

Therefore, Bank 14, Bank 15, Bank 12 and Bank 11 should be on SIB watch list because the failure of any one of them could also have ramifications beyond other non-SIBs and they can also easily fall into the category of SIBs.

Table 3 shows the ranking of the Nigerian banks based on their beta and market capitalization for December 2012 to September 2013. The ranking shows that different methods rank the systemic importance of the banks differently but ranking based on market capitalization closely mirrors that based on systemic risk. According to SRISK, a firm has higher systemic risk ranking if the correlation of the riskier firm with the system is higher than the correlation of the less risky institution (beta) and if the riskier firm has the lower market capitalization.

Analyzing Capital Requirements for Banks categorized as SIB

Under SRISK approach, most of expected aggregate capital shortfall is captured by just three banks (Bank 1, Bank 2 and Bank 3) accounting for a minimum of 65% of the whole systemic risk in the industry. The same banks account for less than 40%, but greater than 30%, of the total industry systemic risk under the BIS Indicator approach. These results suggest therefore that based on the period under review, a relatively small fraction of firms are responsible for most systemic surcharges and should be subjected to higher capital and regulatory requirements.

Analysis of Systemic Risk against GDP

The nominal GDP for the fourth quarter of 2012 was estimated at 10,593,714,64 million naira as against the 9,554,854.69 million naira during

the corresponding quarter of 2011. The nominal GDP for the first quarter of 2013 was estimated at 9,493,779.44 million naira as against the 9,142,858.51 million naira during the corresponding quarter of 2012.

Acharya et al (2011b) report some bailout costs and real economy welfare losses associated with banking crises, as estimated by several researchers, generally lies somewhere between 3.2-50% of GDP. The bailout of the thrift industry cost $180 billion (3.2% of GDP) in the US in the late 1980s, 16.8% for Spain, 6.4% for Sweden, 8% for Finland, while others set the cost at 15-50% of GDP.

In 2009, special joint committee of CBN and NDIC conducted a special examination of all the 24 universal banks in Nigeria. The results of the examination of 10 banks revealed that five banks were insolvent. Consequently, the CBN as the lender of last resort had to inject N420 billion into these banks in the form of a subordinated loan. Furthermore, the examination result of the remaining 14 universal banks led to the dismissal of the CEOs of three additional insolvent banks by the regulators and injection of an additional N200 billion into the affected banks. The total bailout costs is about 6% of the nation's GDP, which is in line with several jurisdictions.

Applying the contribution of each bank to systemic crisis, using 1st Quarter GDP of 2013 (N9.1 trillion) and applying bail-out cost of N620 billion representing 6.81% of GDP, will give the systemic surcharge of each bank as tabulated in Table i5.

The firm's contribution to expected losses in the crisis (i.e., the contribution ofeach firm to aggregate losses above a certain threshold) multiplied by the expected systemic costs when the financial sector becomes undercapitalized.

	SRISK Approach		BIS Approach	
	Systemic risk Contribution (%)	Bailout cost Contribution (N)	Systemic risk Contribution (%)	Bailout cost Contribution (N)
Bank 3	26.0%	161,217,272,599	8.2%	51,096,116,818
Bank 2	23.9%	148,189,773,555	8.9%	55,145,585,999
Bank 1	20.3%	125,900,201,331	13.4%	83,245,995,192
Bank 5	6.4%	39,652,015,910	7.1%	44,181,027,435
Bank 4	5.7%	35,302,200,628	14.0%	86,592,368,410
Bank 11	5.2%	32,399,981,793	3.4%	21,140,671,282
Bank 12	5.1%	31,907,948,335	3.2%	19,703,003,308
Bank 6	4.3%	26,912,593,152	6.7%	41,259,722,912
Bank 13	0.7%	4,617,871,827	4.9%	30,273,049,144
Bank 7	0.5%	3,264,490,545	4.4%	27,177,491,797
Bank 10	0.4%	2,687,801,531	2.0%	12,338,000,000
Bank 9	0.4%	2,527,487,587	1.9%	11,842,000,000
Bank 15	0.4%	2,470,560,055	6.7%	41,365,335,533
Bank 8	0.3%	2,159,605,772	2.4%	14,571,865,584
Bank 14	0.1%	790,195,381	3.7%	22,738,222,010

Table i5: Systemic surcharge to bail-out systemic risk

Table i5 quantifies the relative importance of a bank's contribution to overall systemic risk and thus the percentage of total systemic surchargesit must pay. The surcharge component capturesmany of the characteristics considered

important for systemic risk such as size, interconnectedness and concentration all of which serve to increase the expected capital shortfall in a crisis.

5.0 Tools to manage systemic risk and SIBs in Nigeria

Macro prudential policy is concerned with re-orienting prudential regulation towards risk across the system as a whole system (the so-called systemic risk) and not just individual banks (BoE, 2009).

According to Bank of England (BoE, 2009), systemic risk has two principal sources. First, is the overexposure of financial firms, companies and households, to risk in the upswing of a credit cycle, and to become overly risk-averse in a downswing. Second, individual banks typically fail to take account of the spillover effects of their actions on risk in the rest of the financial network. Macroprudential policy is expected to address both sources of systemic risk.

Systemic risk increases the probability of default (PD) across the financial system and equally increases the loss given default (LGD) of the financial system (that is, the resulting increase in distress felt across the financial system when one bank fails).

Tools advocated by Bank of England (BoE, 2009) to manage systemic risk include the application of a top-up or 'surcharge' over and above microprudential capital requirements (including forward-looking dynamic provisions against expected losses (Systemic capital surcharges) and other complementary measures. These measures are to supplement macroprudential capital requirements with other prudential instruments which could help to achieve macroprudential objectives. An example of complementary measure is time-varying margins or haircuts on certain secured financial transactions between banks and non-banks.

According to IADI (2012), the necessary tools to prevent a systemic crisis by deposit insurers include the information-sharing framework with other FSN players, appropriate level of coverage, public awareness, early detection of risk and timely intervention. Public awareness is essential in preventing bank runs

in crisis times by enhancing public confidence in the deposit insurance system. Equally important is early detection of risk and timely intervention when a bank (s) is deemed to be in a problem.

The CBN created the Financial Policy and Regulation (FPRD) with the key responsibility of macroprudential regulation and supervision in Nigeria. The NDIC carries out several public key awareness campaigns, improved its payout process, extended scope and level of coverage and has strengthened its early warning signals to identify weak banks early and intervene appropriately. Both CBN and NDIC carry out routine stresstesting of the economy to identify systemic vulnerabilities and act accordingly.

Blancher et al (2013) offer a practical guidance on the use of current systemic risk monitoring tools at IMF based on six key questions policymakers are likely to ask.
Finally, all banks identified as systemically important have to be subjected to higher capital and other regulatory requirements than those that are non-SIBs. This is due to the burden they can place on the financial system and the economy when they fail. The CBN/NDIC SIB Framework has recommended higher capital requirement SIBs.

Systemic Risk Regulatory Framework for Financial Stability

No FSN player, whether central bank or deposit insurer, are meant to deal by themselves with systemically significant bank failures or a systemic crisis. In this case, there is a need for a Framework that deals with systemic crisis. Recent crisis shows that to successfully prevent and handle a financial crisis, there must be a framework that clearly defines each FSN player's roles and responsibilities and ensures close coordination among them (IADI, 2010). This is because there is little time to design and build such a framework for systemic risk management during crisis. Therefore, it is desirable that such a

framework for crisis prevention, management and resolution be formally specified through regulation in advance.

A robust Systemic Risk Regulatory Framework for Financial Stability should be built on three pillars: prevention, management and resolution (IADI, 2010). Prevention is concerned with the establishment of effective regulation and supervision that monitors and acts on economy-wide systemic risk; a sound macroeconomic management framework (for monetary, fiscal, and exchange rate policies that can counteract the buildup of systemic vulnerabilities such as asset price bubbles; and creation of a strong international financial architecture thatcan send pointed early warnings and induce effective international policy coordination to reduce systemic risk internationally.

Prevention of systemic risks can be significantly achieved by strengthening of micro-prudential regulation and supervision, establishing a robust framework for coordination of roles and responsibilities among FSN players including the lender of last resort function of the central bank, deposit insurance and resolution of failed financial institutions as well as macro-prudential supervisory functions.

Accoding to IADI (2010), Management of systemic risk deals with provision of timely and adequate liquidity; rigorous examination of financial institutions' balance sheets, including through stress tests; support of viable but ailing financial institutions through guarantees, nonperforming loan removal, and recapitalization; and adoption of appropriate macroeconomic policies to mitigate the adverse feedback loop between the financial sector and the real economy, reflecting the specific conditions and reality of the economy.

The Resolution pillar is concerned with use of mechanisms for restructuring financial institutions' impaired assets and, hence, corporate and household debt; use of well-functioning domestic insolvency procedures for nonviable financial institutions; and use of international mechanisms for resolving

nonviable internationally active financial institutions, including clear burden sharing mechanisms.

Systemic Crisis: Funding the Resolution

All over the world, including Nigeria, financial institutions have benefitted from government support during the financial crisis. However, the financial sector needs to provide a fair contribution to the resolution of the recent systemic crisis. Therefore, the new international best practiceof funding systemic crisis is that the costs of recovery should be first borne by the responsible parties, i.e., shareholders, creditors and depositors of failed financial institutions. Government injection of funds raised with taxpayers' money to stabilize the financial System should be the last resort.

Payment of funds for resolving systemic crisis can be ex ante or ex post fund (including the deposit insurance fund). The recent financial crisis has led to the formation of ex-ante and ex-post fund for systemic crisis management under various names such as the resolution fund and bank levy (IADI, 2010). In Nigeria, the financial stability fund is established for the systemic risk management as an ex-ante fund in line with global best practice.

Germany, Hungary, Sweden, United Kingdom, and the United States have taken a number of different policy approaches to fill the funding gap with regard to systemic crisis resolution (Schich and Kim, 2010). These countries include both ex post levies charged to make financial sectors contribute more fully than they did up to now to the costs of the financial crisis resolution and ex ante premiums to finance systemic crisis resolution in the future.

Specifically, ex-ante funding for future crisis is in place in the case of Sweden called the Stability Fund, Germany referred to as Restructuring Fund, EC known as Bank Resolution Fund and that of IMF is Financial Stability Contribution.

Some other jurisdictions practice ex-post revenue generation for general budget as follows; in United States this fund is called Financial Crisis Responsibility Fee while Austria, France, Hungary and United Kingdom call the fund Bank Levy.

Other ex-ante funds like the United Kingdom's Bank Payroll Tax is also available. Refer to Scich and Kim (2010) for more details.

Deposit insurance schemes are established to share burden in caseof failure by individual deposit-taking institutions. Deposit insurers and other FSN players are not expected to single-handedly deal with a systemic crisis (IADI, 2010), even though deposit insurers are mandated with resolutions of failed banks. Due to the recent crisis, deposit insurers are also equipped with more powers to deal with the resolution of SIBs in crisis situations.

5 Findings, Recommendations and Conclusion

We have identified SIFIs or SIBs and measured their contribution to systemic shortfall based on approaches advocated by BIS (the Indicator-based approach) and by academics using the systemic expected shortfall (SES) or SRISK. We have also provided a comprehensive comparison of the above systemic risk measures by considering the Nigerian Deposit Money Banks (DMBs) over the period 2009-2013.

The identification of systemic risk and SIBs is an integral element in the design and implementation of macroprudential supervision with a view towards enhancing the resilience of the financial sector. However, assessing the magnitude of systemic risk is complex due to several reasons that include lack of universally accepted definition and different approaches that give different ranking of SIFIs.

An advantage of the SRISK market data-based approach over the BIS Indicator approach is that market data is available at a daily frequency and therefore can capture the changing condition of banks at a daily frequency. The BIS Indicator approach can at most be updated at a monthly frequency and can only capture conditions of banks with a month's lag. Financial firms' risks, especially banks'can change very quickly. This implies that the BIS indicator approach

needs to be augmented with a model that usesmore up-to-date information like the SRISK approach.

Applying SRISK market data-based and BIS Indicator approaches to the Nigerian DMBs unambiguously establishes the six banks as systemically important: Bank 1, Bank 2, Bank 3, Bank 4, Bank 5 and Bank 6.

As it is already established, size is not the only criterion to determine systemic importance. We observe that banks identified as systemically important change in terms of weight or degree of importance from one month to the next and also different methods rank the systemic importance of the banks differently.

Basel capital requirements and other recent financial regulations seek to limit each institution's risk appetite. The market-based models show how the external costs of systemic risk are internalized by each bank so each individual firm may take actions to prevent its own collapse and by so doing reduce its negative externality on the system. That is why systemic risk is viewed as a negative externality imposed by each financial firm on the system.

A major advantage of the market-based approach and its feature of calculating systemic risk surcharge is that it makes it possible to understand systemic risk in terms of an individual bank and the broader context of banking subsectors. This implies that it is possible to compute the systemic risk surcharges a regional bankingsector against another region.

The recent financial crisis has shown that no single FSN participant can resolve systemic crisis alone. All the members should participate and collaborate to manage systemic risk. The near-financial crisis of 2009 that involved the collaboration of CBN and NDIC in special examination of all the universal banks, establishment of bridge-banks by NDIC and capital injection of N620 billion involved the coorperation of most FSN players in the country.

Finally, all banks identified as systemically important have to be subjected to higher capital and other regulatory requirements than those that are non-SIBs. This is due to the burden they can place on the financial system and the economy when they fail. The CBN/NDIC SIB Framework has recommended higher capital requirement SIBs.

The necessary tools to prevent a systemic crisis by deposit insurers include the information-sharing framework with other FSN players, appropriate level of coverage, public awareness, early detection of risk and timely intervention. Public awareness is essential in preventing bank runs in crisis times by enhancing public confidence in the deposit insurance system. Equally important is early detection of risk and timely intervention when a bank (s) is deemed to be in a problem. The CBN created the Financial Policy and Regulation (FPRD) with the key responsibility of macroprudential regulation and supervision in Nigeria. The NDIC carries out several public key awareness campaigns, improved its payout process, extended scope and level of coverage and has strengthened its early warning signals to identify weak banks early and intervene appropriately. Both CBN and NDIC carry out routine stress testing of the economy to identify systemic vulnerabilities and act accordingly.

Finally, all banks identified as systemically important have to be subjected to higher capital and other regulatory requirements than those that are non-SIBs. This is due to the burden they can place on the financial system and the economy when they fail. The CBN/NDIC SIB Framework has recommended higher capital requirement SIBs.

Recommendations

- The Corporation should assess its status in terms of systemic risk management as well as examine the legal framework for the resolution of this risk. International Association of Deposit Insurers (IADI, 2012) stated that a coordinated financial safety net (FSN) and legal framework are essential for promoting financial stability. The Association also stated that governments,

central banks or deposit insurers are the leading agencies in systemic crisis management.

- The Corporation, in collaboration with CBN and other FSN players, should establish a legal framework for systemic risk management. Effective systemic risk management requires that a crisis response mechanism should be specified in advance, and a speedy resolution of failed financial institutions should be carried out under the mechanism.

- The Corporation shares failure resolution responsibility with CBN. While, resolution of SIB can be quite tedious and demanding, international best practice requires the SIBs to submit resolution plans to resolution authorities at a predefined frequency, usually yearly. The NDIC/CBN SIB Framework requires all Nigerian banks designated as SIBs to develop and submit resolution and winding-down plan ("Living Will") annually to CBN. The Corporation should also be a recipient of the SIBs' annual Living Wills given its responsibility in failure resolution. Guidance should be issued to the identified SIBs on how to submit their respective plans including their strategy for rapid and orderly resolution in the event of failure of the bank.

- The Corporation should equally examine and if necessary strengthen its resolution processes for large complex financial institutions or SIBs. The Corporation should develop a resolution mechanism to safely wind down failing, systemically important banks in line with recent global financial reforms.
- Payment of funds for resolving systemic crisis can be ex ante or ex post fund. The recent financial crisis has led to the formation of ex-ante and ex-post fund for systemic crisis management under various names such as the resolution fund and bank levy. In Nigeria, the financial stability fund is established for the systemic risk management as an ex-ante fund in line with global best practice. However, the contribution of each bank to the financial stability fund should be based on individual bank's systemic risk capital surcharge. Systemic risk surcharge of each bank should be used in computing the bank's contribution to bail-out cost in crisis situations.

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