Monetary Policy and Financial Stability in the Nigerian Banking Industry

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Abstract

This study examined the impact of monetary policy on financial stability in the Nigerian banking industry for the period 2008Q1 to 2016Q2, using an error correction model. Banking industry financial stability index (BIFSI) was computed within the study and was used as a measure of financial stability in the Nigerian banking industry. The study discovered that the impact of monetary policy on financial stability in the Nigerian banking industry was weak. It also revealed a significant long run equilibrium relationship between monetary policy and financial stability in the Nigerian banking industry with a speed of adjustment to long run equilibrium of 66.54%. It was concluded that open market operation and exchange rate channels are more effective channels of transmitting monetary policy to financial stability in the banking industry, than interest rate channel.

Keywords: financial stability, monetary policy, Z-Score, financial soundness indicators, monetary policy rate, deposit money banks, global financial crisis

1. Introduction

Regular financial stability assessment and the detection of early warning signals to impending risks to the banking industry are major tasks of central banks and other supervisory authorities. Therefore using monetary policy, the central bank aims at preventing costly banking industry crises and financial instability. Financial stability is generally defined as the ability of the financial system to withstand shocks, as well as imbalances, and still continue to adequately provide financial intermediation. The banking industry is a subset of the financial system hence, its ability to withstand both internal and external shocks has been a major concern to economists and regulators. The global experience however, shows that sometimes the banking industry was not able withstand shocks and financial imbalances. Such situations are referred to as financial instability.

Financial instability in the banking industry was manifest during the Great Depression of 1929 to 1933. Similarly, the recent global financial crisis which began in 2007 and became exacerbated in 2008 with the collapse of a US investment bank (Lehman Brothers) paralyzed the global financial system. Several bail-out packages by the government of some countries were needed to resuscitate the global economy. For instance, in the United States of America, $115 billion dollars was disbursed to eight banks as bailout funds in 2008 (Congressional Budget Office, 2009). France and United Kingdom also announced bailout plans of $500 billion and $850 billion respectively in 2008 (Congressional Research Service, 2010), and the Central Bank of Nigeria (CBN) bailed out eight distressed banks in the country to the tune of ₦620 billion in 2009 (CBN, 2009; Sanusi, 2010). Many economists however, believe that banking industry instability is part and parcel of business cycle which occurs due to unrealistic responses and biased expectations by market participants (Allen, Babus, & Carletti, 2009).

In Nigeria, different monetary policy approaches have been adopted during the various financial development eras of the banking industry in a bid to ensure financial stability. However, various cases of financial instability were witnessed in the industry within the different eras classified as the pre Structural Adjustment Programme (SAP)-1970 to 1985, the SAP (1986 to 1999) and the Millennium (2000 to 2016) eras.

The pre-SAP era (1970 to 1985) marked the period before the introduction of SAP in 1986. During this period, the direct monetary policy approach was in use. This approach made use of sectoral allocation and credit ceiling tools in monetary policy management. This was a period of intensive banking regulation following the establishment of the CBN in 1958. Hence, with severe regulation of interest rates and exchange rates, the banking industry witnessed relative financial stability. This manifested in lack of major banking industry crises during this period, as the CBN effective controlled the banking industry.

During the SAP era which spanned through 1986 to 1999, the indirect monetary transmission system was adopted. This made use of open market operation, reserve requirement and moral suasion to manipulate monetary variables so as to achieve desired policy objectives. However, monetary policy direction and the institutional framework provided by the CBN to control the banking environment could not resolve the problem of financial instability in the banking industry. Inadequate capital base, bad loans, liquidity and poor management problems persisted in the industry which made many banks unable to withstand shocks during this period. Consequently, 5 banks were liquidated in 1994, 17 were distressed in 1995 and were taken over by the CBN and 1 was liquidated in 1996. Furthermore, the amendment of the Bank and Other Financial Institutions Act (BOFIA) in 1991 led to the revocation of licenses of 27 banks in 1998 (Uzoaga 1981, Elegbe 2013).

The millennium era was the period from 2000 to 2016. In this era, the indirect monetary policy method continued to be in use. However, financial instability appears to be greatest in this era. For instance, the bank consolidation exercise of 2005 resulted in the total number of deposit money banks (DMBs) being reduced from 89 in 2005 to 24 in 2008 (CBN, 2009). However, the continued instability in the banking industry in 2009 necessitated the CBN to conduct a special audit of all the 24 banks to ascertain the state of their financial health. The result of the audit showed that many of the banks had serious liquidity and capital adequacy problems (CBN, 2009). This led to the injection of ₦620 billion bail-out funds into eight banks in 2009. The banks were: Afribank Plc, Finbank Plc, Oceanic Bank Plc, Union Bank Plc, Intercontinental Bank Plc, Platinum Habib Bank Plc (Bank PHB), Equatorial Trust Bank Ltd and Spring Bank Plc. The board of directors of these eight banks were changed while three of them (Afribank Plc, Bank PHB and Spring Bank) were nationalized and later sold off by the CBN (Proshare, 2009; CBN, 2009; Chiejine, 2010). Subsequent mergers/acquisitions reduced the number of banks to 19 in 2015 (CBN, 2015). The CBN has also adopted several other supervisory measures termed macro-prudential policies in addition to monetary policy so as to effectively control the banking industry. However, these measures by the CBN did not solve the problem of financial instability as many banks continued to suffer capital inadequacy and assets quality problems (CBN, 2015).

From the establishment of the CBN in 1958, the apex bank has adopted several measures within the ambit of monetary policy to encourage financial stability in the banking industry. Other supervisory measures such as the establishment of the prudential guidelines for banks following the enactment of BOFIA in 1991 were also adopted. These measures intended to address the issues of incessant bank distress, bank failures and financial instability in the industry in general. However, despite the actions of the CBN, financial instability still persists in the banking industry in Nigeria. The industry still lacks the ability to withstand shocks (both internal and external) as could be seen from the rate of bank failures, capital inadequacy and liquidity problems it grapples with. For instance, financial instability in the banking industry led to the collapse of many banks evidenced by the decrease in the number of DMBs from 89 in 2005 to 20 in 2012 (IMF, 2013). The number of DMBs was further reduced to 19, with the acquisition of Enterprise bank by Heritage bank in 2015 (CBN, 2015).

The underperformance of the banking industry could be attributed to weak monetary policy measures and lack of strong supervisory disposition of the CBN. For instance, the monetary policy rate (MPR) which is the benchmark interest rate has remained double digit between 2011Q4 and 2016Q2. The MPR which was 9.5% in 2008Q1 increased steadily up to 13% in 2015Q3. It declined marginally to 11% in 2015Q4 but still increased to 12% in 2016 (CBN, 2016). This appeared to have contributed to the high lending rate experienced in the banking industry, with the concomitant adverse effects on banks income and profitability. This discourages borrowing and increases loan default rate. Lack of adequate income and the erosion of banks' capital base due to increased bad loans, weakened the ability of banks to withstand shocks and provide financial intermediation.

Furthermore, the less effective open market operation (OMO) activity of the CBN which reflected in the highly oscillatory nature of the treasury bill rate over the years might have contributed to weaken financial stability in the banking industry. For instance, the TBR which was 8.5% in 2008Q1 fell to 3.32% in 2009Q2 but rose steadily to 8.49% in 2011Q3. It jumped sharply to 14.23% in 2011Q4 and remained at double digit up till 2014Q1 when it was 11.92% (CBN, 2016). This erratic movement in the TBR makes it difficult for the CBN to control liquidity as the rates are most times not impressive to money market participants. Hence in periods of economic boom, the excess liquidity resulting from the inability of the CBN to effectively mop-up liquidity tends to produce financial imbalances which ultimately results in financial instability in the banking industry.

The exchange rate policy appears not to have yielded the required results due to policy inefficiency. Continuous fall in the value of the local currency (the Naira), against other major currencies has been experienced over the years. For instance, the official Naira-US Dollar exchange rate which was ₦116.79 in 2008Q1 depreciated to ₦231.76 in 2016Q2, almost 100% depreciation in 8 years (CBN, 2016). This sustained depreciation of the Naira was also accompanied by erratic foreign exchange market activities which plausibly led to several bad debt portfolios in the banking industry. Hence, financial stability in the industry was negatively affected.

Given the foregoing, it became germane to investigate these banking instability issues in Nigeria in the face of varying monetary policy measures by the CBN. Thus, this study examined the impact of monetary policy on financial stability in the Nigerian banking industry from 2008Q1 to 2016Q2 by examining specifically, the impacts of monetary policy tools of monetary policy rate, open market operation and exchange rate respectively on financial stability in the Nigerian banking industry. Deposit money banks (DMBs) were used to represent the banking industry in Nigeria. This is because DMBs dominate the banking industry in terms of assets and deposit liabilities (CBN, 2015). Furthermore, this study focused on the industry as a whole (macro-analytical) and not on individual banks (micro-analytical). It is believed that this engendered a holistic assessment of the subject matter of the study.

The remaining part of this study is structured such that the next section examined empirical literature and theoretical framework. Section three and four are methodology and results analysis respectively. Section five is the concluding section.

2. Empirical Literature and Theoretical Framework

2.1 Empirical Literature

Many economists believe that a financially stable banking system is able to withstand systemic shocks, avoid financial crisis, ensures efficient resource allocation within the economy and maintains investors as well as public confidence in the system. It also ensures the smooth running of all the components of the system so as to positively influence economic performance. However, measurement of financial stability varies due to the complex nature of the phenomenon. These measurements aim at providing an idea on the soundness and dependability of the financial system. IMF (2006) indentified 24 financial soundness indicators (FSIs) for the assessment of soundness of banks based on a framework commonly referred to as the CAMELS - capital adequacy, asset quality, management quality, earnings and profitability, liquidity, and sensitivity to market risk. This was grouped under capital based, assets based and income/expense based indicators. Similarly, Bank Z-Score has been identified as a measure of financial stability. According to World Bank (2016), "A common measure of stability at the level of individual institutions is the z-score. It explicitly compares buffers (capitalization and returns) with risk (volatility of returns) to measure a bank's solvency risk. To measure systemic stability, a number of studies attempt to aggregate firm-level stability measures (z-score and distance to default) into a system-wide evaluation of stability by averaging or by weighting each measure by the institution's relative size". Several studies have employed Z-Score as a measure of financial stability. Such studies include: Amidu and Wolfe (2013), Fernández, A. I., Gonzalez F. and Suarez N. (2014), Mensi and Labidi (2015), and Soedarmono, W., Machrouh F. & Tarazi A. (2011).

Financial and macroeconomic conditions are closely linked. Intense financial instability in the banking industry could disrupt the monetary transmission mechanism that links monetary policy to the real economic variables. Two major beliefs concerning the association between monetary policy and financial stability exist in literature. The first belief proposes a synergy between the two. It was argued that stable prices generate an atmosphere of predictable interest rates, resulting in a lower risk of interest rate mismatch that tends to reduce the long run inflation risk premium and engender financial stability. Thus, monetary policy should be employed to foster price stability and financial stability (Schwart, 1995; Bernanke & Gertler, 1999; Herrero & Lopez, 2003). Conversely, the other belief opines the existence of a trade-off between monetary policy and financial stability (Graeve, Kick & Koetter, 2008). Some economists like Christensen and Meh (2011), Collard F., Dallas H., Diba B., Loisel O (2012), Alpanda and Zubairy (2014) and Svensson (2015) hold the view that monetary policy cannot achieve financial stability, instead emphasis should be on macro-prudential or regulatory tools to address financial imbalance in the banking industry.

Some studies have examined the nature of the association between monetary policy and financial stability as well as what causes financial instability in the banking industry. Graeve, *et al* (2008), employed the logit model and vector autoregressive (VAR) model in their study on "Monetary policy and financial (in) stability: An integrated micro–macro approach". The study focused on the banking industry in Germany and employed quarterly macroeconomic data for the period 1995 to 2004. The results showed a trade-off between monetary policy and financial stability, implying that the contraction of former raises the likelihood of bank failure. The results also showed that low capitalization increases the probability of financial instability. Therefore, the study advocates for increased supervision in addition to monetary policy among central banks and other regulatory agencies.

Granville and Mallick (2009) investigated the association between financial stability and monetary policy in the European Economic and Monetary Union for the period 1994 to 2008, using a vector autoregressive (VAR) model. The study discovered a long-run pro-cyclical correlation between monetary and financial stability. They concluded that monetary policy measure of using interest rate tool for inflation targeting engenders financial stability.

Tabak, Laiz and Cajueiro (2010) adopted the feasible generalized least squares (FGLS) estimation technique in their study on financial stability and monetary policy – The case of Brazil. The study made use of panel data covering 99 banks for the period 2003 to 2009. Bank z-score, assets quality (the ratio of non-performing loans to total gross loans) and credit risk exposure were adopted as measures of financial stability. The result shows that there exists a significant association between assets quality and monetary policy, lower monetary policy rate increases banks' risk taking while high interest rates increases bank's credit exposure which may adversely affect financial stability. Furthermore, the study revealed that banks with large amount of capital and high liquidity position are able to withstand monetary policy shocks, while banks increase their loans during periods of expansionary monetary policy.

Dhal, Kumar and Ansari (2011) in their study on financial stability, economic growth, inflation and monetary policy linkages in India: An empirical reflection, adopted the (VAR) model consisting of macroeconomic indicators and a banking industry stability index (proxied by CAMEL) indicators. The study covered the period 1995Q2 to 2012Q3. The results indicate that "financial stability and macroeconomic indicators comprising output, inflation and interest rates share a statistically significant bi-directional Granger type causal relationship. Hence, price instability could adversely affect financial stability while financial stability contributes to the effectiveness of monetary transmission mechanisms".

Ngakosso (2016) investigated the association between monetary policy and financial stability in the Economic and Monetary Community of Central Africa (CEMAC) zone countries. The Taylor increased rule estimation method was adopted for the study using annual data covering the period 1980 to 2013. The result rejects the integrated policy mix approach whereby monetary policy is used alongside macroprudential policy in a bid to ensuring financial stability. It shows however, that macroprudential policy is the most suitable policy to ensure financial stability.

Some studies have tried to elucidate on the factors responsible for financial instability and banking crises in Nigeria. The implications of this to financial intermediation were also highlighted. Adeyemi (2011) adopted survey method to study "bank failure in Nigeria: a consequence of capital inadequacy, lack of transparency and non-performing loans?" The study showed that inadequate capital, lack of transparency and bad loans are responsible for financial instability in the banking industry and bank failures in Nigeria. Other studies by Ohwofasa and Mayuku (2012), Mayuku, G., Ogude B., Ibeh S., and Oluwafase B. (2012) and Elegbe (2013) revealed that ineffective monetary policy and inadequate supervision by the regulatory authorities were partially responsible for the bank failures witnessed in the country.

Nwosu *et al*. (2012) adopted a combination of the pooled ordinary least squares (POLS) and the generalized moment method (GMM) to examine the effect of bank recapitalization on the risk taking behavior of deposit money banks in Nigeria using panel data covering the period 2001 to 2008. Using bank z-score to represent aggregate risk of insolvency (or financial stability) they observed that increased bank capitalization promotes financial stability in the banking industry. Conversely, banks with low capitalization levels tend to suffer financial instability. The result further shows that while growth capital base is a positive linear determinant of banking stability, growth in size is non linear.

From the foregoing review, it is evident that there is dearth of studies in this area especially in a developing sub-Sahara African country such as Nigeria. Most of the studies like Graeve *et al* (2008), Granville and Mallick (2009), Tabak *et al. (2*010), Ngakosso (2016), etc were not localized to Nigeria. Besides, they focused mainly on individual banks (micro) rather than the banking industry as a whole (macro). The few studies that were carried out in Nigeria like Adeyemi (2011), Nwosu *et al.* (2012) and Egbo (2012) were not robust They were majorly on banking distress which is just an aspect of banking industry financial instability. They did not take a holistic approach towards ascertaining monetary policy impact on the banking industry stability as a whole. Furthermore, none of the studies reviewed used an index of financial stability constructed within the study. They used stability indexes from secondary sources.

This work therefore differs from other studies reviewed above. Hence this study makes an improvement by examining the issue of the financial stability in the banking industry at the industry level (macro) and not at the individual bank level (micro). Besides, unlike other studies, banking industry stability index (Z-score) constructed within the study was used to measure financial stability in the industry. These differing approaches make this study more pragmatic.

2.2 Theoretical Framework

Theoretical literature shows that banking systems influence sustained economic progress through the process of financial intermediation and that developed financial systems contribute positively to economic growth. Improvements in the banking sector aid savings and capital formation and ease the external financing constraints that firms and households face; this will lead to higher growth. Theoretical evidence suggests that in the long run, a well developed financial system has a high salutary effect on economic growth (Levine, 2005).

The financial system fragility hypothesis also known as the financial instability hypothesis was postulated by Hyman Minsky (1972; 1980). Minksy believes that financial crisis is prevalent in capitalism since periods of economic opulence encourage borrowers and lenders to be progressively out of control. This excessive optimism generates financial bubbles which later bust. This hypothesis holds that dynamics of business investment finance prevalent in the business cycles is the persistent cause of financial instability. Consequently, business cycles are complicated by (i) the inherent dynamics of market economies, and (ii) the structure of policies initiated to maintain the economy at acceptable boundaries. During the boom phases of the business cycle, the growth of debt-financed investments results in initial “robust” financial structures evolving into “fragile” financial structures. It is this development that eventually brings the expansion to a stop. Following this is a contraction in which various fragile financial structures crumple leading to financial instability.

3. Research Methodology

3.1 Model Specification

The theoretical underpinning of the models for this study is a combination of the Keynesian monetary transmission theory and the financial system fragility hypothesis. The financial system fragility hypothesis postulated by Hyman Minsky (1972; 1980) explains the conditions for financial stability while the Keynesian monetary transmission theory emphasized the importance of monetary policy in ensuring financial stability and economic progress. This study measured financial stability by adopting the categorization of financial stability indicators (FSIs) by IMF (2006) with emphasis on the banking industry. This categorization specified the indices to measure financial stability in the banking industry.

This study constructed a banking industry financial stability index (BIFSI) for Nigeria. This BIFSI is the z-score for the Nigerian banking industry. The BIFSI was employed as a measure for financial stability in the banking industry, while monetary policy was represented by interest rate (monetary policy rate) and treasury bill rate (proxy for open market operation) based on the Keynesian monetary transmission theory. Exchange rate is also included to represent monetary policy so as to reflect the peculiarities of the Nigerian economy. Investment (gross fixed capital formation) was included in the model, as a control variable in line with the financial system fragility hypothesis. Consequently, the relationship between monetary policy and financial stability in the banking industry is expressed as follows:

$BIFSI_t = f(MPR_t, TBR_{t,} EXR_{t,} GFCF_t)$

Specifying into an econometric model implies

$$BIFSI_t = \alpha_0 + \alpha_1 MPR_t + \alpha_2 TBR + \alpha_3 EXRt + \alpha_4 GFCF_t + U_t \quad (1)$$

Where:

BISFI= Financial stability in the banking industry (proxied by banking industry financial stability index).

MPR= Monetary policy rate (proxy for interest rate).

TBR= Treasury bill rate. This is the rate at which the CBN buys/sell securities during open market operation (OMO)

EXR = Exchange rate. This is the Naira to US dollar exchange rate.

GFCF = Gross fixed capital formation (Investment).

U = stochastic error term

t = measure of time

$\alpha_1 > 0$; $\alpha_2 > 0$; $\alpha_3 < 0$; $\alpha_4 > 0$ (economic a-priori criteria)

Table 1. Individual indicators for BIFSI

Category	Indicator	Notation	Impact
1. Banking soundness Index			
	Capital adequacy ratio	CAR	+
Capital adequacy	Ratio of non-performing loans net of provisions to capital	NPLP/C	-
Asset quality	Ratio of non-performing loans to total gross loans	NPL/TL	-
	Ratio liquid assets to total assets	LA/TA	+
Liquidity	Loans to deposits ratio	TL/D	-
	Return on assets	ROA	+
	Interest margin to gross income ratio	NIM	+
Profitability	Non-Interest Expense to Gross Income	NIE/GI	-
2. Banking Vulnerability Index			
	Current account balance to GDP Ratio	CAB/GDP	+
	Ratio of external assets to total assets of DMBs	EA/TA	-
External Sector	Ratio of foreign currency assets to foreign currency Liabilities of DMBs	FCA/FCL	+
Financial Sector	DMBs domestic credit to GDP	DC/GDP	+
	Inflation	INF	-
Real Sector	GDP growth rate	GDPR	+
3. World Economic Climate Index			
	GDP growth rate of the US	GDPRUS	+
	GDP growth gate of China	GDPRCH	+

Source: Author's compilation

3.2 Construction of the Banking Industry Financial Stability Index (BIFSI)

Based on the IMF-FSIs compilation guide 2006 and following studies by Verlis, (2011); Sere-Ejembi, A., Udom, I.S., Salihu, A., Atoi. N.V and Yaaba, B.N (2014) and Krist ńa (2015), the BIFSI was developed using 16 individual financial stability indicators as shown in the table 1 above.

The BIFSI model is specified as follows:

$$BIFSI_t = w1BSI_t + w2BVI_t + w3WECI_t \quad (2)$$

Where:

BIFSI= Aggregate banking industry financial stability index for Nigeria

BSI = Banking soundness index

BVI= Banking vulnerability index

WECI= World economic climate index

W1= weight assigned to BSI

W2= weight assigned to BVI

W3= weight assigned to WECI

$$\sum_{i=1}^{3} Wi = 1 \quad (3)$$

t = time (quarter in the review period)

3.2.1 Description of Indicators

The individual indicators are classified into three broad categories, namely banking industry soundness index (BSI), banking vulnerability index (BVI) and world economic climate index (WECI). These are explained below:

(a) Capital adequacy

i. CAR: This evaluates banks' ability to absorb unanticipated losses. It shows the ability of the industry to withstand shocks to the industry's statement of financial position. Higher values for this ratio indicate better financial healthiness of the industry.

ii. NPLP/C: NPLP/C indicates the ability of bank capital to withstand potential losses arising from non-performing loans. Higher values of this indicator impact negatively on financial stability of the industry.

(b) Asset Quality

i. NPL/TL: Non Performing loans affect the quality of bank's risk assets. Hence, this ratio seeks to discern problems with asset quality in the credit portfolio. The higher the ratio the worse it is for the industry.

(c) Liquidity

i. LA/TA: This ratio measures the banks' capacity to meet short term financial obligation and customers demand for cash. The higher the ratio the better it is for financial stability. The CBN usually prescribes the minimum acceptable value for this ratio.

ii. TL/D: The ratio indicates the percentage of depositors' funds that are given out as loans. High values for this ratio may expose the banks to not being able to meet obligations due depositors at all times.

(d) Profitability

i. ROA: This ratio assess banks' efficiency in assets usage and shows the ability of the banks to mitigate potential business risks. The higher the ratio the better for the industry.

ii. NIM: NIM assesses the relative share of interest earned less interest expenses (net interest income) within gross income. The higher the ratio the better.

iii. NIE/GI: This ratio assesses the degree to which high non-interest expenses erode earnings. A high ratio indicates inefficiency.

(e) External sector

i. CAB/GDP: This portrays the ability of the country as a whole to meet short term obligations to its trading partners.

ii. EA/TA: The ratio assesses the level of the local banking sector in relation to the external world.

iii. FCA/FCL: It assesses the divergence of foreign currency asset in relation to liability positions and also assesses the susceptibility of banks to foreign exchange fluctuations.

(f) Financial sector

i. DC/GDP: A high measure depicting rapid loan growth compared to GDP growth precedes declining loan standards, system instability and precedes banking crisis. The regulators usually set a ceiling for this indicator.

(g) Real sector

i. INF: The inflation rate is an important factor in determining inter-bank, lending and deposit rates. Banks usually absorbs the impact of high inflation rate with upward review of lending rates.. The lower the rate the better.

ii. GDPR: This provides a linkage between the real sector and the financial sector. A declining rate slows down economic activities. The higher the rate the better.

(h) World economic climate index

This is represented by GDPRUS and GDPRCH. These are the GDP growth rates of major trading partners of Nigeria that account for a high percentage of Nigeria's international trade transactions.

3.3 Construction of the Aggregate Banking Industry Financial Stability Index for Nigeria

Prior to the last aggregation, the various data underwent a procedure of normalization and weight allocation so as to bring them to a common scale (Nicholas and Isabel, 2010). Consequently, all individual indicators were normalized to make them assume equal variance. Two main methods of normalization could be identified namely: statistical normalization and empirical normalization.

The statistical normalization method translates indicators to an identical scale having a mean =0 and standard deviation =1. The outcome is a Z-score for the variable. The zero mean prevents introducing aggregation bias emanating from disparities in the individual indicator's means. The scaling parameter is the standard deviation. Hence, an indicator with high value will fundamentally exert a higher impact on the combined indicator (Krist ńa, 2015). The statistical normalization method is given by:

$$\mathbf{Z_t = (X_{it} - \overline{x})/s} \quad (4)$$

Where:

X_{it} = value of indicator X_i during period *t*.

$\overline{\mathbf{x}}$ = mean

s = standard deviation

Z_t = normalized value of the indicator.

The empirical normalization method translates all indicators to equal range of 0 or 1. It uses the range (Max – Min) instead of standard deviation as the scaling parameter. The value of 0 (Min) symbolizes most unfavourable while the value 1 (Max) symbolizes the most favourable value. One major shortcoming of this method is that the minima and maxima could distort the normalized indicators as they are majorly unreliable pointers.

For this study, the statistical normalization method has been adopted so as to avoid the shortcomings of the empirical method as discussed above. All the individual indicators were converted such that a higher value implies an enhancement in financial stability while a lower value implies a decline. Thus for indicators that have inherent negative impact on financial stability (NIE/GI, NPL/TL, (NPL-P)/C, etc) the reciprocal values were used.

3.4 The Aggregate Index

All individual indicators were normalized by subtracting each observation from the mean of the individual indicator and dividing the outcome by the standard deviation of the indicator. The result is a z-score for that indicator given by:

$Z_t = (X_{it} - x)/s$ (where all the variables are as defined in equation 4). The normalized indicators were then combined into a single index. All individual indicators were assigned equal weights so as to compute the composite indices of BSI, BVI and WECI. Hence, the indices conferred equal significance to every single indicator. This is the most frequently used weighting method in literature. The normalized variables were combined to form an aggregate index by employing the arithmetic mean, as given by the formulas below:

$$\overline{S_t} = \frac{\sum_{i=1}^{8} BSI_{it}}{8} \quad (5)\ \text{(Banking soundness index)}$$

$$\overline{V_t} = \frac{\sum_{i=1}^{7} BVI_{it}}{6} \quad (6)\ \text{(Banking vulnerability index)}$$

$$\overline{E_t} = \frac{\sum_{i=1}^{2} WECI_{it}}{2} \quad (7)\ \text{(World economic climate index)}$$

The next step entails the weighting of the average values of the sub indices so as to show their importance to the stability of the banking industry. According to Illing and Liu (2003); and Maliszewski, (2009), several methods of assigning weights to sub-indices exist. These include estimation of a logit model, expert judgment, standardization (variance-equal weights), market segment size, etc. Consequently, this study adopted the variance-equal weights method. This method creates an index that allocates the same weights to all sub-indices, indicating equal significance to each indicator. This is the most popular weighting technique employed in modern studies (Krist ńa, 2015). Therefore, equal weights were assigned to the sub-indices as follows:

$$W1=W2=W3= 1/3 \quad (8)$$

Lastly, the aggregate banking industry financial stability index was constructed as follows:

$$BIFSI_t = \tfrac{1}{3}\overline{S_t} + \tfrac{1}{3}\overline{V_t} + \tfrac{1}{3}\overline{E_t} \quad (9)$$

The values obtained from equation 9 were used in the estimation of equation 1. However, before estimating equation 1 several diagnostic tests were carried out on the data, after which appropriate estimation technique was applied.

3.5 Sources of Data Collection

Data for this study are time series quarterly data obtained from secondary sources. They were obtained from the CBN statistical bulletin (2014 to 2016), the CBN financial stability report (various issues) and several bulletins of the National Bureau of Statistics.

3.6 Model Estimation Technique

This study adopted a dynamic estimation technique. Based on this technique, if all the variables of the model are integrated of order one - I(1), and are cointegrated, then the appropriate method to estimate the model is an error correction model (Engle & Granger, 1987). Thus the error correction model (ECM) was adopted so as to evaluate the short-run dynamics and the adjustments to long-run equilibrium. The choice of ECM was to eliminate spurious regression. Furthermore, the ECM incorporates the short run dynamics into the long run equilibrium without any information loss. Unit root test was employed to establish the stationarity condition of time series economic variables used in this study. That is whether such variables are stationary or non-stationary.

4. Empirical Results

4.1 Normalization of Financial Stability Indicators, FSIs (Statistical Normalization Method)

In the statistical normalization method, each observation was subtracted from the mean of the indicator and the resulting quantity was divided by the standard deviation of the indicator to derive the z-score of that particular indicator. By aggregation and assigning of weights, the BIFSI was derived as shown in tables 2, 3, 4 and 5 below.

Table 2. Normalized series of financial stability indicators (statistical normalization method)

	2008				2009				2010			
1. Banking soundness Index	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
CAR	0.9883	1.2966	1.1645	1.0323	1.0764	1.1057	-0.2379	-1.5815	-1.7724	-1.9633	-1.9413	-1.9192
NPLP/C	2.1836	1.6793	0.3345	-0.1827	-0.3659	-0.4993	-1.1690	-1.2474	-1.2931	-1.3100	-1.3026	-1.2916
NPL/TL	0.8794	0.7389	0.1432	-0.2350	-0.4868	-0.6734	-1.3376	-1.5422	-1.5504	-1.5583	-1.4492	-1.2491
LA/TA	1.5125	2.0111	1.0693	0.1274	-0.1496	-0.4266	-0.3019	-0.1773	-0.0803	0.0166	0.0166	0.0166
TL/D	0.5494	1.1056	1.0379	1.3932	1.3731	1.2537	1.8008	1.2434	0.9627	0.8875	0.8817	-0.5941
ROA	1.0730	0.4897	0.8230	1.1564	0.7397	0.3230	-1.8853	-4.0936	-2.0311	0.0314	0.6355	1.2397
NIM	-1.1199	-0.5205	-0.1952	0.1130	0.2671	0.4212	0.2329	0.0274	-0.2979	-0.6233	-0.6490	-0.6747
NIE/GI	1.6407	1.2681	1.1000	0.9370	0.5089	0.1292	-1.0029	-1.8915	-1.8577	-1.8236	-1.0973	-0.2233
2. Banking Vulnerability Index												
CAB/GDP	2.5693	2.6788	2.2445	-0.8413	-0.1387	0.1918	0.5460	1.7814	-0.3633	0.0678	-0.3027	0.3887
EA/TA	-0.8326	-0.6329	-0.1860	1.1312	0.5409	-0.3252	-0.5595	-0.6999	-0.5498	-0.9373	-0.2627	-0.4901
FCA/FCL	1.2523	1.9644	1.2756	2.3349	1.4044	0.8862	0.7457	0.3156	0.4366	0.2927	0.3959	0.3336
DC/GDP	0.0097	0.3367	0.1374	0.5267	0.9413	1.2037	1.6352	2.2029	0.1383	0.1438	0.0284	-0.1965
INF	1.5495	-0.5741	-0.8624	-1.3474	-1.1988	-0.2767	0.0441	-1.0963	-1.2952	-1.1367	-1.0276	-0.4988
GDPR	0.6346	0.7841	0.9767	1.0450	1.3069	1.0522	0.7056	0.9016	0.7764	0.9316	0.8357	0.3114
3. World Economic Climate Index												
GDPRUS	-0.0757	-0.2155	-0.8136	-2.0845	-2.4413	-2.7555	-2.3527	-0.7757	0.1774	0.7578	0.9428	0.7640
GDPRCH	0.9308	1.0846	1.0077	0.6231	0.4692	0.7000	0.6231	0.8538	1.1615	1.4692	1.7769	1.5462

Source: Author’s computation

Table 3. Normalized series of financial stability indicators (statistical normalization method) - continued

	2011				2012				2013			
1. Banking soundness Index	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
CAR	-1.7430	-1.5668	-0.5536	0.4449	0.4302	0.4156	0.4596	0.5037	0.5477	0.5918	0.4596	0.3275
NPLP/C	-1.2672	-1.2040	-1.0950	-0.2980	0.1244	1.1164	1.2684	1.4404	0.8371	0.4485	0.4638	0.4794
NPL/TL	-1.1234	-0.9407	-0.6032	0.0846	0.2054	0.3416	0.6739	1.1201	0.9552	0.8073	0.9948	1.2097
LA/TA	0.7645	1.5125	1.9418	2.3712	0.7922	-0.7867	-0.5235	-0.2604	-0.6066	-0.9529	-0.5235	-0.0942
TL/D	-0.8215	-1.0189	-1.1045	-1.0241	-1.2445	-0.9059	-1.0367	-0.5941	-1.3955	-1.0746	-1.6808	-1.5149
ROA	0.6147	-0.0103	-0.1770	-0.3436	-0.0520	0.2397	0.1772	0.1147	0.1564	0.1980	0.0730	-0.0520
NIM	-0.9229	-1.1712	-1.9075	-2.6438	-0.4521	1.7226	1.2346	0.7466	1.0205	1.2945	1.1832	1.0719
NIE/GI	-0.6298	-1.0029	-1.1552	-1.2911	-0.2796	1.0088	0.5254	0.0837	0.2448	0.4113	-0.0060	-0.3902
2. Banking Vulnerability Index												
CAB/GDP	0.2598	0.4115	-1.1735	-0.1611	0.0070	-0.4850	0.4860	-0.0819	0.2153	-0.0998	-0.2262	-0.0545
EA/TA	0.4157	1.3009	0.5696	0.5694	1.1855	1.0237	2.0698	1.0972	0.8188	0.5904	0.7987	0.4662
FCA/FCL	0.2664	0.3982	0.1626	0.1321	0.4438	0.2899	0.2655	-0.1412	-0.2523	-0.3717	-0.4354	-0.5562
DC/GDP	-0.2907	-0.1845	-0.0441	0.5643	0.7443	0.4495	0.2953	0.1841	0.2979	0.1491	0.0670	0.2279
INF	-0.7951	0.1143	0.0658	0.0921	-0.5933	-0.8263	-0.2990	-0.5515	0.9844	1.1404	1.3847	1.4140
GDPR	0.6073	0.3911	-0.7412	-0.2964	-0.8010	-0.5332	0.0666	-0.7271	-0.3915	-0.0033	-0.0982	0.5573
3. World Economic Climate Index												
GDPRUS	0.3300	0.2054	-0.0381	0.2207	0.7756	0.6377	0.5898	0.0108	0.0298	-0.1140	0.2266	0.7286
GDPRCH	1.3154	1.0846	0.7000	0.1615	-0.3000	-0.6846	-0.7615	-0.3000	-0.4538	-0.6846	-0.4538	-0.6077

Source: Author’s computation

Table 4. Normalized series of financial stability indicators (statistical normalization method) - continued

	2014				2015				2016	
1. Banking soundness index	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
CAR	0.2761	0.2247	0.2834	0.3421	0.3715	0.4009	0.2907	0.1806	0.0778	-0.0250
NPLP/C	0.5114	0.5446	0.8371	1.2365	0.4953	0.0846	0.0846	0.0846	-0.7549	-0.9736
NPL/TL	1.1642	1.1201	1.4059	1.7508	0.7727	0.2054	0.0292	-0.1202	-0.7162	-1.0168
LA/TA	-0.8006	-1.5069	-1.5485	-1.5900	-0.9114	-0.2327	0.0720	0.3767	-0.2465	-0.8698
TL/D	-0.3927	-0.3358	-0.1590	0.0557	0.2009	0.2951	0.4644	0.3984	0.2985	0.7021
ROA	0.0314	0.1147	0.5168	0.9189	0.3376	-0.2436	-0.2915	-0.3395	-0.2749	-0.2103
NIM	0.9692	0.8664	-0.1182	-1.1027	-0.8716	-0.6404	0.2072	1.0548	0.8493	0.6438
NIE/GI	-0.2091	-0.0208	0.6590	1.4415	0.3711	-0.5116	-0.1806	0.1751	0.9728	1.9107
2. Banking vulnerability index										
CAB/GDP	-0.2719	-0.6924	-0.5209	-0.9996	-1.5254	-0.9538	-0.8727	-0.7384	-0.4752	-0.8647
EA/TA	0.6652	0.6428	0.1233	-0.3157	-0.4215	-1.5938	-2.3419	-2.0530	-1.3754	-0.4852
FCA/FCL	-0.5726	-0.6487	-0.9201	-1.2016	-1.3089	-1.5371	-1.6369	-1.4615	-1.2494	-1.3029
DC/GDP	0.6702	0.2740	0.3201	0.2432	-1.8632	-1.9578	-1.9038	-1.8296	-1.7138	-1.8069
INF	1.5495	1.2634	1.1605	1.3847	1.0419	0.6411	0.5167	0.4388	-0.7923	-1.6142
GDPR	0.3296	0.4646	0.3352	0.2185	-0.5928	-1.2522	-1.0516	-1.3515	-2.3649	-3.0616
3. World economic climate index										
GDPRUS	0.2023	0.6149	0.8503	0.6377	1.0666	0.8917	0.5093	0.3222	0.1644	0.0101
GDPRCH	-0.8385	-0.7615	-1.0692	-0.9923	-1.1462	-1.1462	-1.2231	-1.3000	-1.3769	-1.3769

Source: Author's computation

Table 5. Statistical normalization process of BIFSI

PERIOD	BSI	BVI	WECI	BIFSI = (BSI+BVI+WECI)
2008Q1	7.7070	5.1827	0.8551	4.5816
2008Q2	8.0688	4.5569	0.8691	4.4983
2008Q3	5.4771	3.5858	0.1941	3.0857
2008Q4	4.3416	2.8491	-1.4615	1.9097
2009Q1	2.9629	2.8560	-1.9721	1.2823
2009Q2	1.6337	2.7320	-2.0555	0.7700
2009Q3	-3.9009	3.1170	-1.7296	-0.8378
2009Q4	-9.2626	3.4052	0.0782	-1.9264
2010Q1	-7.9203	-0.8570	1.3389	-2.4795
2010Q2	-6.3430	-0.6381	2.2270	-1.5847
2010Q3	-4.9054	-0.3331	2.7197	-0.8396
2010Q4	-4.6957	-0.1517	2.3101	-0.8458
2011Q1	-5.1286	0.4634	1.6454	-1.0066
2011Q2	-5.4025	2.4316	1.2900	-0.5603
2011Q3	-4.6541	-1.1608	0.6619	-1.7177
2011Q4	-2.7000	0.9004	0.3822	-0.4724
2012Q1	-0.4759	0.9863	0.4756	0.3287

2012Q2	3.1521	-0.0813	-0.0469	1.0080
2012Q3	2.7788	2.8842	-0.1717	1.8304
2012Q4	3.1546	-0.2203	-0.2892	0.8817
2013Q1	1.7596	1.6726	-0.4240	1.0027
2013Q2	1.7239	1.4050	-0.7986	0.7768
2013Q3	0.9641	1.4907	-0.2272	0.7425
2013Q4	1.0373	2.0546	0.1209	1.0709
2014Q1	1.5500	2.3699	-0.6362	1.0946
2014Q2	1.0069	1.3038	-0.1466	0.7214
2014Q3	1.8765	0.4981	-0.2189	0.7186
2014Q4	3.0528	-0.6705	-0.3546	0.6759
2015Q1	0.7662	-4.6700	-0.0795	-1.3277
2015Q2	-0.6423	-6.6536	-0.2545	-2.5168
2015Q3	0.6760	-7.2901	-0.7138	-2.4426
2015Q4	1.8106	-6.9953	-0.9778	-2.0542
2016Q1	0.2059	-7.9709	-1.2125	-2.9925
2016Q2	0.1611	-9.1354	-1.3668	-3.4470

Source: Author’s computation

4.2 Trend in the Aggregate Banking Industry Financial Stability Index

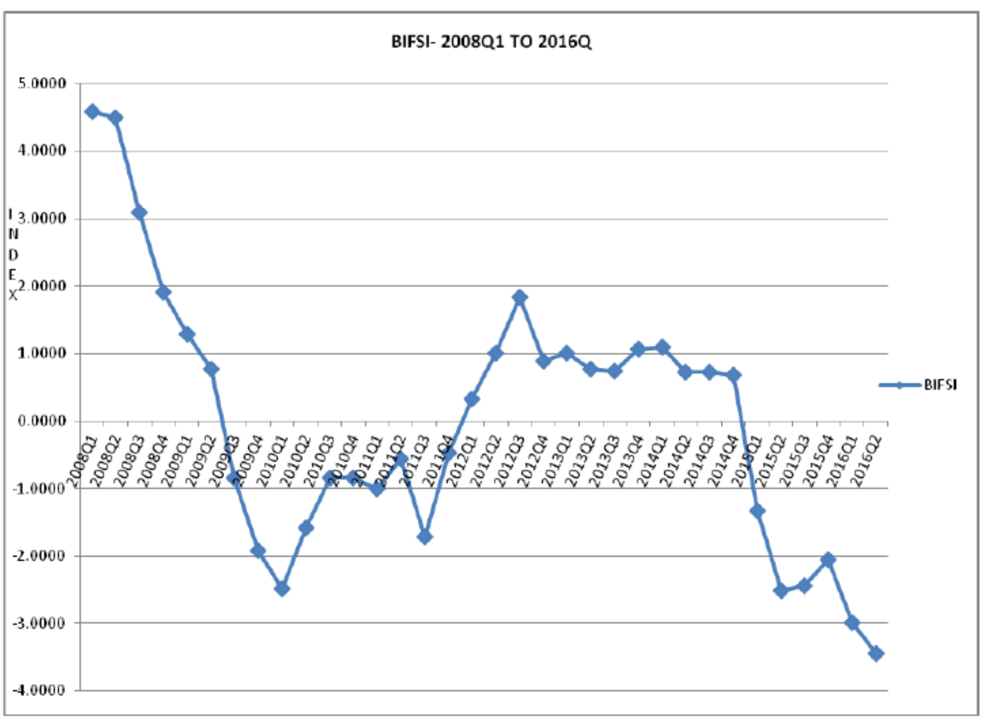

Figure 1. Aggregate banking industry financial stability index (2008Q1-2016Q2)

Source: Author’s computation

Figure 1 shows the trend in the aggregate BIFSI. Using the statistical normalization method, the aggregate BIFSI has a threshold of zero. Consequently, any level above zero depicts above average level and implies that the banking industry is financially stable. The farther away above zero, the more stable is the industry. Conversely, any level below zero depicts financial instability in the banking industry. The farther away below zero the index lies, the higher the degree of financial instability.

The trend in Figure 1 shows that in some periods, there was financial stability in the banking industry while in some other periods, the industry witnessed financial instability. Specifically, the banking industry experienced financial stability firstly from 2008Q1 to 2009Q2 but from 2009Q3 to 2011Q4 it experienced financial instability. From 2012Q1, the industry bounced back to the path of financial stability up to the end of 2014. Between 2015 and 2016, the industry witnessed financial instability.

From the beginning of 2008, it appeared the global financial crises had not largely impacted the banking industry plausibly due to the banking consolidation exercise that was introduced by the CBN in 2005. However, with serious signs of imminent financial instability, the CBN conducted a comprehensive banking audit in 2009. This audit which showed that many of the banks had capital adequacy and liquidity problems, is well depicted in the below average trend of the BIFSI as shown in figure 1. The 2009 post audit injection of ₦620 billion into the banking industry by way of bail-out funds to eight distressed banks, did not immediately resolve the financial stability problem due to lags in monetary policy effectiveness (CBN, 2009; Sanusi, 2010). Similarly, Due to the high volume of bad loans in the banking industry, the Assets Management Corporation of Nigeria (AMCON) was set up in 2010 to acquire the qualifying non-performing loans of DMBs. Banking supervision and risk based audit were also strengthened by both the CBN and the NDIC. These measures engendered the return of financial stability in 4th quarter of 2011.

Between 2012Q1 and 2014Q4, financial stability remained in the industry owing to several reforms and macro-prudential policies adopted by the CBN. These include increased supervision, revised capital adequacy, liquidity and assets quality ratios. For instance, in 2014 the CBN designated 8 banks as Systemically Important Banks (SIBs) and required them to maintain liquidity ratio of 5% above industry standard and CAR of 15% out of which Tier 2 capital should not constitute more than 25% of the qualifying capital (CBN, 2014). The CAR for DMBs in Nigeria currently set at 10% for national/regional banks and 15% for banks that have international banking license (CBN, 2016).

From 2015, the trend in BIFSI shows a return of financial instability. This could largely be attributed to the current economic downturn experienced by the country owing to slump in oil prices and declining government revenue. This has culminated into economic recession in the country and build-up of NPLs in the banking industry, especially in banks with credit exposures in the oil and gas sector. Furthermore, the current persistent high inflation rate also drags the BIFSI into the region of instability. However, it is believed that with appropriate policy measures by the government including diversification of the economic mainstay of the nation, the banking industry will be geared towards the part of financial stability.

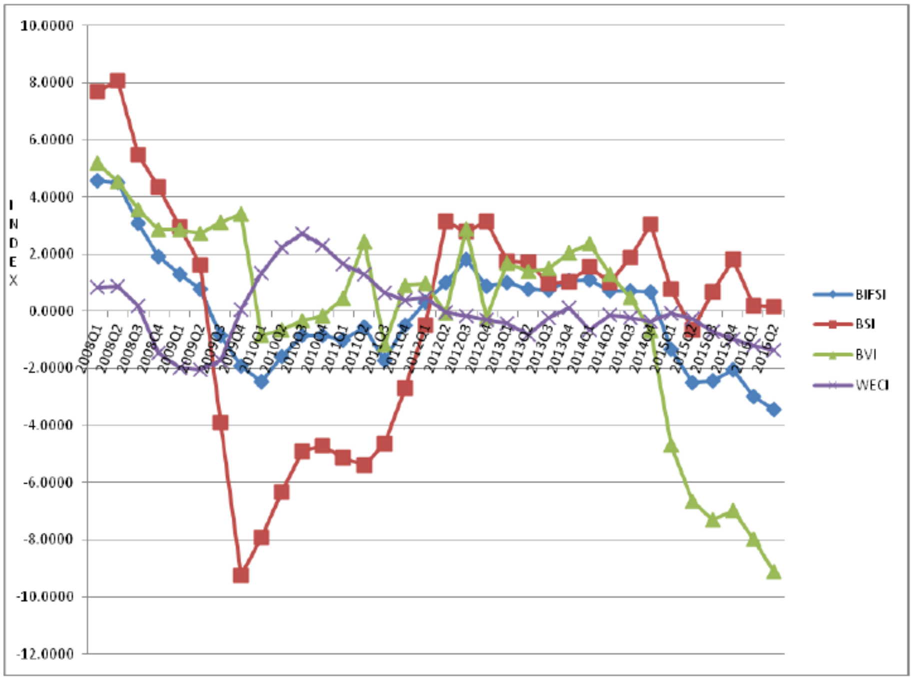

Figure 2. Aggregate banking industry financial stability index and its sub-constituents (2008Q1-2016Q2)

Source: Author's computation

Figure 2 above shows the interaction between the BIFSI and its components. It is interesting to note that the BIFSI lies in the middle of its constituents (BSI, BVI and WECI) meaning that it a good representation of them. All the four curves oscillate over the period; lying below the threshold, zero, in some years and above the threshold in other years. This means that there was financial instability in some years, while there was financial stability in other years.

4.3 Presentation and Analysis of Econometric Results

The Augmented Dicky-Fuller (ADF) and the Phillips-Perron (PP) tests were carried out to establish the stochastic behavior of the data employed for this study. The result shows that all the variables are stationary at the first difference. This means that the variables are integrated at order one, I (1). This is shown in table 6 below:

Table 6. Summary of unit root test result

	ADF Test		**PP Test**		
Variable	**Level**	**1st difference**	**Level**	**1st difference**	**Order of integration**
BIFSI	-1.810424	-4.051945*	-1.92414	-4.051945*	I(1)
MPR	-0.903741	-4.377307*	-1.20414	-4.458869*	I(1)
TBR	-1.685447	-4.813317*	-1.762243	-4.712009*	I(1)
EXR	2.250801	-3.172309*	0.352172	-3.172309*	I(1)
LNGFCF	-1.373743	-7.365515*	-2.01731	-6.543275*	I(1)

Note: 5% critical value for the test is -2.95; * implies variable is significant at 5%

Source: Author's computation.

Table 7. Summary of cointegration test result (trace statistic)

Hypothesized Noof CE(s)	Eigenvalue	Trace Statistic	5% Critical Value	1% Critical Value
None*	0.802178	100.7995	69.81889**	77.81884*
Atmost 1*	0.625628	50.56751	47.85613**	54.68150
Atmost 2	0.411816	20.10982	29.79707	35.45817
Atmost 3	0.110431	3.657625	15.49471	19.93711
Atmost 4	0.000969	0.030054	3.841466	6.634897

Note: *, ** Implies statistical significance at the 1% and 5% levels, respectively.

Source: Author's computation

Table 8. Summary of cointegration test result (Max-Eigen statistic)

Hypothesized Noof CE(s)	Eigenvalue	Max-Eigen Statistic	5% Critical Value	1% Critical Value
None*	0.802178	50.23195	33.87687**	39.37013*
Atmost 1*	0.625628	30.45769	27.58434**	32.71527
Atmost 2	0.411816	16.45220	21.13162	25.86121
Atmost 3	0.110431	3.627572	14.26460	18.52001
Atmost 4	0.000969	0.030054	3.841466	6.634897

Note: *, ** Implies statistical significance at the 1% and 5% levels, respectively.

Source: Author's computation

The cointegration test seeks to determine whether or not there exists a long run equilibrium relationship among the variables included in the model. The result of the Johansen cointegration test result is shown in the tables 7 and 8 above. The result of the cointegration test indicates that there is one cointegrating equation respectively, for both the trace and the Max-Eigen statistics at the 1% level of significance. However, at the 5% levels of significance, there are two cointegrating equation respectively, for both the Trace statistic and Max-Eigen statistic. Therefore, it was concluded that there exists a long run equilibrium relationship among the variables. Consequently, ECM was employed to estimate the relationship.

The parsimonious ECM results were obtained by removing the variables that were not statistically significant from the over-parameterized ECM results. Monetary policy rate (MPR) which is the key monetary policy variable was discovered to be statistically insignificant in the over-parameterized model. However, given that is it a key monetary policy variable, it was included in the parsimonious model. Two period lag was employed, based on the optimal lag length selection criteria. The result of the parsimonious ECM and the associated model diagnostic test results are depicted in the tables 9 and 10 respectively below:

Table 9. Parsimonious error correction model (ECM)

Dependent variable: BIFSI				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	0.104366	0.116614	0.894972	0.3809
D(MPR)	-0.077507	0.127764	-0.606636	0.5506
D(MPR(-1))	0.096186	0.112472	0.855205	0.4021
D(MPR(-2))	0.016779	0.120376	0.139386	0.8905
D(TBR)	0.099874	0.053112	1.880431	0.0740
D(EXR)	-0.042043	0.011200	-3.753766	0.0012

D(EXR(-2))	-0.062803	0.018095	-3.470785	0.0023
D(LNGFCF)	-1.811223	0.580438	-3.120444	0.0052
D(LNGFCF(-2))	0.963787	0.509265	1.892507	0.0723
ECM(-1)	-0.665377	0.137640	-4.834181	0.0001
R-squared	0.771327	Mean dependent var		-0.210733
Adjusted R-squared	0.673325	S.D. dependent var		0.793252
S.E. of regression	0.453387	Akaike info criterion		1.511555
Sum squared resid	4.316756	Schwarz criterion		1.974132
Log likelihood	-13.42911	Hannan-Quinn criter.		1.662344
F-statistic	7.870480	Durbin-Watson stat		2.191552
Prob(F-statistic)	0.000052			

Source: Author's computation

Table 10. Model diagnostic test result

Jarque-bera: 0.20	Probability: 0.90
Breusch-Godfrey serial correlation LM test	
F statistic: 5.43	Probability: 0.07
Heteroskedasticity: White	
F statistic: 9.44	Probability: 0.39

Source: Author's computation

The parsimonious result shows that current MPR, one period lagged MPR and two periods lagged MPR are not statistically significant given that their t-values are individually less than 2 (in absolute value). However, current period TBR is positively related to BIFSI and this is consistent with economic a-priori expectation. This implies that 1% increase in TBR will result in 9% increase in BIFSI, all things being equal. Lagged values of TBR were found to be statistically insignificant, hence did not feature in the parsimonious results. Both the current period exchange rate and two period lagged exchange rates have negative relationship with BIFSI. This is consistent with economic a-priori expectation. This implies that 1% increase in current period exchange rate will result in 4% decrease in BIFSI. Similarly, 1% increase in two periods lagged exchange rate will result in 6% decrease in BIFSI, ceteris paribus.

Furthermore, current period investment (LNGFCF) is negatively related to BIFSI; this is inconsistent with a-priori expectation. However, this could be explained in the light of the financial system fragility hypothesis. The hypothesis opined that during periods of economic boom, increased investment could result in the buildup of financial imbalances that ultimately results in financial instability. On the other hand, two periods lagged investment is positively related to BIFSI and this is consistent with economic a-priori expectation. This implies that a 1% increase in two periods lagged investment will result in 0.96 unit increase in BIFSI.

The result also shows that EXR, EXR_{t-2}, and LNGFCF are statistically significant, at the 5% level of significance. This is because the absolute values of their respective t-values are each greater than 2 (using the rule of thumb). However, TBR and $LNGFCF_{t-2}$ are statistically significant at the 10% level of significance. The coefficient of the error correction term has the right negative sign and it is statistically significant at the 5% level of significance. This shows that long run disequilibrium in the previous period is corrected by the system quarterly at a speed of 66.54 percent. The adjusted R^2 indicates that about 67% of the variation in BIFSI is explained by the model. This implies that the model has a good fit and a high explanatory power. The F-statistic shows that the overall model is statistically significant given that its p-value is less than 5%.

The result of the normality test shows that the residuals were normally distributed. The serial correlation test indicates that the residuals were not serially correlated, and the result of the heteroskedasticity test shows the presence of homoscedasticity. For the three tests, these decisions were made because the p-values are individually greater than 5%. This is shown in table 10 above. Furthermore, the results of the CUSUM and CUSUM of square tests show that the parameters of the model are stable (given that the blue lines are between the red lines in the two tests respectively).

This study discovered mixed results regarding the effectiveness of monetary policy in ensuring financial stability. This is because not all the policy variables were statistically significant in influencing financial stability. MPR which is a key policy variable and a bench mark rate was found to be statistically insignificant. This means that monetary policy rate will be ineffective if used by the CBN to influence financial stability in the banking industry. This result is however, contrary to the Keynesian monetary theory which posited that interest rate is the principal medium for monetary policy transmission. The ineffectiveness of monetary policy rate in ensuring financial stability in the banking industry in Nigeria could be ascribed to the underdeveloped nature of the Nigerian money market.

Current period TBR was discovered to have the correct sign and was statistically significant. This means that the CBN exerts strong influence on financial stability in the banking industry through the activities of the OMO in the current period. Hence, by buying or selling treasury bills in the money market, the CBN can effectively increase or reduce liquidity in the banking industry so as to ensure financial stability in the banking industry in Nigeria. This result is in line with the Keynesian monetary transmission mechanism and it is also supported by Graeve et al (2008).

Exchange rate was discovered to have the correct sign and was statistically significant both at the current period and two period lagged values. This shows that depreciation in the value of the naira against the dollar has detrimental effect on financial instability in the banking industry. This result implies that the fall in value of the Naira in relation to other major currencies has adverse effect on financial stability in the banking industry. Furthermore, the result is in line with the studies by Mishkin (1995) and Taylor (1995). These studies held that monetary transmission through exchange rate is more effective under floating exchange rate regime.

Previous period investment was discovered to have a significant positive effect on financial stability in the banking industry. However, current period investment has a significant negative effect. Hence, high investment rate in current period could lead to buildup of financial imbalances which could impinge on financial stability in the banking industry. This implies that although previous period investment has salutary effects on financial stability, in current periods (especially during periods of economic boom), high investment could lead to reckless spending by economic agents which could cause banks to venture into granting unsecured and poorly secured loans resulting in bad loans. The high loan default rate will ultimately lead to financial instability. This result is in tune with the financial fragility hypothesis.

The study discovered long run relationship between monetary policy and financial stability in the banking industry. The speed of adjustment to long run equilibrium was 66.54%. This means that previous period's disequilibrium is corrected by the system at the speed of 66.54% quarterly.

5. Conclusion

The study examined the effect of monetary policy on financial stability in the Nigerian banking industry for the period 2008Q1 to 2016Q2. The study employed econometric method in its investigation. To represent financial stability in the Nigerian banking industry, a banking industry financial stability index (BIFSI) was constructed using the financial stability indicators specified by IMF (2006). MPR, TBR and EXR were used to represent monetary policy, while investment (GFCF) was used as control variable in line with the relevant theories.

The constructed BIFSI was analyzed so as to examine the trend over time. The trend showed mixed outcome implying that the Nigerian banking industry was financially stable in some years while there was financial instability in most other years. The result of the econometric analysis showed that, although, there exists a significant long run equilibrium relationship between monetary policy and financial stability in the banking industry, the impact of the former on the later is weak. This was evidenced by the statistical insignificance of some key monetary policy variables like current period MPR, past periods MPR, past periods TBR etc. Therefore, this study concludes that monetary policy has sparsely impacted financial stability in the banking industry in Nigeria. However, open market operation and exchange rate channels are more effective channels of transmitting monetary policy to financial stability in the banking industry, than monetary policy rate. It is therefore believed that a combination of monetary policy with other relevant policies such as the macro-prudential policy could help in ensuring financial stability in the banking industry in Nigeria.

Based on the foregoing it is recommended that deliberate efforts should be made by the CBN to moderate the MPR and to bridge the gap between the MPR and other interest rates such as lending and deposit rates. Moderate lending rates will reduce loan repayment burden and hence reduce the volume of bad loans which impinge financial stability. Open market operations should be encouraged so as to regulate the liquidity trend in the banking industry. This will ensure that excess liquidity does not generate financial instability in the banking industry. Volatility of the exchange rate and pressure on the demand side of the foreign exchange market should be discouraged through appropriate policies such as high tariffs on ostentatious commodity imports and abolition of multiple foreign exchange market (abolition of the bureaux de change and the parallel market).

Although this study is very promising in the depth of its results, it is pertinent to state that the study faced some limitations such as the use of retrospective indicators, exclusion of qualitative factors and the use of quarterly data. This study opens opportunities for future extensions. First, it would be germane to delve into the area of macro-prudential regulation of the CBN and determine whether this has improved the financial stability standing of Nigerian banks. Secondly, the use of annual data or higher frequency data such as monthly data could provide differing results. Lastly, cross country studies which compare the relationship between monetary policy and financial stability in the Nigerian banking industry with that of other African countries such as Kenya, Ghana and South Africa would provide an insight into how outcomes differ amongst similar economies.

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Appendix

Appendix 1. Macroeconomic variables

PERIOD	BIFSI	MPR	LNGFCF	EXR	TBR
2008Q1	4.5816	9.50	13.1437	116.79	8.50
2008Q2	4.4983	10.25	13.0357	117.74	8.61
2008Q3	3.0857	9.75	13.2450	117.62	9.10
2008Q4	1.9097	9.75	13.1587	134.33	5.46
2009Q1	1.2823	9.75	13.4049	148.54	2.53

2009Q2	0.7700	8.00	13.3889	153.25	3.32
2009Q3	-0.8378	6.00	13.5265	149.80	5.27
2009Q4	-1.9264	6.00	13.8010	149.80	3.77
2010Q1	-2.4795	6.00	14.6346	150.08	1.04
2010Q2	-1.5847	6.00	14.5475	151.28	2.29
2010Q3	-0.8396	6.25	14.7811	152.62	4.91
2010Q4	-0.8458	6.25	14.7119	152.63	7.47
2011Q1	-1.0066	7.50	14.7734	155.21	8.27
2011Q2	-0.5603	8.00	14.6570	155.65	8.35
2011Q3	-1.7177	9.25	14.8501	156.70	8.49
2011Q4	-0.4724	12.00	14.7078	162.17	14.23
2012Q1	0.3287	12.00	14.8406	157.72	14.51
2012Q2	1.0080	12.00	14.8162	162.33	14.08
2012Q3	1.8304	12.00	14.7074	157.78	12.75
2012Q4	0.8817	12.00	14.7982	157.33	11.77
2013Q1	1.0027	12.00	14.7525	158.38	10.17
2013Q2	0.7768	12.00	14.8976	160.02	11.60
2013Q3	0.7425	12.00	14.8606	161.96	10.91
2013Q4	1.0709	12.00	14.9569	159.05	10.97
2014Q1	1.0946	12.00	14.9792	164.62	11.92
2014Q2	0.7214	12.00	15.0928	162.82	9.98
2014Q3	0.7186	12.00	14.9641	162.93	9.75
2014Q4	0.6759	13.00	15.1113	180.33	10.80
2015Q1	-1.3277	13.00	15.0980	197.07	10.77
2015Q2	-2.5168	13.00	15.1365	196.92	9.95
2015Q3	-2.4426	13.00	14.9861	197.00	10.36
2015Q4	-2.0542	11.00	15.0784	196.99	4.57
2016Q1	-2.9925	12.00	15.0319	197.00	5.53
2016Q2	-3.4470	12.00	15.0481	231.76	8.32

Appendix 2. Cointegration test results

Date: 03/07/17 Time: 13:24		
Sample (adjusted): 2008Q4 2016Q2		
Included observations: 31 after adjustments		
Trend assumption: Linear deterministic trend		
Series: BIFSI MPR EXR TBR LNGFCF		
Lags interval (in first differences): 1 to 2		
Unrestricted Cointegration Rank Test (Trace)		
Hypothesized	Trace	0.05

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.802178	100.7995	69.81889	0.0000
At most 1 *	0.625628	50.56751	47.85613	0.0272
At most 2	0.411816	20.10982	29.79707	0.4155
At most 3	0.110431	3.657625	15.49471	0.9292
At most 4	0.000969	0.030054	3.841466	0.8623
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.802178	50.23195	33.87687	0.0003
At most 1 *	0.625628	30.45769	27.58434	0.0208
At most 2	0.411816	16.45220	21.13162	0.1995
At most 3	0.110431	3.627572	14.26460	0.8964
At most 4	0.000969	0.030054	3.841466	0.8623
Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):				
BIFSI	MPR	EXR	TBR	LNGFCF
-4.650977	1.768409	-0.496808	0.209822	3.993011
0.606812	-1.642197	0.073324	0.872889	1.302126
-0.625299	0.009665	0.010489	0.642532	-2.800877
-0.449260	-0.536113	0.000909	0.311027	-1.861012
0.373979	-0.549250	0.159444	0.129683	-2.366235

Unrestricted Adjustment Coefficients (alpha):					
D(BIFSI)	0.411286	-0.036377	0.100404	-0.046074	-0.004752
D(MPR)	0.204177	0.189491	-0.311088	0.043055	0.008033
D(EXR)	-1.236866	-3.734815	-1.371921	-0.110925	0.095484
D(TBR)	0.636323	0.005925	-0.898831	0.140525	-0.009544
D(LNGFCF)	-0.033514	-0.011376	0.016123	0.038063	0.000390

1 Cointegrating Equation(s):		Log likelihood	-147.6640	
Normalized cointegrating coefficients (standard error in parentheses)				
BIFSI	MPR	EXR	TBR	LNGFCF
1.000000	-0.380223	0.106818	-0.045114	-0.858532
	(0.04022)	(0.00369)	(0.02786)	(0.11792)

Adjustment coefficients (standard error in parentheses)				
D(BIFSI)	-1.912882			
	(0.35524)			
D(MPR)	-0.949622			
	(0.66297)			
D(EXR)	5.752637			
	(6.46960)			
D(TBR)	-2.959525			
	(1.63030)			
D(LNGFCF)	0.155871			
	(0.12800)			
2 Cointegrating Equation(s):		Log likelihood	-132.4351	
Normalized cointegrating coefficients (standard error in parentheses)				
BIFSI	MPR	EXR	TBR	LNGFCF
1.000000	0.000000	0.104527	-0.287627	-1.349637
		(0.00745)	(0.02807)	(0.26690)
0.000000	1.000000	-0.006026	-0.637819	-1.291625
		(0.01690)	(0.06364)	(0.60506)
Adjustment coefficients (standard error in parentheses)				
D(BIFSI)	-1.934956	0.787061		
	(0.35610)	(0.18322)		
D(MPR)	-0.834636	0.049886		
	(0.63674)	(0.32762)		
D(EXR)	3.486306	3.946017		
	(5.13975)	(2.64452)		
D(TBR)	-2.955930	1.115550		
	(1.64410)	(0.84593)		
D(LNGFCF)	0.148968	-0.040584		
	(0.12850)	(0.06612)		
3 Cointegrating Equation(s):		Log likelihood	-124.2091	
Normalized cointegrating coefficients (standard error in parentheses)				
BIFSI	MPR	EXR	TBR	LNGFCF
1.000000	0.000000	0.000000	-0.933233	3.652130
			(0.18465)	(0.86338)
0.000000	1.000000	0.000000	-0.600601	-1.579968
			(0.06375)	(0.29810)
0.000000	0.000000	1.000000	6.176463	-47.85152
			(1.77934)	(8.31962)

Adjustment coefficients (standard error in parentheses)				
D(BIFSI)	-1.997739	0.788031	-0.205944	
	(0.34232)	(0.17459)	(0.03634)	
D(MPR)	-0.640113	0.046879	-0.090806	
	(0.54644)	(0.27869)	(0.05801)	
D(EXR)	4.344167	3.932758	0.326244	
	(4.96674)	(2.53311)	(0.52723)	
D(TBR)	-2.393891	1.106863	-0.325124	
	(1.34128)	(0.68407)	(0.14238)	
D(LNGFCF)	0.138887	-0.040429	0.015985	
	(0.12845)	(0.06551)	(0.01364)	

4 Cointegrating Equation(s):		Log likelihood	-122.3953	
Normalized cointegrating coefficients (standard error in parentheses)				
BIFSI	MPR	EXR	TBR	LNGFCF
1.000000	0.000000	0.000000	0.000000	5.844287
				(2.96656)
0.000000	1.000000	0.000000	0.000000	-0.169162
				(1.96808)
0.000000	0.000000	1.000000	0.000000	-62.35998
				(19.9561)
0.000000	0.000000	0.000000	1.000000	2.348992
				(3.27495)

Adjustment coefficients (standard error in parentheses)				
D(BIFSI)	-1.977039	0.812732	-0.205986	0.104726
	(0.34017)	(0.17692)	(0.03595)	(0.08208)
D(MPR)	-0.659456	0.023797	-0.090766	0.021753
	(0.54688)	(0.28444)	(0.05779)	(0.13197)
D(EXR)	4.394001	3.992226	0.326143	-4.435603
	(4.98761)	(2.59409)	(0.52707)	(1.20354)
D(TBR)	-2.457024	1.031526	-0.324996	-0.395135
	(1.33857)	(0.69620)	(0.14146)	(0.32301)
D(LNGFCF)	0.121787	-0.060834	0.016019	0.005236
	(0.12217)	(0.06354)	(0.01291)	(0.02948)

Date: 03/07/17 Time: 13:27
Sample (adjusted): 2008Q4 2016Q2
Included observations: 31 after adjustments
Trend assumption: Linear deterministic trend
Series: BIFSI MPR EXR TBR LNGFCF

Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.01	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.802178	100.7995	77.81884	0.0000
At most 1	0.625628	50.56751	54.68150	0.0272
At most 2	0.411816	20.10982	35.45817	0.4155
At most 3	0.110431	3.657625	19.93711	0.9292
At most 4	0.000969	0.030054	6.634897	0.8623

Trace test indicates 1 cointegrating eqn(s) at the 0.01 level

* denotes rejection of the hypothesis at the 0.01 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.01	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.802178	50.23195	39.37013	0.0003
At most 1	0.625628	30.45769	32.71527	0.0208
At most 2	0.411816	16.45220	25.86121	0.1995
At most 3	0.110431	3.627572	18.52001	0.8964
At most 4	0.000969	0.030054	6.634897	0.8623

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.01 level

* denotes rejection of the hypothesis at the 0.01 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

BIFSI	MPR	EXR	TBR	LNGFCF
-4.650977	1.768409	-0.496808	0.209822	3.993011
0.606812	-1.642197	0.073324	0.872889	1.302126
-0.625299	0.009665	0.010489	0.642532	-2.800877
-0.449260	-0.536113	0.000909	0.311027	-1.861012
0.373979	-0.549250	0.159444	0.129683	-2.366235

Unrestricted Adjustment Coefficients (alpha):

D(BIFSI)	0.411286	-0.036377	0.100404	-0.046074	-0.004752
D(MPR)	0.204177	0.189491	-0.311088	0.043055	0.008033
D(EXR)	-1.236866	-3.734815	-1.371921	-0.110925	0.095484
D(TBR)	0.636323	0.005925	-0.898831	0.140525	-0.009544
D(LNGFCF)	-0.033514	-0.011376	0.016123	0.038063	0.000390

1 Cointegrating Equation(s):	Log likelihood	-147.6640

Normalized cointegrating coefficients (standard error in parentheses)				
BIFSI	MPR	EXR	TBR	LNGFCF
1.000000	-0.380223	0.106818	-0.045114	-0.858532
	(0.04022)	(0.00369)	(0.02786)	(0.11792)

Adjustment coefficients (standard error in parentheses)	
D(BIFSI)	-1.912882
	(0.35524)
D(MPR)	-0.949622
	(0.66297)
D(EXR)	5.752637
	(6.46960)
D(TBR)	-2.959525
	(1.63030)
D(LNGFCF)	0.155871
	(0.12800)

2 Cointegrating Equation(s):		Log likelihood	-132.4351	
Normalized cointegrating coefficients (standard error in parentheses)				
BIFSI	MPR	EXR	TBR	LNGFCF
1.000000	0.000000	0.104527	-0.287627	-1.349637
		(0.00745)	(0.02807)	(0.26690)
0.000000	1.000000	-0.006026	-0.637819	-1.291625
		(0.01690)	(0.06364)	(0.60506)

Adjustment coefficients (standard error in parentheses)		
D(BIFSI)	-1.934956	0.787061
	(0.35610)	(0.18322)
D(MPR)	-0.834636	0.049886
	(0.63674)	(0.32762)
D(EXR)	3.486306	3.946017
	(5.13975)	(2.64452)
D(TBR)	-2.955930	1.115550
	(1.64410)	(0.84593)
D(LNGFCF)	0.148968	-0.040584
	(0.12850)	(0.06612)

3 Cointegrating Equation(s):		Log likelihood	-124.2091	
Normalized cointegrating coefficients (standard error in parentheses)				
BIFSI	MPR	EXR	TBR	LNGFCF
1.000000	0.000000	0.000000	-0.933233	3.652130
			(0.18465)	(0.86338)

0.000000	1.000000	0.000000	-0.600601	-1.579968	
			(0.06375)	(0.29810)	
0.000000	0.000000	1.000000	6.176463	-47.85152	
			(1.77934)	(8.31962)	

Adjustment coefficients (standard error in parentheses)					
D(BIFSI)	-1.997739	0.788031	-0.205944		
	(0.34232)	(0.17459)	(0.03634)		
D(MPR)	-0.640113	0.046879	-0.090806		
	(0.54644)	(0.27869)	(0.05801)		
D(EXR)	4.344167	3.932758	0.326244		
	(4.96674)	(2.53311)	(0.52723)		
D(TBR)	-2.393891	1.106863	-0.325124		
	(1.34128)	(0.68407)	(0.14238)		
D(LNGFCF)	0.138887	-0.040429	0.015985		
	(0.12845)	(0.06551)	(0.01364)		

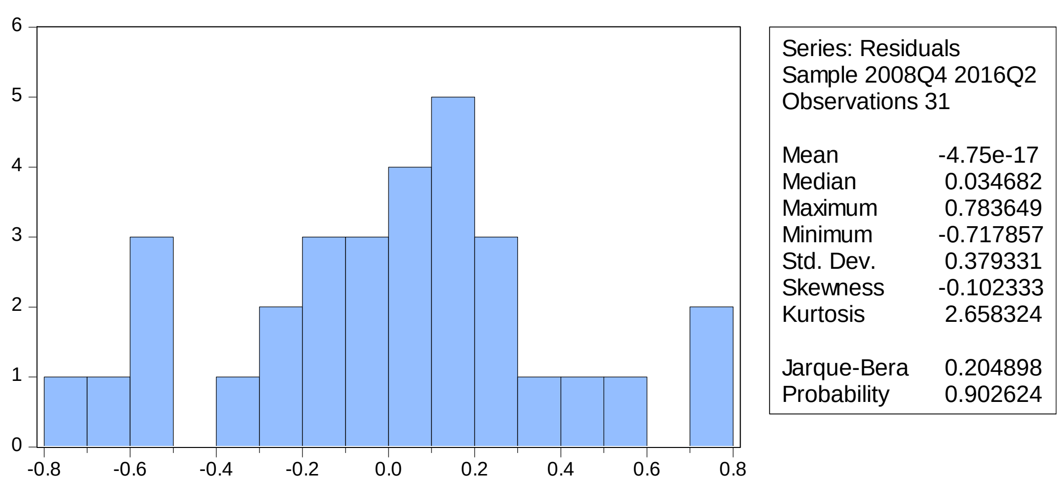
4 Cointegrating Equation(s):		Log likelihood	-122.3953		
Normalized cointegrating coefficients (standard error in parentheses)					
BIFSI	MPR	EXR	TBR	LNGFCF	
1.000000	0.000000	0.000000	0.000000	5.844287	
				(2.96656)	
0.000000	1.000000	0.000000	0.000000	-0.169162	
				(1.96808)	
0.000000	0.000000	1.000000	0.000000	-62.35998	
				(19.9561)	
0.000000	0.000000	0.000000	1.000000	2.348992	
				(3.27495)	

Adjustment coefficients (standard error in parentheses)					
D(BIFSI)	-1.977039	0.812732	-0.205986	0.104726	
	(0.34017)	(0.17692)	(0.03595)	(0.08208)	
D(MPR)	-0.659456	0.023797	-0.090766	0.021753	
	(0.54688)	(0.28444)	(0.05779)	(0.13197)	
D(EXR)	4.394001	3.992226	0.326143	-4.435603	
	(4.98761)	(2.59409)	(0.52707)	(1.20354)	
D(TBR)	-2.457024	1.031526	-0.324996	-0.395135	
	(1.33857)	(0.69620)	(0.14146)	(0.32301)	
D(LNGFCF)	0.121787	-0.060834	0.016019	0.005236	
	(0.12217)	(0.06354)	(0.01291)	(0.02948)	

Appendix 3. Result of over-parameterized model

Dependent Variable: D(BIFSI)				
Method: Least Squares				
Date: 03/07/17 Time: 13:57				
Sample (adjusted): 2008Q4 2016Q2				
Included observations: 31 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.138805	0.125734	1.103957	0.2850
D(MPR)	-0.239669	0.150059	-1.597166	0.1286
D(MPR(-1))	0.236341	0.141742	1.667401	0.1137
D(MPR(-2))	-0.082833	0.130448	-0.634991	0.5339
D(EXR)	-0.031007	0.012235	-2.534254	0.0214
D(EXR(-1))	-0.025355	0.017782	-1.425850	0.1720
D(EXR(-2))	-0.056125	0.019720	-2.846093	0.0112
D(TBR)	0.130196	0.061760	2.108096	0.0502
D(TBR(-1))	-0.065082	0.047418	-1.372516	0.1877
D(TBR(-2))	0.108018	0.064540	1.673641	0.1125
D(LNGFCF)	-2.078864	0.601428	-3.456548	0.0030
D(LNGFCF(-1))	-0.280636	0.503980	-0.556839	0.5849
D(LNGFCF(-2))	1.406211	0.540505	2.601659	0.0186
ECM(-1)	-0.600163	0.157011	-3.822435	0.0014
R-squared	0.828652	Mean dependent var		-0.210733
Adjusted R-squared	0.697621	S.D. dependent var		0.793252
S.E. of regression	0.436201	Akaike info criterion		1.481025
Sum squared resid	3.234615	Schwarz criterion		2.128633
Log likelihood	-8.955895	Hannan-Quinn criter.		1.692129
F-statistic	6.324094	Durbin-Watson stat		2.614848
Prob(F-statistic)	0.000314			

Appendix 4. Result of normality test

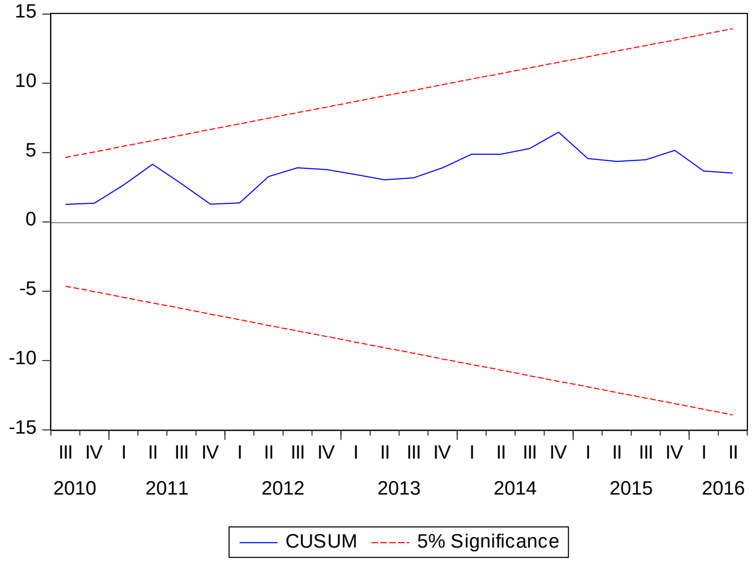


Appendix 5. Result of serial correlation test

Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	2.017955	Prob. F(2,19)		0.1604
Obs*R-squared	5.431224	Prob. Chi-Square(2)		0.0662

Test Equation:				
Dependent Variable: RESID				
Method: Least Squares				
Date: 04/20/17 Time: 13:47				
Sample: 2008Q4 2016Q2				
Included observations: 31				
Presample missing value lagged residuals set to zero.				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.057898	0.121229	0.477594	0.6384
D(MPR)	0.009552	0.136765	0.069843	0.9450
D(MPR(-1))	0.036903	0.111745	0.330248	0.7448
D(MPR(-2))	-0.011176	0.115091	-0.097108	0.9237
D(EXR)	0.001517	0.011073	0.137025	0.8925
D(EXR(-2))	-0.007484	0.019050	-0.392875	0.6988
D(TBR)	-0.024438	0.053055	-0.460619	0.6503
D(LNGFCF)	-0.313385	0.576513	-0.543587	0.5930
D(LNGFCF(-2))	0.098202	0.493013	0.199187	0.8442
ECM(-1)	0.338156	0.215669	1.567934	0.1334
RESID(-1)	-0.602101	0.356319	-1.689781	0.1074
RESID(-2)	-0.527277	0.300411	-1.755183	0.0953
R-squared	0.175201	Mean dependent var		-4.75E-17
Adjusted R-squared	-0.302315	S.D. dependent var		0.379331
S.E. of regression	0.432889	Akaike info criterion		1.447972
Sum squared resid	3.560457	Schwarz criterion		2.003064
Log likelihood	-10.44357	Hannan-Quinn criter.		1.628918
F-statistic	0.366901	Durbin-Watson stat		2.175459
Prob(F-statistic)	0.954021			

Appendix 6. Result of model stability test (CUSUM TEST)



Appendix 7. Result of model stability test (CUSUM OF SQUARES TEST)