The Effectiveness of Altman's Z Score Model in Predicting the Financial Health of Banking Institutions in Ghana

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ABSTRACT

The purpose of this study was to assess the relevance and effectiveness of Altman's Z Score model in predicting the failures and the financial health of banking institutions in Ghana. The study was conducted using the quantitative research method and the descriptive analytical research design. Drawing on annual financial data from a sample of 5 failed banks and 21 non-failed banks licensed by the Bank of Ghana, the study examined the Altman Z Score model with data set from the 2012 financial year to the 2016 financial year. Analysis of the failed banks revealed a 75 per cent prediction accuracy for the Altman Z Score model five years prior to failure and a 100 per cent prediction accuracy four, three and two years prior to failure. Assessment of the financial health of the non-failed banks for the 2016 financial year, classified 9 banks as distressed, 11 banks into the grey zone and 1 bank as safe. The study concluded that Altman's Z Score model is an effective model for predicting the failures and financial health of banking institutions in Ghana and recommends its consideration and adoption as the model of choice for assessing the financial health and the possible failure of banking institutions in Ghana.

Introduction

Fundamental to every profit-minded corporate organisation is the survival of their business for the foreseeable future (Bello, 2011). Most corporate entities face a daily challenge of ensuring enough inflow of cash to meet their obligations to avoid corporate failure. According to Mbat and Eyo (2013) corporate failure is the inability of a corporate institution to meet its strategic financial and economic goals along with its legal obligations leading to termination of operations. Any business, irrespective of size, can fail if it does not produce the necessary cash flow to cover expenses and debt obligations (Revolvy, 2017). Corporate failure can result from numerous factors such as, ineffectiveness and inefficiency of management, socio-cultural factors, economic instability and public policies (Mbat & Eyo, 2013).

Corporate institutions in Ghana are not immune to the causes and consequences of corporate failure which is a global phenomenon. One noteworthy corporate failure in Ghana was the collapse of the national airline, Ghana Airways Limited, which ceased operations in 2015. The banking industry in Ghana, has seen notable corporate failures in recent times with seven banks collapsing within a one-year period leading to the loss of faith in the banking industry and loss of jobs for employees.

The Altman Z-Score formulated by Edward Altman in 1968, is a statistical tool used to measure the possibility of a company going bankrupt or failing. The formula evaluates seven simple pieces of data available in the company's public disclosure (Altman E. I., 1968). The required data include total assets, working capital, earnings before interest and tax, retained earnings, market value of equity, sales and total liabilities.

Various corporate failure prediction studies have been done using the Altman model. However, most of these studies have been done in developed economies and focused primarily on the manufacturing/industrial sector. Regarding African countries, a number of such studies have been done in Kenya, Nigeria, South Africa and Zimbabwe. Like the studies done in developed countries, all the studies done in African countries, except for two done in Zimbabwe (Ncube, 2014) and Kenya (Mamo, 2011), have focused on sectors other than the financial sector.

The absence of relevant information on the effectiveness of Altman's Z score model in predicting failures in the financial sector and the recent failure of seven local banks in Ghana naturally result in a very important research question of whether corporate failure prediction models such as the Altman Z Score model could have been used to predict the recent corporate failures of the banking institutions in Ghana.

Consequently, it is necessary to explore the effectiveness of determining the financial health and failure predictability of banking institutions in Ghana using the Altman's Z-score model. This study therefore seeks to ascertain the extent to which Altman's Z-score model could have been used in predicting the corporate failures of banking institutions in Ghana. In effect, the research is designed to assess the relevance and effectiveness of Altman's Z Score model in predicting the failures and financial health of banking institutions in Ghana. The outcome of this study will be of importance to managements of banks in the country. It will also advise the need for the development of a model specific for banks in Ghana.

Literature Review

Corporate Failure Prediction Using Financial Ratios

Corporate failure as a research area in finance has gained relevance since the failure of major banks like Barings Bank in 1995 and Lehman Brothers in 2008. Several studies have focused on the development of the most efficient corporate failure prediction model taking into consideration accounting data and statistical procedures. Extensive research has been done in the effort to develop corporate failure models (Altman, 1984;

Dimitras et al., 1996; Altman & Narayanan, 1997). Maricica and Georgeta (2012) examined the ability of financial ratios to give warning indications about the foreseeable downward progression of a firm's financial well-being and to distinguish between companies that are doing well and those that are not. The study was conducted on sixty-three listed companies on the Bucharest Stock Exchange (BSE). It revealed a distinction between failure of companies based on profitability and return, financial position, leverage and capital structure. There was however no clear distinction based on cash-flow, liquidity and capacity to payback debt and interest. The analysis period for the study was two years, from 2009 to 2010 and therefore raises questions over a long analysis period.

Ohlson (1980) looked at the probabilistic prediction of bankruptcy using financial ratios by observing 2,163 companies comprising 105 failed and 2,058 non-failed firms. Findings from the study outlined the size of the company, financial layout, performance and current liquidity as being statistically significant factors in predicting failure of a company within one year. In conclusion, Ohlson indicated that the predictive power of any model depends on when information from the financial report is available.

Liu and Wang (2016) considered the influence of cut off points in predicting the failure of firms in China. Financial ratios from 3,485 companies in China between 2003 and 2013 were analysed. The study revealed that the optimal cut-off points and the suggested logistic model for business failure prediction described mostly accuracy in the debt ratios one quarter prior to a failure and unadjusted economic value added two to four quarters prior to a failure. Therefore, debt ratios or unadjusted economic value added may be the best index to sense corporate failure in China. The study focused primarily on Chinese companies; therefore, it cannot be universally applicable or adopted due to the different economic factors and environments.

Altman's Z-Score Model

Altman (1968) questioned the adaptation of results from traditional ratio analysis for assessing the possible failure of firms both theoretically and practically. Altman's 1968 Z-score model studied 66 corporations in existence between 1946 - 1965 to formulate a function which best distinguishes between businesses in two mutually exclusive groups: failed and non-failed. Extracted data from the annual financial statements of the selected companies was used for the study. Failed and non-failed businesses were stratified by size and industry and chosen on a random stratified basis. The discriminant equation was formulated with 33 firms in each category. Due to the large quantity of variables found to be relevant pointers of corporate problems in earlier studies, 22 ratios were compiled for the study and categorised into five standard ratio categories including profitability, liquidity, solvency, leverage and activity ratios. The eventual discriminant function is as follows:

Equation 1: Altman's Z-score model

$$Z = 0.012X_1 + 0.014X_2 + 0.033X_3 + 0.006X_4 + 0.999X_5$$

where:

X_1 = Working capital/Total assets
X_2 = Retained Earnings/Total assets
X_3 = Earnings before interest and taxes/Total assets
X_4 = Market value of equity/Total liabilities
X_5 = Sales/Total assets
Z = Overall index

Discrimination Zones:
Z > 2.99 Safe Zone: Financially healthy
1.81 ≤ Z ≤ 2.99 Grey Zone: Could go either way
Z < 1.81 Distress Zone: Company at risk of failure within two years

Source: Altman (1968)

Using the above equation, firms which recorded a Z-Score above 2.99 fell into the non-bankruptcy sector, while firms with a Z-Score below 1.81

fell into the bankruptcy sector. Scores of within 1.81 and 2.99 were in the 'grey area'. The model classified 95 percent of the total sample correctly.
Altman later revised the Z-score model in 1983 to cover private companies since the 1968 model was based on data from publicly traded firms. The market value of equity was therefore replaced with the book value of equity to enable the model to be applied to private firms. The revised Z-score model took the form:

Equation 2: Altman's Z'-score model (Private companies)

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$$

where:

X_1 = Working capital/Total assets
X_2 = Retained Earnings/Total assets
X_3 = Earnings before interest and taxes/Total assets
X_4 = Market value of equity/Total liabilities
X_5 = Sales/Total assets
Z' = Overall index

Source: Altman (1983)

The Z-score model was further revised for non-manufacturing firms. The revised equation removed the sales to total assets ratio. According to Altman (1995), the reason for this exclusion is "to minimise the potential industry effect which is more likely to take place when such an industry-sensitive variable as asset turnover is included". The model was hence revised to:

Equation 3: Altman›s Z''-score model (Non-manufacturing companies)

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

where:

X_1 = Working capital/Total assets
X_2 = Retained Earnings/Total assets
X_3 = Earnings before interest and taxes/Total assets
X_4 = Market value of equity/Total liabilities
Z'' = Overall index

Boundary values:
Z'' > 2.60 Safe Zone: Financially healthy
1.10 ≤ Z'' ≤ 2.60 Grey Zone: Could go either way
Z'' < 1.10 Distress Zone: Company at risk of failure within two years

Source: Altman, Hartzell and Peck (1995)

For companies including banks in emerging markets like Ghana, Altman, Hartzell and Peck proposed the addition of a constant +3.25 to standardise the results in order that "scores equal or less than zero (0) would be equivalent to the default situation" (Altman, Hartzell, & Peck, 1995). The model therefore takes the form:

Equation 4: Altman's Z''- score model (Banks in emerging markets)

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 + 3.25$$

where:

X_1 = Working capital/Total assets
X_2 = Retained Earnings/Total assets
X_3 = Earnings before interest and taxes/Total assets
X_4 = Market value equity/Total liabilities
Z'' = Overall index

Boundary values:
Z'' ≥ 5.85 Safe Zone: Financially healthy
4.15 ≤ Z'' < 5.85 Grey Zone: Could go either way
Z'' < 4.15 Distress Zone: Company at risk of failure within two years

Source: Altman & Hotchkiss (2006)

Application and Power of Altman's Z-Score Model
In 2015, Ariesta examined the suitability of Altman's model to measure the financial output of listed and delisted banks on the Indonesian Stock Exchange. The research sample size was comprised of 8 listed banks and 3 delisted banks. Results from the study indicated that 4 or more of the listed banks were in the Grey area or experiencing financial difficulties during the three-year period of observation. The study further indicated that not all listed banks

had good financial performance as expected. Additionally, not all delisted banks underperformed financially. The study was however not conclusive on the suitability of Altman's model in measuring the financial performance of listed and delisted banks.

Mamo (2011) considered how financial distress can be predicted in the Kenyan banking industry using Altman's (1968) model. The study analysed data from 43 commercial banks. From the study, Altman's financial distress prediction model predicted accurately eight (8) out of the ten (10) failed banks which represented an 80 percent validity rate for the model. For the thirty-three (33) non-failed banks, Altman's Z-Score model recorded a 90 percent prediction accuracy.

Numerous studies have shown that Altman's model has a high accuracy level in corporate failure prediction. In a 2013 study aimed at validating Altman's Z" score model for banks as a prediction tool for corporate failure in the Eurozone, Chieng concluded that the Z" score model was a dependable predictor to determine the failure of Eurozone banks within five years prior to bankruptcy. It was further concluded that the model revealed a great predictive ability useful to many stakeholders.

Manousaridis (2017) conducted a similar study by analysing data from 42 European banks with the aim of examining the accuracy and effectiveness of the Altman Z score model in determining the financial health of banks. In the analysis, Altman's model gave a 100 percent confirmation of estimated results for all banks in the "failed" group. A 2014 publication in the European Journal of Business and Management established the Altman Z score model as a very practical instrument that can be used to determine the possible bankruptcy of companies and used it for the maintenance and monitoring of companies being risk managed (Shisia, Sang, Waitindi, & Okibo, 2014).

Ncube (2014) in a study aimed at examining the use of Altman's Z score model in predicting corporate failure in a developing country in Southern Africa, specifically Zimbabwe, recommended that the Altman's Z score model can be used in forecasting corporate failure in the financial services sector.

Methodology

Research Design

The quantitative research method and the descriptive analytical research design were used for the study. As indicated by Leedy (1993), quantitative research methods deal with figures and anything that is quantifiable in a methodical way of investigating a phenomenon and their relationships. According to Fox and Bayat (2007), descriptive research is "...aimed at casting light on current issues or problems through a process of data collection that enables them to describe the situation more completely than was possible without employing this method." Cooper & Schindler (2001) describes it as a study that is characteristically structured with clearly specified analytical objective.

Research Population and Sampling

The population of the study consists of all the 35 universal banks (multinational and locals) licensed by the Bank of Ghana to operate in Ghana as of the end of 31st December 2017 and Capital Bank and UT Bank which failed earlier in 2017. Universal banks were preferred because they were well organised and filed their returns to the Central Bank regularly.

The probability sampling technique, a method of sampling which utilises some form of random selection, was used for the study.The study employed a 99 percent confidence level and 1 percent margin of error; the sample size was therefore equal to the population size since the

population size is less than 100 (The Research Advisors, 2006).

The research sample of the study consisted of 26 banks categorised into two groups:

- Group One – 5 Failed Banks
- Group Two – 21 Non-failed banks

Group One: Failed Banks

Altman's (1968) model stipulates that failure can be predicted five years earlier. The first sample group therefore consisted of the failed banks with financial data five to two years before failure as shown in Table1 below. This excludes three failed banks, The Beige Bank Limited, The Construction Bank (Gh.) Limited and Sovereign Bank Limited which did not have relevant and enough data for the analysis periods.

Table 1 Sample List of Failed Banks

No.	Bank Name	Year of Incorporation	Majority Ownership	Abbr.	Year of Failure
1	BSIC Ghana Limited	2008	Foreign	BSIC	2018
2	Capital Bank Ghana Ltd	2009	Local	CBL	2017
3	The Royal Bank Limited	2011	Local	TRB	2018
4	UniBank Ghana Ltd	1997	Local	UBG	2018
5	UT Bank Ghana Ltd	1995	Local	UTB	2017

Source: Bank of Ghana (2018)

Group Two: Non-Failed Banks

Altman asserts that the Altman Z-Score model is most accurate up to two years prior to failure with the accuracy diminishing substantially as the lead time increases. The second sample group therefore comprised of 21 universal non-failed banks licensed by the Bank of Ghana with financial data for the 2016 financial year as shown in Table 2 below.

Table 2 Sample List of Non-failed Banks in Ghana as at September 2018

No.	Bank Name	Year of Incor-poration	Majority Ownership	Abbr.
1	Access Bank (Ghana) Ltd	2008	Foreign	ABL
2	ADB Bank Ltd	1965	Local	ADB
3	Bank of Africa Ghana Ltd	1997	Foreign	BOA
4	Bank of Baroda (Ghana) Ltd	2007	Foreign	BOB
5	Barclays Bank of Ghana Ltd.	1917	Foreign	BBG
6	CAL Bank Ltd	1990	Local	CAL
7	Ecobank Ghana Ltd	1990	Foreign	EGH
8	Energy Bank (Ghana) Ltd	2010	Foreign	EBL
9	FBN Bank Ghana Ltd	2006	Foreign	FBN
10	Fidelity Bank Ltd.	1996	Local	FBL
11	First Atlantic Bank Ltd	1994	Foreign	FAB
12	GCB Bank Ltd	1953	Local	GCB
13	Guaranty Trust Bank (Ghana) Ltd	2004	Foreign	GTB
14	HFC Bank Ghana Ltd (Republic Bank)	1990	Foreign	HFC
15	Prudential Bank Ltd	1993	Local	PBL
16	Societe General Ghana Ltd	1975	Foreign	SG
17	Stanbic Bank Ghana Ltd	1999	Foreign	SBG
18	Standard Chartered Bank (Ghana) Ltd	1896	Foreign	SCB
19	United Bank for Africa (Ghana) Ltd.	2004	Foreign	UBA
20	Universal Merchant Bank (Ghana) Ltd (Merchant Bank Ghana Ltd)	1971	Local	UMB
21	Zenith Bank (Ghana) Ltd	2005	Foreign	ZBL

Source: Banking of Ghana (2018)

The sample list for the non-failed banks did not include National Investment Bank Limited due to the absence of relevant data for the analysis period. The bank as at the time of this study had not released its financial statements for the 2016 financial year.

Data Collection

Relevant data extracted from financial statements of the commercial banks was used for the study. The secondary data for banks was collected directly from the annual financial reports or electronically from the website of the banks for five years (2012 - 2016). Specifically, items from the income statement and balance sheet of each bank in the sample were collected (Bank of Ghana/Ghana Stock Exchange).

Data Analysis

The 1983 Altman Z-score model revised in 1995 for banks in emerging markets as shown below, was used for analysing the data and compared to results from the revised model which did not include the addition of the constant term 3.25. As earlier stated in Chapter 2, the constant term 3.25 was added to the revised model to make it

standardised in order that "scores equal or less than zero would be equivalent to the default situation" (Altman, Hartzell, & Peck, 1995).

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 + 3.25$$

The Data analysis used the following ratios:

- X_1 = Working capital/Total assets
- X_2 = Retained Earnings/Total assets
- X_3 = Earnings before interest and taxes/Total assets
- X_4 = Book value of equity/Total liabilities

To validate Altman's 1968 assertion that the Altman Z-Score model can predict failure five years earlier, the Z-scores of the failed banks sample list were computed for the 2012 to 2016 financial years, covering a maximum of five years and a minimum of two years before failure for all the failed banks. The Altman's model, as earlier stated, is most accurate up to two years prior to failure (Altman E. I., 1968). Based on this assertion, analysis of non-failed banks was done using financial data two years prior to the year the research was conducted (2018). The Z-scores for the year ending December 31, 2016 were therefore computed and analysed to determine the financial health and the extent to which the Altman Z-score model could be used in predicting the failure of banks in Ghana.

From the data of each bank for the respective years under consideration, the relevant ratios were computed. The extracted data was analysed with Microsoft Excel 2016 and presented in tables. The Altman's Z score model for banks used for analysis of data and the determination of discrimination zones is as shown below:

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

where:

X_1 = Working capital/Total assets
X_2 = Retained Earnings/Total assets
X_3 = Earnings before interest and taxes/Total assets
X_4 = Book value equity/Total liabilities
Z'' = Overall index for banks

Discrimination Zones:

- $Z > 2.60$ Safe Zone: Financially healthy
- $1.10 \leq Z \leq 2.60$ Grey Zone: Could go either way
- $Z < 1.10$ Distress Zone: Company at risk of failure within two years

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4 + 3.25$$

Discrimination values:

- $Z'' \geq 5.65$ Safe Zone: Financially healthy
- $4.15 \leq Z'' < 5.65$ Grey Zone: Could go either way
- $Z'' < 4.15$ Distress Zone: Company at risk of failure within two years

Research Data Analysis and Findings

To test the effectiveness of Altman's model in predicting failure prior to it taking place, financial data of five (5) failed banks from 2012 to 2016 was extracted and analysed. The data extracted included earnings before interest and tax, retained earnings, shareholders' equity, total assets, total liabilities and working capital. From these extracted financial data, the independent variables (ratios) and Z-Scores were computed for the respective years as presented in the Tables 3 and 4 below.

Table 3: Altman's Z-Scores for Failed Banks

Bank	2012	2013	2014	2015	2016
BSIC Ghana Ltd	2.67	0.74	1.23	1.10	0.90
Capital Bank Ghana Ltd	N/A	0.80	0.73	0.94	N/A
The Royal Bank Ltd	N/A	3.01	0.57	0.49	-0.35
UniBank Ghana Ltd	0.62	0.66	0.57	0.44	0.57
UT Bank Ghana Ltd	0.85	1.06	1.14	-0.44	N/A

Source: Author's computation (2018)

Table 4: Altman's Z''-Scores for Failed Banks

Bank	2012	2013	2014	2015	2016
BSIC Ghana Ltd	5.92	3.99	4.48	4.35	4.15
Capital Bank Ghana Ltd	N/A	4.05	3.98	4.19	N/A
The Royal Bank Ltd	N/A	6.26	3.82	3.74	2.90
UniBank Ghana Ltd	3.87	3.91	3.82	3.69	3.82
UT Bank Ghana Ltd	4.10	4.31	4.39	2.81	N/A

***** *Z'' Score = Z Score + 3.25*

Source: Author's computation (2018)

Following the computation of the independent variables and Z-Scores for the respective years, the model was validated vis-à-vis Altman's assertion that the model is accurate up to two years prior to failure with the accuracy diminishing substantially as the lead time increases. This was done by assessing the accuracy of the model two years, three years, four years and five years prior to failure as presented in Table 5 below.

Table 5: Altman's Z-Score Prediction Accuracy for Failed Banks

		Number of Years Prior To Failure (Altman's Z Score)							
Failed Banks	Year of Failure	Five (5) Years		Four (4) Years		Three (3) Years		Two (2) Years	
Capital Bank Ghana Ltd	2017	N/A	N/A	0.8	Distress	0.73	Distress	0.94	Distress
UT Bank Ghana Ltd	2017	0.85	Distress	1.06	Distress	1.14	Grey	-0.4	Distress
BSIC Ghana Ltd	2018	0.74	Distress	1.23	Grey	1.1	Distress	0.9	Distress
The Royal Bank Ltd	2018	3.01	Safe	0.57	Distress	0.49	Distress	-0.4	Distress
UniBank Ghana Ltd	2018	0.66	Distress	0.57	Distress	0.44	Distress	0.57	Distress
Prediction Accuracy		**75%**		**80%**		**80%**		**100%**	

Source: Author's computation (2018)

Table 6: Altman's Z-Score + 3.25 Prediction Accuracy for Failed Banks

		Number of Years Prior To Failure (Altman's Z Score + 3.25)							
Failed Banks	**Year of Failure**	**Five (5) Years**		**Four (4) Years**		**Three (3) Years**		**Two (2) Years**	
Capital Bank Ghana Ltd	2017	N/A	N/A	4.05	Distress	3.98	Distress	4.19	Distress
UT Bank Ghana Ltd	2017	4.10	Distress	4.31	Distress	4.39	Distress	2.81	Distress
BSIC Ghana Ltd	2018	3.99	Distress	4.48	Distress	4.35	Distress	4.15	Distress
The Royal Bank Ltd	2018	6.26	Safe	3.82	Distress	3.74	Distress	2.90	Distress
UniBank Ghana Ltd	2018	3.91	Distress	3.82	Distress	3.69	Distress	3.82	Distress
Prediction Accuracy		**75%**		**100%**		**100%**		**100%**	

Source: Author's computation (2018)

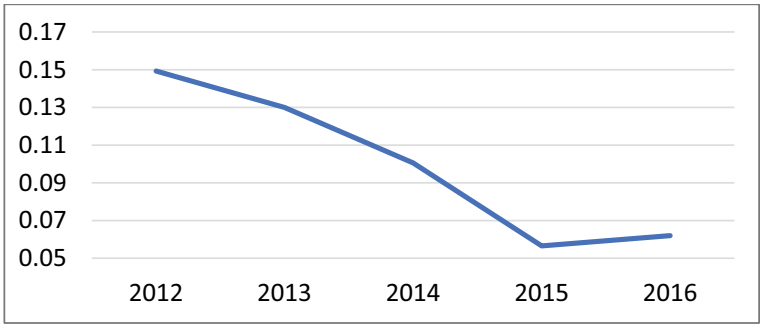
From the analysis of the 5 failed banks, The Royal Bank recorded a deteriorating Z-score from five years prior to failure up to two years prior to failure. Unibank recorded a Distress Z-score for all the four analyses periods. Both UT Bank and The Royal Bank recorded negative Z-scores 2 years prior to failure.

A significant discrepancy in the analysis was the sharp deterioration in the Z Score of BSIC Ghana Ltd and The Royal Bank Ltd from the year 2012 to the year 2013 and 2013 to 2014 respectively. BSIC Ghana Ltd reduced from a Z Score of 2.67 to a Z Score of 0.74 in 12 months while The Royal Bank Ltd, which recorded the highest deterioration, reduced from a Z Score of 3.01 to a Z Score of 0.57 in 12 months. From the analysis, both deteriorations can be attributed to a sharp decrease in the profitability of both banks. The Royal Bank Ltd recorded a profitability decrease of negative 50 percent from 2013 to 2014 while BSIC recorded a profitability decrease of negative 125 percent from 2012 to 2013.

The results as displayed in Table 5, revealed 75 percent prediction accuracy for the five years before failure when the revised Altman's Z score was used. This was improved to 80 percent for four and three years prior to failure, predicting accurately 4 out of the 5 failed banks. The model, two years prior to failure, predicted accurately for all five banks recording a 100 percent prediction accuracy.

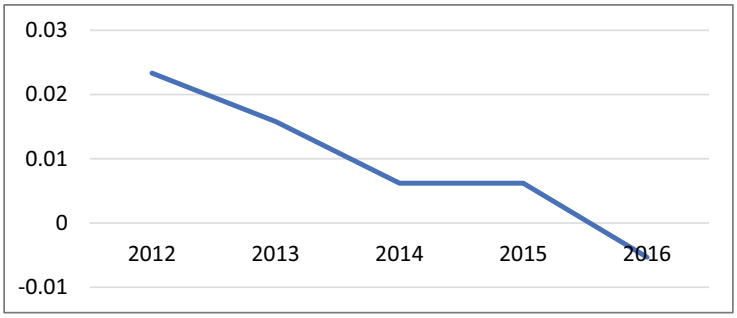
The results, after the addition of the constant term 3.25, produced a 75 percent prediction accuracy for five years prior to failure. The model for four, three and two years prior to failure, recorded 100 percent prediction accuracy. The prediction accuracy percentages as exhibited in Table 6 and Table 7, confirm Altman's assertion that the model is accurate up to two years prior to failure with the accuracy diminishing substantially as the lead time increases. From the analysis and the tables above, it is evident that the revised Z Score model provides an accurate prediction of failure two years prior to failure.

Figure 1: Mean Liquidity Ratio (X_1) for Failed Banks



A noticeable factor determining the low Z-scores for the failed banks, as indicated in Figure 1 and Figure 2, was the liquidity and profitability challenges evidenced in the low and downwards trend of the liquidity (X1) and profitability ratios (X3). For the two (2) years prior to failure analysis, all five banks recorded a liquidity ratio, that is, Working Capital/Total Assets of less than 15 percent. UT bank recorded the least with negative 4.5 percent, while BSIC recorded the highest with 12.6 percent. Similarly, for the same analysis period, all the banks recorded low profitability ratios, X3 (EBIT/Total Assets). UT bank again recorded a negative figure of 2.3 percent and Unibank recorded the highest with only 9.1 percent, indicating very low return on investments.

Figure 2: Mean Profitability Ratio (X_3) for Failed Banks



Presentation and Analysis of Data for Non-Failed Banks

Following the analysis of the Z-scores for the failed banks and the confirmation of Altman's assertion on the prediction accuracy of the model, the Z-scores for the non-failed banks was computed and analysed to ascertain the financial strength and extent to which the model can be used in predicting the failure of banks in Ghana. Financial data for year ending December 31, 2016 was analysed for 21 non-failed banks. The resulting Z-Scores are presented in Table 4.9 below.

Table 7 Altman's Z-Scores for Non-Failed Banks for 2016

#	Bank	Z-Score	Z" Score
1	Access Bank (Ghana) Ltd	**1.12**	**4.37**
2	ADB Bank Ltd	**1.99**	**5.24**
3	Bank of Africa Ghana Ltd	**0.69**	**3.94**
4	Bank of Baroda (Ghana) Ltd	**5.38**	**8.63**
5	Barclays Bank of Ghana Ltd.	**2.06**	**5.31**
6	CAL Bank Ltd	**0.98**	**4.23**
7	Ecobank Ghana Ltd	**1.51**	**4.76**
8	Energy Bank (Ghana) Ltd	**0.87**	**4.12**
9	FBN Bank Ghana Ltd	**1.55**	**4.80**
10	Fidelity Bank Ltd.	**0.75**	**4.00**
11	First Atlantic Bank Ltd	**0.71**	**3.96**
12	GCB Bank Ltd	**1.78**	**5.03**
13	Guaranty Trust Bank (Ghana) Ltd	**1.95**	**5.20**
14	HFC Bank Ghana Ltd	**0.01**	**3.26**
15	Prudential Bank Ltd	**0.48**	**3.73**
16	Societe General Ghana Ltd	**1.42**	**4.67**
17	Stanbic Bank Ghana Ltd	**1.62**	**4.87**
18	Standard Chartered Bank (Ghana) Ltd	**2.23**	**5.48**
19	United Bank for Africa (Ghana) Ltd.	**1.25**	**4.50**
20	Universal Merchant Bank (Ghana) Ltd	**1.00**	**4.25**
21	Zenith Bank (Ghana) Ltd	**1.77**	**5.02**

***** *Z" Score = Z Score + 3.25*

Source: Author's computation (2018)

The analysis using the revised Altman's Z Score model, as indicated in the Table 4.10, revealed that 8 banks, representing 38 percent of the sample were classified as distressed while 12 banks representing 57 percent, were classified into the Grey Zone. Only 1 bank recorded a Z-Score greater than 2.60 thereby classifying it as Safe. From the table below, the biggest banks to be classified as failed were Fidelity Bank Ltd, CAL Bank Ltd and Universal Merchant Bank Ltd with total assts of GHC4.2 billion, GHC3.6 billion and GHC2.8 billion respectively. For the banks in the Grey zone, Ecobank Ghana Ltd, GCB Bank Ltd and Stanbic Bank Ghana Ltd were the biggest banks with total assets of GHC8 billion, GHC6 billion and GHC5.4 billion respectively.Two banks namely ADB Bank Ltd, classified into the grey zone and HFC Bank Ghana Ltd, classified as distressed, made losses for the year under review as a result of high personnel cost, high impairment losses and high operating expenses.

Table 8: Altman's Z-Scores Categorization for Non-Failed Banks for 2016

#	Bank	Z Score	Zone	%
1	Bank of Africa Ghana Ltd	0.689	Distress	**38%**
2	CAL Bank Ltd	0.981		
3	Energy Bank (Ghana) Ltd	0.871		
4	Fidelity Bank Ltd.	0.750		
5	First Atlantic Bank Ltd	0.712		
6	HFC Bank Ghana Ltd	0.014		
7	Prudential Bank Ltd	0.483		
8	Universal Merchant Bank (Ghana) Ltd	0.996		
9	Access Bank (Ghana) Ltd	1.120	Grey	**57%**
10	ADB Bank Ltd	1.991		
11	Barclays Bank of Ghana Ltd.	2.056		
12	Ecobank Ghana Ltd	1.510		
13	FBN Bank Ghana Ltd	1.552		
14	GCB Bank Ltd	1.781		
15	Guaranty Trust Bank (Ghana) Ltd	1.954		
16	Societe General Ghana Ltd	1.419		
17	Stanbic Bank Ghana Ltd	1.621		
18	Standard Chartered Bank (Ghana) Ltd	2.233		
19	United Bank for Africa (Ghana) Ltd.	1.252		
20	Zenith Bank (Ghana) Ltd	1.773		
21	**Bank of Baroda (Ghana) Ltd**	**5.375**	**Safe**	**5%**

Source: Author's computation (2018)

Using the Z-Score for banks in emerging markets, the analysis revealed that 9 banks representing 43 percent of the sample were classified as distressed. These banks consisted of the same banks classified as distressed by the revised model with the addition of Access Bank (Ghana) Ltd. 11 banks representing 52 percent, were classified into the Grey Zone and like the results from the revised Z-Score model analysis, only one bank, that is, Bank of Baroda, was classified as safe.

Table 9: Altman's Z-Scores + 3.25 Categorization for Non-Failed Banks for 2016

#	Bank	Z"Score	Zone	%
1	Access Bank (Ghana) Ltd	4.37		
2	Bank of Africa Ghana Ltd	3.94		
3	CAL Bank Ltd	4.23		
4	Energy Bank (Ghana) Ltd	4.12		
5	Fidelity Bank Ltd.	4.00	Distress	**43%**
6	First Atlantic Bank Ltd	3.96		
7	HFC Bank Ghana Ltd	3.26		
8	Prudential Bank Ltd	3.73		
9	Universal Merchant Bank (Ghana) Ltd	4.25		
10	ADB Bank Ltd	5.24		
11	Barclays Bank of Ghana Ltd.	5.31		
12	Ecobank Ghana Ltd	4.76		
13	FBN Bank Ghana Ltd	4.80		
14	GCB Bank Ltd	5.03		
15	Guaranty Trust Bank (Ghana) Ltd	5.20	Grey	**52%**
16	Societe General Ghana Ltd	4.67		
17	Stanbic Bank Ghana Ltd	4.87		
18	Standard Chartered Bank (Ghana) Ltd	5.48		
19	United Bank for Africa (Ghana) Ltd.	4.50		
20	Zenith Bank (Ghana) Ltd	5.02		
21	**Bank of Baroda (Ghana) Ltd**	**8.63**	**Safe**	**5%**

Source: Author's computation (2018)

Table 10: Assessment of Non-Failed Banks Classified as Distressed

Bank	WC (GHC '000)	Total Assets (GHC '000)	EBIT (GHC '000)	Z" Score
Access Bank (Ghana) Ltd	224,001.00	2,679,839.00	69,070.00	4.37
Bank of Africa Ghana Ltd	78,255.00	1,144,481.00	25,115.00	3.94
CAL Bank Ltd	360,255.00	3,599,355.00	12,085.00	4.23
Energy Bank (Ghana) Ltd	32,714.00	364,103.00	623.00	4.12
Fidelity Bank Ltd.	358,254.00	4,173,602.00	18,576.00	4.00
First Atlantic Bank Ltd	92,549.00	1,442,038.00	24,500.00	3.96
HFC Bank Ghana Ltd	61,575.00	1,852,652.00	(56,995.00)	3.26
Prudential Bank Ltd	68,003.00	1,631,151.00	12,880.00	3.73
Universal Merchant Bank (Ghana) Ltd	430,771.00	2,789,940.00	27,472.00	4.25
MEAN	**189,597.44**	**2,186,351.22**	**14,814.00**	**3.89**
STANDARD DEVIATION				**0.33**
STANDARD ERROR				**0.111**

Source: Author's computation (2018)

As displayed in Table 4.12, Figure 4-4 and Figure 4-5, it was evident from the analysis of the financial data extracted that, similar to the characteristics of the failed banks, the non-failed banks classified to be in distress had low liquidity and profitability ratios with a downwards trend from 2012. The 9 non-failed banks classified to be in distress, for the 2016 financial year, averaged liquidity ratio of 8 percent and profitability ratio of 1 percent.

Figure 3: Mean Liquidity Ratio (X1): Failed Banks vs Non-Failed Banks (Distressed)

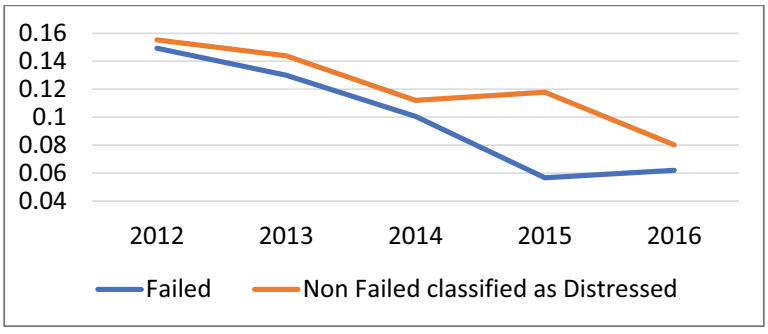
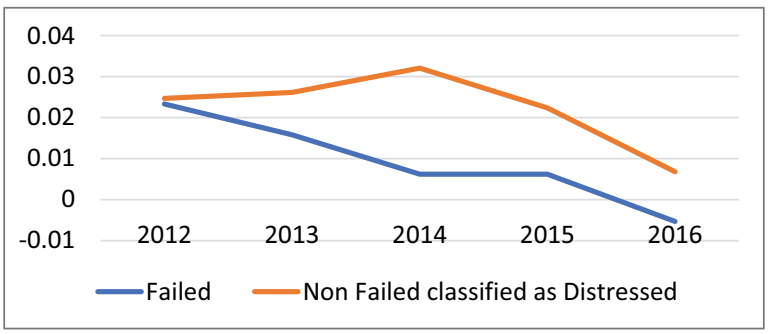


Figure 4: Mean Profitability Ratio (X3): Failed Banks vs Non-Failed Banks (Distressed)



The non-failed banks classified into the grey zone, relative to the non-failed banks classified as distressed, had higher liquidity and profitability ratios as displayed in Table 11, Figure 5 and Figure 6 below. The banks averaged a liquidity ratio twice that of the non-failed banks classified as distressed for the 2016 financial year and an average profitability ratio 4.8 percent.

Table 11: Assessment of Non-Failed Banks Classified as Grey

Bank	WC (GHC '000)	Total Assets (GHC '000)	EBIT (GHC '000)	Z" Score
ADB Bank Ltd	1,037,752.00	3,035,493.00	(105,714.00)	5.24
Barclays Bank of Ghana Ltd.	849,240.00	5,288,817.00	423,190.00	5.31
Ecobank Ghana Ltd	1,077,258.00	8,025,510.00	457,186.00	4.76
FBN Bank Ghana Ltd	98,352.00	565,410.00	4,406.00	4.80
GCB Bank Ltd	641,731.00	6,049,604.00	446,782.00	5.03
Guaranty Trust Bank (Ghana) Ltd	276,619.00	1,545,337.00	106,534.00	5.20
Societe General Ghana Ltd	334,895.00	2,448,836.00	91,888.00	4.67
Stanbic Bank Ghana Ltd	770,136.00	5,410,018.00	219,418.00	4.87
Standard Chartered Bank (Ghana) Ltd	819,939.00	4,373,564.00	345,558.00	5.48
United Bank for Africa (Ghana) Ltd.	423,176.00	3,742,765.00	210,716.00	4.50
Zenith Bank (Ghana) Ltd	412,869.00	3,403,744.00	202,589.00	5.02
MEAN	**612,906.09**	**3,989,918.00**	**218,413.91**	**4.99**
STANDARD DEVIATION				**0.30**
STANDARD ERROR				**0.09**

Source: Author's computation (2018)

Figure 5: Mean Liquidity Ratio (X1) for Non-Failed Banks Classified into the Grey Zone

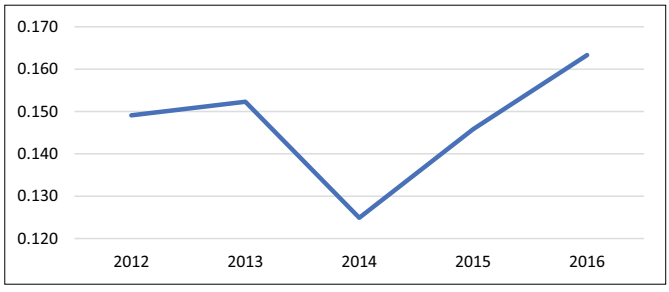
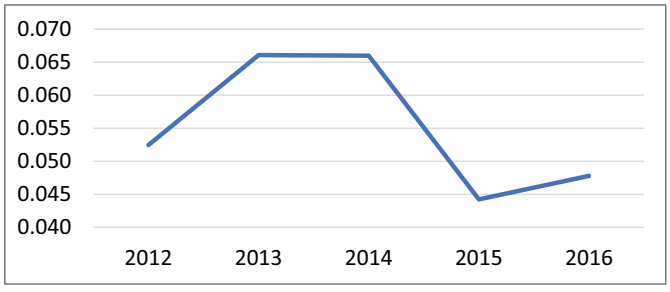


Figure 6: Mean Profitability Ratio (X3) for Non-Failed Banks Classified into the Grey Zone



From Table 10 and Table 11, the standard error of the banks classified to be in the Grey zone was lower relative to that of the banks classified as distressed. This suggests that the results of the banks classified to be in the Grey zone is representative of the overall population or industry. This assertion is further confirmed by the industry Z-score presented in Table 12, which classifies the industry into the 'Grey' zone.

Table 12: Ghanaian Banking Industry Altman's Z Score for 2016

Total Assets (GHC '000)	Working Capital (GHC '000)	Retained Earnings (GHC '000)	EBIT (GHC '000)	Equity (GHC '000)	Total Liabilities (GHC '000)	Z" Score	Zone
71,293,048	8,995,321	2,683,647	2,589,848	9,431,637	61,861,404	4.6	Grey

Source: Author's computation (2018)

Out of the 21 non-failed banks analysed, Bank of Baroda (Ghana) Ltd, produced the highest Z-score of 5.375. The bank recorded the highest liquidity (X1) and profitability (X3) ratios of 0.486 and 0.112 respectively. According to the 2017 PWC Banking Survey, Bank of Baroda (Ghana) Ltd ranked number one with respect to pre-tax profit margin, cost income ratio and return on assets for the 2016 financial year making it if not the most, one of the most efficient banks in Ghana. The bank recorded a pre-tax profit margin of 87.1 percent, a cost income ratio of less than 15 percent and a ROA 7.9 percent (PricewaterhouseCoopers, 2017)

Table 13: Assessment of Non- Failed Banks Classified as Safe

Bank	Profit before tax margin	Cost income ratio	Return on Assets
Bank of Baroda (Ghana) Ltd	87.10%	0.13	7.90%

Source: PWC Banking Survey (2017)

Conclusions and Recommendations

This study was aimed at ascertaining the extent to which Altman's Z-score model can be used in predicting corporate failure of banking institutions in Ghana.

Empirical results from the study of the failed banks revealed that the revised Altman Z-Score model has 75 percent prediction accuracy five years prior to failure, 80 percent four and three years prior to failure and 100 percent two years before failure. This is improved further by the model's Score for banks in emerging markets which records 80 percent prediction accuracy five years prior to failure and a 100 percent prediction accuracy for four, three and two years prior to failure despite reported manipulation of financial data by banks. This is an indication that the model can be considered as an effective predictor of failure of banks.

Analysis of the financial data from the non-failed banks generally produced low Z-Scores with majority of the banks being classified into the grey zone. Calculated Z-Scores indicated that the non-failed banks classified as distressed, were threatened by the possibility of failure in the years ahead. The results demonstrated that the non-failed banks classified as distressed had

characteristics of low liquidity and profitability ratios. These characteristics were similar to those of the failed banks, which was an indication of distress and failures in the absence of contingency plans. The non-failed banks in the grey zone raised concerns and uncertainties about their financial health. They also reflected the harsh financial climate in Ghana during the period under review, as evidenced by the low industry Z-Score which placed most banks in survival mode.

Consequently, the categorisation of the non-failed banks should not be considered as misclassifications vis-à-vis the discrimination zones of Altman's Z-Score model since the model provided an indication of the financial health of the banks under review.

The results from both the revised Altman's Z- Score model and the Altman's Z -Score model for banks in emerging markets demonstrated that both models produced close to same classifications for banks regarding failure prediction.

The ability of the Altman's Z-Score model for banks in emerging markets to predict accurately the failure of banks years ahead of time, as evidenced in the analysis of the failed banks and to assess the financial health and vulnerability of banks to failure, as evidenced in the analysis of the non-failed banks, is clearly demonstrated in the study. Ultimately, it can be argued that the Altman's Z-Score model for banks in emerging markets is an effective model for predicting the failures and financial health of banking institutions in Ghana.
In view of the above, it can be established that the consideration and adoption of the Altman's Z-Score model as the model of choice for assessing the financial health and the possible failure of banking institutions is recommended for the banking industry in Ghana.

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