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Altman's Z-Score Discriminant Analysis and Bankruptcy Assessment of Banks in Nigeria

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***Abstract*:** This study aims to determine the distress level subsisting in the bridge banks set up by the Central Bank of Nigeria in 2011 to take over the nationalized banks; and the 2011-classified unsound banks using the Altman's discriminant analysis model. Secondary data from four sampled classified distressed and unsound banks from the declared six for two years preceding their nationalization and two years after using the stratified sampling technique were analysed using the Alman Z-score discriminant analysis. Results shows that there are marginal improvements in the financial status of the sampled banks between 2010-2013 but they are still in a bankrupt position with Union Bank Plc, Wema Bank Plc, Keystone Bank Ltd and Mainstreet Bank Ltd having a Z-score of -0.56, 0.417, 1.5 and 0.45 respectively at 2013, all below the minimum threshold of 2.675 for classification of a bank as sound and non-bankrupt. This implies that the general broad-based monetary policy measures introduced by the CBN for the financially distressed bank are not much effective in resolving their financial crises in general, making necessary the introduction of bank-specific monetary and financial policies to solve identified bank-specific problems, and the CBN directly supervising these banks with daily monitoring of their operations.

Key words: Bankruptcy, discriminant analysis, failed banks, financial crises, Z-score

1.0 Introduction

Prediction of corporate failures is rife in foreign literature, but non-existent in Nigeria except that by the Central Bank of Nigeria carried out in the course of performing its statutory functions. To Yildiz and Akkoc (2009), repeated global financial crises have increased corporate bankruptcies necessitating its prediction. Erdogan (2008) noted that moves by a country at the liberalising its financial market (as witnessed during the recent bank consolidation exercise in Nigeria) opens such economies, increasing its fragility; making it vulnerable to further global economic crises. Yildiz and Akkoc (2009)[b] contended that monitoring and

controlling of the banking sector in any economy is important for maintaining confidence in such a financial system. This to them necessitates its tight regulation to make it healthy. To Lanine and Vennet (2006), the healthier a country's banking system, the greater will be investors' confidence; with attendant increases in private savings and allocation of credit facilities to relevant productive sectors with positive effects on economic growth. The occurrence of bank bankruptcies is seen to have a greater effect on the economy than bankruptcies in other sectors. Yildiz and Akkoc (2009)[a] observed that its effect exceeds bank stakeholders extending to the entire economy.

Varied reasons had been adduced for corporate bankruptcies. Sullivan et al (1998), Argentin(1997), Blazy and Combier (1997) and Lussier (1995) attributed corporate failures to accidental factors (malfeasance, death of leader, fraud, disasters, litigation), market factors (loss of market share, failure of customers, inadequate products), financial threats (undercapitalization, cost of capital, default on payment, loan refusal), macroeconomic factors of fragility (decline in demand, increased competition, high interest rate), information and managerial problems (incompetence, prices), costs and production structures, and strategy failures. The immediate and long-run effects of these are evident in corporate financial positions measurable using corporate liquidity status indicators: current and acid-test ratios; corporate financial risks measurable using the gearing ratios; and firm profitability measurable using operating profits to sales ratio. du Jardin (2009) noted that causes of corporate failures are predictable over time and preventable. To Perez (2002), these symptoms are observable from final accounts of such firms. Assets and credit evaluation measures were introduced by the Central Bank of Nigeria (CBN) to identify early enough bankruptcy symptom in banks in Nigeria, in addition to frequent liquidity bailouts of these banks by the apex bank. The continuous negative liquidity positions and toxic nature of bank assets resulted in the takeover of three deposit money banks (AfriBank Nig Plc, Spring Bank Nig Plc, and BankPHB Plc) by the CBN in 2011 as they were financially distressed. Three bridge banks: Mainstreet Bank Ltd, Enterprise Bank Plc and Keystone Bank Ltd were set up to take over their operations by the CBN (CBN 2013). Three other financially unsound banks: Oceanic Bank Plc, FinBank Plc and Intercontinental Bank Plc were acquired by other banks within this period. Wema Bank Plc and Union Bank Plc were given bailouts by the CBN to resolve marginally their financial problems; with additional finances from rights issues. How financially sound are these bridge and unsound banks since the administrative and monetary intervention of the CBN in 2011? The remaining part of this paper is divided into: objectives/justification for the study, research hypothesis, theoretical framework and review of literature, methodology, research results and policy implications of findings, conclusions and recommendations.

1.2 Research objective/justification for the study

The objective of this study is to determine the financial distress level of the three bridge banks set up to take over the three nationalized banks in

2011 and three other non-nationalized banks classified as unsound by the CBN in 2011 using the Altman's discriminant analysis model. The existence of claims and counter claims in financial literature of political undertone underlying the takeover banks nationalized by the CBN in 2011 without prior determination of their distress levels and the ineffectiveness of the takeover made this study apt to determine the financial status of the nationalized banks at the time of their takeover; as to whether they were distressed or not and the change in financial status if any after the takeover.

1.3 Research hypothesis

The following hypothesis is tested in this study:

H_o: The 2011-classified unsound deposit banks are not yet financially sound, periods after their takeover.

H_1: The 2011-classified unsound deposit banks are financially sound, periods after their takeover.

2.0 Review of literature

2.1 Theoretical framework

Globalization and cross-border financial activities transfer financial crises across borders making national monetary control and administration difficult and cumbersome. Advanced theories and models offer monetary regulators means of assessing the liquidity and financial positions of deposit money banks within its control and introduce corrective measures when distress symptoms are identified. Distress predictions seems a viable option for monetary regulators as identifiable-potential distress cases are corrected to avert bank financial crises with its contagion effect on other deposit money banks in the country and negative effects on the country's economy. Models (Altman's z-score discriminant analysis, neural-fuzzy model, factor analysis, logistic regression analysis, multivariate regression analysis and the artificial neural network) abound in bankruptcy literature for predicting corporate failures. These models have successfully predicted corporate failures firms within and across industries the world over with the Altman (1968) z-score analysis as the most successful (Arora and Saini, 2013; Martin et al, 2011; Jordan et al, 2010; Bellovary et al, 2007).

2.2 The Altman Z-score model

In a bid to determine in advance the likelihood of corporate bankruptcies, Altman (1968) developed the Z-score discriminant model which uses a multivariate approach based on the values of both accounting and categorical variable measures. To him, as failed companies exhibit economic trends and proportions different from financially healthy firms, accounting and analysis of categorical measures' values need to be combined and weighted to produce another measure (standard credit risk). This he added, make better discrimination between failed and healthy firms. The model uses the multiple discriminant analysis to analyse variables to maximize the difference between group differences while maximizing differences within the group. To Kyriazopoulos et al (2012), this model uses a sequential process in which the processor includes or excludes variables using established statistical criteria with the optimal Z-score equivalent to:

$ZETA_c = \{Inq_1c_1\}/q_2c_2$

where q_1 is prior bankruptcy and q_2, non-bankrupt. C_1 and c_2 are costs of type 2 and 1 errors. Useable ratios for determining Z-score are:

i. Short-term debt/book value of equity (leverage)

ii. Cash/total assets (liquidity)
iii. Earnings before interest and taxes/total assets (profitability)
iv. Retained earnings/total assets (cover)
v. Earnings before interest and taxes/interest paid.

In Altman's (1983, 1993) revised model, five ratios were determined as jointly the best discriminators between business viability and failure. In the revised model, Altman (1983) required the use of: working capital/total assets (X1), retained earnings to total assets (X2), EBIT/total assets (X3), market value of equity/book value of total debt (X4) and sales /total assets ratio (X5); with Z as the overall index (Altman's score). He posited that the final discriminant function for public firms is:
Z= 0.012X1 + 0.014X2 + 0.033X3 + 0.006X4 + 0.999X5; and
for private firms, a re-estimation of the model substituting the book value of equity for market value in X4, giving the revised Z-score model:
Z=0.717X1 + 0.847X2 + 3.107X3 + 0.420X4 + 0.998X5
With X4= book value of equity/book value of total liabilities.
Firm overall Z-score of <2.675 indicates that is or that there is 95% chance of such a firm being bankrupt within twelve months. In practice, Altman (1968) argued that Z scores of ≥ 1.81≤ 2.99 indicate grey area; values of < 1.81 show that the firm is bankrupt, and Z-score of > 2.99 indicates that the firm is non-bankrupt. Arora and Saini (2013) and Martin et al (2011) argued that the empirical results of Altman's (1968) model and subsequent studies based on this model had widely, successfully and consistently predicted corporate failures, and has proved effective in predicting corporate bankruptcies across industries in various countries over different periods.

Altman Z-score model and corporate bankruptcy predictions

Bank bankruptcy indicators and predictions are rife in literature. Detailing indicators of corporate failures based on importance, du Jardin (2009) argued that financial variables (measured by financial ratios) obtainable from the firm statement of financial positions and comprehensive incomes are best used. To him, these ratios express the relationship between two variables either within a statement or between variables in both statements increasing the coverage of most corporate failure determining factors. In their study, Salmi and Martikainen (1994) used the financial data of different firms to control for size effect. Horrigan (1983) contended that non-controlling for size is itself positive on any study, as size itself may be a variable of interest in explaining some financial characteristics of firms. To du Jardin (2009), use of ratios makes interpretation accurate and comparable. Adding, Lev and Sunder (1979) noted that financial ratio data rely on the proportionality between the numerator and the denominator. Findings by Back et al (1994) showed that models built with financial ratios alone perform better than those built with common financial variables. This argument was substantiated by Pompe and Bilderbeek (2005), Perez (2002), Atiya (2001), Mossman et al (1998) and Keasey and Watson (1987). Relating bankruptcy to stock returns, Beaver (1968) found that equity returns predict bankruptcy earlier that financial ratios in general. Furthering, Clark and Weinsten (1983) and Altman and Brenner (1981) argued

that stock market indicates bankruptcy at least a year before it occurs. To Aharony et al (1980), volatility in firm-specific return increases as bankruptcy converges.

From a monetary perspective, Hauser and Booth (2011) opined that accurate assessment of the probability of bankruptcy can lead to sound lending practice and better fair value of interest rates that reflect credit risks; adding that bankruptcy could be predicted in all sectors. The need for distress prediction in the financial sector is more pronounced as credit or counterparty risk assessment by rating agencies are reactive and not predictive. These predictions, to Hauser and Booth (2011) are feasible as bankrupt firms are outliners from the perspective of a group of healthy firms. Commenting on the spiral effects of bank bankruptcies, Vaziri et al (2012) noted that assets' market will experience a high level of volatility through huge movements in the exchange rates, interest rates and commodity prices; recommending that banks and other financial institutions need to add risk management to their investment decisions. In assessing bank financial distress, Betz et al (2013) suggested complimenting bank-specific vulnerabilities with indicators for country-level macro-financial imbalances and banking sector vulnerabilities.

On causes of bank bankruptcy in Europe, USA and Asia, Vaziri et al (2012) argued that changes in market, policy, economy and political influences were responsible factors, with these bankruptcies transcending national boundaries. The global crises, they added, resulted in mergers, acquisitions, takeovers, part nationalization and liquidation; attributing the crises in detail to sub-prime mortgages, collateralized debt obligations, frozen credit markets and credit swap defaults reflected in excessive lending concentrations, deteriorating financial ratios, tracking loan recoveries to gross loan charge-offs, deposit rates higher than market rates, off-balance sheet liabilities, delayed financials, change in auditors, change in management, use of political influence, rumors in the money market, share price volatility and deterioration of the economy. To Beltratti and Stulz (2009), poor bank and country-level governances, poor country-level regulation, poor balance sheet status and low profitability contributed to the poor performances of banks across countries. Specifically, Kiff and Mills (2007) attributed the banking crises in the US in 2000's to increasing inflation in the housing market. Adding, kwan and Eisenbeis (1995) noted that under-capitalised banks took high risk which they could not absorb, supporting earlier arguments by Kim and Santomero (1988) and Koehn and Santomero (1980). Commenting, Vilen (2010) noted that though many banks in the US failed in 1985, the problem originated from the 1960's with deregulation of the US banking sector to the early 1980's. This to him, increased competition among banks resulted in the introduction of sharp practices in the sector and 'cooking' of the books, both negatively affecting bank profit. The gravity of the crises was most felt in 2008 with the failure of Lehman Brothers which revealed the seriousness and depth of the financial crises. Using bank loan portfolios, Gonzalez-Hermosillo (1999) concluded that banks with a high level of commercial and industrial loans relative to total loans suffered more severe losses than banks with more

conservative loans. To reduce risk exposures, Furlong and Keely (1990) recommended an increase in banks' capital base. Governments across the globe also introduced bail-outs to banks to curtail the negative effects of bank bankruptcies on their economies. These recurring bankruptcies make necessary the continual assessment of the financial status of deposit money banks operating in a country.

Empirical tests of models' efficacies in predicting corporate failures in US, Europe and Asia abound in bankruptcy literature. These models are the Altman z-score, multiple discriminant analysis, the logistic analysis, the artificial neural network, factor analysis and the multiple regression analysis. Erdogan (2008) used the logistic regression model with relevant ratios which predicted bank bankruptcies between 1997 and 1999 in Turkey. Using the same set of banks during the period 2000 – 2001, Erdogan (2008) concluded that the neurofuzzy prediction model outperforms the multiple discriminant analysis (MDA) and the artificial neural network (ANN) prediction models in predicting bank failures in Turkey. Beaver (1966) used the financial ratios, Sinkey (1975) the MDA, Meyer and Pifer (1970) the multiple regression analysis (MRA), Martin (1997) and Ohlson (1980) the logistic regression analysis, West (1985) the factor analysis; Cielen et al (2004) and Kao and Liu (2004), Tan and Diharjo (2001), Spicegood and Clark (2001), Alam et al (2000), Yang et al (1999), Zhang et al (1999), Bell (1997), Tsukkuda and Baba (1994), Wilson and Sharda (1994), the artificial neural networks; and Lanine and Vennet (2006) and Kolari et al (2002) the trait recognition model. Bellovary et al (2007) concluded from their study of bankruptcy prediction results from 1930 to 2007 that the Altman's (1968) MDA is more accurate; cautioning against the use of multiple factors in any bankruptcy prediction model as two factors are capable of predicting firm distress as with model using 21 factors. This argument is supported by findings of Pang and Kogel (2013) from their study of US retail business with a 97.5% accuracy of Altman's (1968) model predictions.

Pandey (2010) and Weston and Brigham (1975) argued that ratios prepared from values in annual reports (which may be subjected to manipulations), may not seem an ideal tool for corporate comparison especially of firms of different sizes as ratio analysis do not recognize firm size. As variables' values are combination of other variables, Weston and Brigham (1975) noted that variations in values within a given set of variables changes the total value of that variable with effects on the ratio values; contending that ratios are 'snapshots' of the picture at a point in time but trends in motion may exist rapidly, eroding a relatively good current position. With these drawbacks, both concluded that ratio analysis is still the best for corporate assessments as it relates more variables in different statements.

3.0 Research methodology

3.1 Population for the study

The population for this study is the 21 deposit money banks in Nigeria.

3.2 Study samples and sampling technique

The two-stage sampling technique was used for this study.

Stage 1: the six CBN declared unsound banks in 2011 were purposively sampled.

Stage 2: four of the CBN declared unsound banks in 2011 were sampled

using the stratified sampling technique as they occupy the top strata of unsound banks in Nigeria.

Thus two of the existing three bridge banks (Keystone Bank Ltd and the then Mainstrreet Bank Ltd) set up by the Central Bank of Nigeria in 2011 to take over the nationalized banks: Bank PHB Plc and Afribank Plc respectively; and Wema Bank Plc, and Union Bank Plc are used for this study. The sampled banks were suddenly declared unsound by the Central Bank of Nigeria without any publicly known signs of financial crises to the shock of shareholders and the banking public.

3.3 Sources of data

Data for this study are ratios computed from secondary data obtained from published annual reports of sampled 2011-classified unsound banks on short-term debt/book value of equity (leverage), cash/total assets (liquidity), earnings before interest and taxes/total assets (profitability), retained earnings/total assets (cover), and earnings before interest and taxes/interest paid.

3.4 Validity and reliability of data

Secondary data from annual reports of sampled banks used for this study were prepared to meet the requirements of the Companies and Allied matters Act, 1999, the Banking Act, the Nigerian Stock Exchange annual information disclosure requirements (as sampled unsound banks are/were quoted banks), and audited by their external auditors making data obtained therefrom valid and reliable.

3.5 Data analysis technique and model justification

To determine the existence of financial distress in the two sampled bridge banks two years prior to their takeover by the CBN in 2011 and two years after, and two other 2011 non-nationalized unsound banks, we use the Altman's z-score discriminant analysis model on the relevant Altman (1968) z-score ratios computed from their annual reports from 2010-2013. This model was successful in bankruptcy prediction studies by Kyriazopoulos et al (2012), Sinkey (1975), Meyer and Pifer (1970), and Beaver (1966). Salmi and Martikainen (1994) argued that corporate financial data are preferable for use in models for predicting corporate failures; suggesting that such data should be financial ratios, making its use in this study accurate. Specifically, this study uses ratios capable of determining the financial health of firms (liquidity and profitability ratios) as used in similar studies (du Jardin, 2009; Back et al 1994, Salmi and Martikainen, 1994; Odom and Sharda, 1990; Zavgren, 1985; Zmijewski, 1984; Lev and Sunder, 1979; and Altman, 1968). The data envelopment analysis (DEA) and the stochastic frontier analysis (SFA) make possible the empirical determination of the production efficiency of decision-making units; and benchmarking in operations management. Sherman and Zhu (2013) referred to DEA as "balanced benchmarking". Studies by Seiford and Thrall (1990), Charnes et al (1978), Brockhoff (1970) and Farrell (1957) showed the efficiency of the technique in benchmaking corporate performances using the variables: number of employees, service quality, environmental safety and fuel consumption. These variables are cost minimizing determinants affecting corporate profits and do not determine the liquidity status of firms and corporate financial distress; making it inappropriate for this study.

Values for z-score variables' components and overall z-score for sampled banks are shown in tables 1-4 where WC= net working capital, TA=total assets, RE=retained earnings, EBIT=earnings before interest and taxes, MVE=market value of equity, BVD=book value of debt, and T=turnover.

Table 1: Wema Bank Plc annual Z-scores

z-score variables	2013	2012	2011	2010
WC/TA	-0.71	-0.87	-0.53	-0.37
RE/TA	-0.11	-0.15	-0.16	-0.15
EBIT/TA	0.0031	0.022	-0.033	0.06
MVE/BVD	0.34	0.11	0.13	0.13
T/TA	0.06	0.07	0.12	0.10
Z	0.417	-0.818	-0.473	-0.23

The Altman z-score values for Wema Bank Plc improved from steadily from -0.23 in 2010 to +0.417 in 2013 (table 1).

Table 2: Union Bank Plc annual Z-scores

z-score variables	2013	2012	2011	2010
WC/TA	-0.49	-0.50	-0.49	-0.82
RE/TA	-0.29	-0.30	-0.34	-0.29
EBIT/TA	0.066	0.026	-0.08	0.10
MVE/BVD	0.11	0.10	0.10	0.03
T/TA	0.04	0.02	0.09	0.14
Z	-0.56	0.246	-0.72	-0.84

The Altman z-score values for Union Bank Plc for the study period fluctuated from -0.84 to -0.72 to +0.246 and -0.56 (table 2).

Table 3: Mainstreet Bank Ltd annual Z-scores

z-score variables	2013	2012	2011 (As AfriBank Nig Plc)	2010(As AfriBank Nig Plc)
WC/TA	-0.32	-0.39	-0.41	-0.40
RE/TA	0.02	0.01	-0.37	-0.501
EBIT/TA	0.03	0.07	0.09	0.091
MVE/BVD	0.58	2.66	1.10	1.17
T/TA	0.14	0.16	0.10	0.12
Z	0.45	2.51	0.51	0.48

Mainstreet Bank Ltd's Altman z-score for the study period also fluctuated, increasing from +0.48 in 2010 to +0.51 in 2011 to +2.51 in 2012, declining to +0.45 in 2013 (table 3).

Table 4: Keystone Bank Ltd annual Z-scores

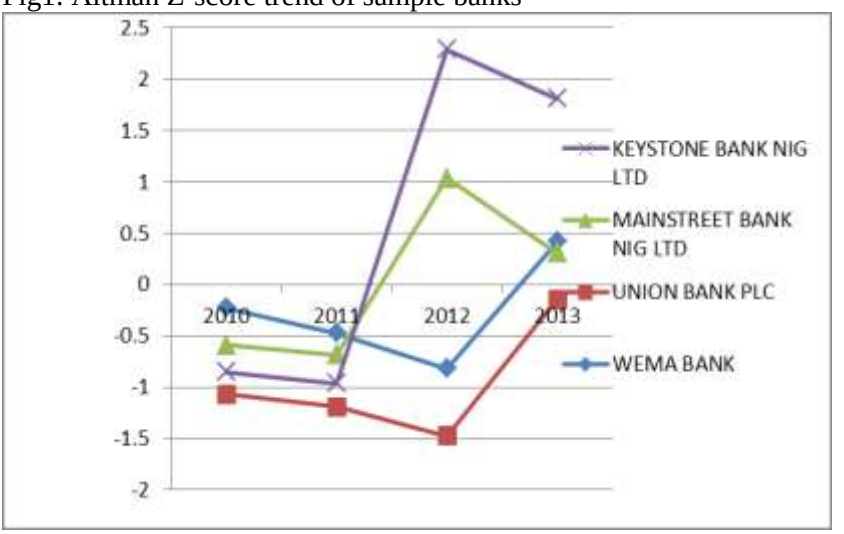
z-score variables	2013	2012	2011	2010
WC/TA	-0.50	-0.53	-0.55	-0.70
RE/TA	0.03	-0.02	0.02	0.00
EBIT/TA	0.07	0.04	0.03	-0.58
MVE/BVD	0.21	0.17	0.14	0.05
T/TA	1.69	1.59	0.08	-0.43
Z	1.50	1.25	-0.28	-0.26

The Altman z-score for Keystone bank Ltd increased steadily from -0.26 in 2010 to +1.50 in 2013 (table 4).

4.0 Research results and policy implications of findings

The Altman Z-score for the four sampled banks for the four were <1.99 showing that they were in a bankrupt position throughout the study period. Thus we accept H_o i.e. the 2011-unsound banks are not yet financially sound. The Altman Z-score for Wema Bank Plc worsen from -0.23 in 2010 to -0.473 in 2011, and further to -0.818 in 2012, increasing significantly to +0.417 in 2013 (fig 1); but still below the minimum threshold of 2.675 indicating that the bank is still in a gross bankrupt position which portends danger to Nigeria's financial system. Union Bank Nig Plc had a fairly improved result (though all negatives) from 2010-2013 with the Altman Z-score improving from -0.84 in 2010 to -0.72 in 2011, -0.654 in 2012 and -0.56 in 2013 (fig 1). The negative values for the years show the poor financial state of the bank in a grossly bankrupt position.

Fig1: Altman Z-score trend of sample banks



Keystone Bank Ltd (formerly BankPHB Plc) improved from a negative Z-score value of -0.26 in 2010 and -0.28 in 2011 before its takeover by the CBN to +1.25 in 2012 and +1.50 in 2013 after the takeover (fig 1). Though still in a bankrupt position, the positive results after the takeover shows improved the financial status of the bank which seemed attributable to the exercise of this administrative function by the CBN with attendant spiral effects on the financial sector. Mainstreet Bank Ltd (formerly AfriBank Nig Plc) had a steadily improved result from 2010 and 2011 of +0.48 and +0.51 respectively before its takeover by the CBN to +2.51 (in grey area of the Altman Z-score map) in 2012 which showed a positive effect of the takeover by the CBN on the financial situation of the bank. The financial situation of the bank worsened in 2013 with the fall of the Altman Z-score to +0.45 (fig 1), indicating the

deepening the bankruptcy crisis of the bank.

The two banks taken over by the CBN AfriBank Nig Plc and BankPHB Nig Plc showed improved financial status after the CBN takeover (though were still bankrupt) indicating the effectiveness of the performance of the regulatory functions by the CBN on the deposit money banks with positive effects on the banks with positive spiral effects on the financial sector of the Nigerian economy. Two distressed banks at 2011: Wema Bank Plc and Union Bank Plc not taken over by the CBN remained in a grossly bankrupt position (with Altman z-score <1.99 for the study period) exposing the error of the apex bank in 2011 with its non-takeover of both banks to instill administrative and financial discipline, and reverse the financial distress of both banks. The bankrupt positions of both banks with their continuous existence portends danger to Nigeria's financial sector because of the contagious effects of these banks on other banks and the entire financial sector.

5.0 Conclusions and recommendations

From this study, we conclude that 4 of the 21 deposit money banks in Nigeria: Wema Bank Nig Plc, Union Bank Nig Plc, Mainstreet Bank Nig Ltd (formerly Afribank Nig Plc) and Keystone Bank Nig Ltd (formerly BankPHB Plc) declared financially distressed by the CBN in 2011 are still in a grossly poor financial state, are unsound and bankrupt. The failure of the general broad-based monetary policies introduced by the CBN for these banks make necessary the introduction of bank-specific monetary and financial policies to solve identified bank-specific problems, and the direct supervision of these banks by the CBN with daily monitoring of their operations.

To avert the negative financial effects of these banks on the banking public, economic development of Nigeria and contagious effects on other banks in the sector and financial system, the apex bank should improve on and regularly assess the financial status of deposit money bank in Nigeria (especially these four banks), takeover Union Bank Plc and Wema Bank Plc and turn around their financial status as fairly done with Keystone Bank Ltd and Mainstreet Bank Ltd; and suspend the proposed sale of the nationalized banks until they are financially sound.

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