THE EFFECTIVENESS OF ALTMAN'S Z-SCORE IN PREDICTING BANKRUPTCY OF QUOTED MANUFACTURING COMPANIES IN NIGERIA

Ahmed Adeshina Babatunde
Principal Lecturer, Department Of Accountancy, Lagos City Polytechnic
Ikeja, Lagos, **NIGERIA**

Joseph Babatunde Akeju
Chief Lecturer, Department Of Accountancy, Yaba College Of Technology
Lagos, **NIGERIA**
&
Ebenezer Malomo
Senior Lecturer, Department Of Accountancy, Yaba College Of Technology, Yaba
Lagos, **NIGERIA**

ABSTRACT

The purpose of this paper is to investigate the effectiveness of Altman's z-score in predicting bankruptcy of quoted manufacturing companies in Nigeria. This research has been performed using a sample of 10 manufacturing companies quoted on the Nigeria Stock Exchange (NSE) for 2015 financial year. The data obtained for the purpose of the study were analysed using Altman's Z-score model. The research evidence provides that Z-score is a very important tool in identifying companies with deteriorating performance in Nigeria.

Keywords: Bankruptcy, Z-score, Nigeria Stock Exchange (NSE), Financial Health.

INTRODUCTION

The anticipation of a potential bankruptcy in a firm has always been a subject of high interest (Muminovic, 2013). It represents one of the basic tasks of financial analysts.

A reliable bankruptcy model with consistent predictive power is essential in today's business environment given the relatively high frequency of bankruptcy filed by publicly quoted companies and the threats posed to suppliers and other stakeholders that rely on firm's solvency for their own success (Hayes et al, 2010).

One common bankruptcy prediction model is known as Altman's Z-score model. Altman's Z-score is one of the best known statistically derived predictive models used for forecasting a firm's impending bankruptcy (Moyer, 2005). The model was developed by Edward Altman, a financial economist and professor at New York's stern school of Business in 1968.

Altman's Z-score model is a multivariate model used to measure the financial health of a company and to predict the probability that a company will go bankrupt within a two-year period (Hayes et al, 2010). The model uses various accounting ratios and market-derived price data to predict financial distress and future bankruptcy. The original model was developed on a sample of 65 manufacturing firms. The Altman's Z-score works well provided that the scores fall within

the "in the tails" indicating that low and high score may predict financial distress more accurately than scores that fall within the grey area. The Z-score gained acceptance by auditors, management accountants, finance experts and data base administrators in the mid-1980s.

Although, Altman (1968) developed the Z-score model based on a small sample of manufacturing companies, some research evidence seem to prove that it is useful in other areas such as health care with some modifications (Al-Sulaiti and Almwajeh, 2007). In the early 2000's, Altman amended the model to allow its application to certain situations not originally included in the original sample set (Altman, 2006).

The paper investigates the effectiveness of Altman's Z-score in predicting Bankruptcy of Quoted Manufacturing Companies in Nigeria.

LITERATURE REVIEW

Although, Altman's Z-score is typically used to predict firms' bankruptcy, it is also a key multidimensional measure of strategic performance (Chakravarthy, 1986). This is due to the fact that it is a composite measure of profitability, cash flow, slack and stock market forces (Altman, 1968). A high Z-score indicates sound financial health while a low Z-score indicates distress (Ferrier et al, 2002).

Altman's Z-score has also been applied to predict bankruptcy in hospitals. The study using hospitals revealed that both discriminant analysis and logistic regression model are able to predict service organizations' success or failure (Al-Sulaiti and Almwajeh, 2007).

Kim (2007) investigated the robustness of Z-model under the assumption that it was no longer significant due to market factors. The evidence of the findings revealed that Z-score seems to be a good predictor of financial bankruptcy in firms one year prior to bankruptcy.
Alexeer and Kim (2008) studied South Korean firms using Altman's Z-score model. The research evidence indicates that a low Altman's Z-score is a significant predictor of financial distress.

Carton and Hofer (2006) examined a variety of common performance metrics on information relating to market-adjusted return to shareholders using Altman's Z-score model. The evidence of the study revealed that Z-score provides a rate higher than other performance metrics such as return on equity and return on assets. Carton and Hofer (2006), therefore, concluded that Altman's Z-score is more than a financial distress predictor, it is also efficacious as a performance management tool.

Hayes et al (2010) investigated the efficacy of Altman's Z-score in predicting bankruptcy of specialty retail firms in the USA. The result shows that Z-score is efficacious in predicting financial distress in retail firms. The Z-score accurately predicted bankruptcy filing 94% of the time and accurately predicted financial distress over 90% of the time.

Ilahi et al (2015) examined financial performance analysis of Pakistan Banking Sector using Altman's Z-score model of corporate bankruptcy for a period of 5 years (2009-2013). The

research evidence reveals that all commercial banks in this model are in monetary troubles but operating successfully. So, the Z-score model is unable to predict bankruptcy of Pakistan Banking Sector.

Tyagi (2014) measured the financial health of a sample of firms in Indian Logistic Industry using Altman's Z-score model from 2005-2012. The research evidence indicates that the overall performance of Indian Logistic Industry is good.

Celli (2015) used a sample of 102 industrial companies quoted on the Italian Stock Exchange in the period of 1995-2013. 51 companies had had their shares permanently suspended or delisted because of default whereas the remaining 51 companies, which have been selected based on same core business and year of data collection did not go bankrupt. The result of the findings suggests that Z-score works effectively and performs well in predicting failures of Italian firms. Thus, it is concluded that the Z-score can be applied to the Italian context.

Sajjan (2016) investigated the use of Altman's Z-score in predicting bankruptcy of selected firms in India for a period of 5 years (2011-2015). The study reveals that Altman's Z-score model is efficacious in predicting corporate distress in India.

Niresh and Pratheepan (2015) examined the application of Altman's Z-score model in predicting bankruptcy in Sri-Lanka. The study revealed that 71% of the firms in trading sector were in financial distress and the remaining 29% were in the grey zone.

Gerantonis et al (2009) investigated the effectiveness of Z-score in predicting bankruptcy for a period up to three earlier before bankruptcy. The research evidence proved that Altman's model performed well in predicting failures three years earlier.

Mizan et al (2011) examined the use of Z-score for predicting bankruptcy of 6 pharmaceutical companies in Bangladesh. The evidence of the findings revealed that two firms were found to be financially sound having no bankruptcy possibility in the near future while other companies were found to be unsatisfactory and thus have a significant likelihood of facing financial crisis.

Alkhatib & Al Bzour (2011) examined the effect of financial ratios in bankruptcy prediction in Jordanian listed companies using Altman and Kida models. The result of their findings revealed that Altman (1968) model is the most accepted and widely used bankruptcy prediction model.
Mohammed (2016) investigated the use of Altman's Z-score in predicting bankruptcy in Oman. The result of his finding shows that Altman's Z-score is an effective too in predicting bankruptcy in Oman.

Unegbu and Onojah {2013} conducted an assessment of Z-score in selected sectors of emerging economies. The research evidence shows that Z-score is a significant tool for predicting corporate failures in emerging economies. The research also found that the predictive ability of Z-score across industrial sectors in a developing economy is significantly different.

Onyewu and Aliemeke (2009) investigated financial ratios and state of health of Nigerian banks using Z-score model. The evidence of the study revealed that Z-score is a good model for

predicting bankruptcy of banks in Nigeria. The research evidence also shows that Z-score provides the regulatory authorities additional insights on how the Z-score model can be used to improve their supervisory oversight functions.

RESEARCH METHODOLOGY

The broad objective of this study is to investigate the effectiveness of Altman's Z-score in predicting bankruptcy in quoted manufacturing companies in Nigeria. Data were obtained from the annual reports of 10 quoted manufacturing companies in Nigeria for 2015 financial year. The data obtained for the purpose of the study were analyzed using Altman's Z-score. The stock prices as at 31st December, 2015 were also obtained from Nigeria Stock Exchange daily official listing.

The original Z-score model for manufacturing firms is:

$Z= 1.2x1 + 1.4x2 + 3.3x3 + 0.6x4 + 0.999x5$

Where

X_1 = Working Capital / Total assets

X_2 = Retained earnings / Total assets

X_3 = EBIT / Total assets

X_4 = Market Value of Equity / Total liabilities

X_5 = Sales / Total assets

The zones of Discrimination are:

$Z > 2.99$	Safe zone
$1.81 < Z < 2.99$	Grey zone
$Z < 1.81$	Distress zone

RESULTS

The working capital to total assets ratio of PZ Nigeria Plc (0.34) and Ashaka Cement Plc (0.18) are positive and reasonably high compared with other companies. The reason for a high working capital to total assets ratio could be due to the fact that the companies are realizing revenue from sales much quicker than they make payments for raw materials and other services. The reason may also be attributable to the fact that the companies are not utilizing their cash reserves optimally.

The working capital to total assets ratio of Nestle Nigeria Plc (-0.09), Unilever Nigeria Plc (-0.27), Flour Mills Plc (-0.16), Nigerian Breweries Plc (-0.24), Guinness Nigeria Plc (-0.10) and Lafarge Cement Plc (-0.03) are negative. A low or negative working capital to total assets ratio indicates serious cashflow difficulties, which may make the companies unable to make payments to suppliers and creditors. A low or negative working capital to total assets ratio may also indicate the adoption of zero working capital initiatives.

The retained earnings to total assets of Nestle Plc (0.20) and Nigerian Breweries are high (0.10) while the retained earnings to total assets of other companies are low. The ratio of retained earnings to total assets indicates the extent to which total assets has been financed by retained earnings. The higher the retained earnings to total assets ratio, the higher the financial stability of a company. Thus, Nestle Plc and Nigerian Breweries Plc are highly financially stable. It also

implies that the two companies are utilizing their earnings efficiently rather than using debt financing.

The operational performance and earning power of companies could be assessed through earnings before interest and tax (EBIT) to total assets ratio. The EBIT to total assets ratio of Nestle Plc (0.28), Nigerian Breweries Plc (0.17) and Guinness Plc (0.13) are higher than that of other companies. This indicates that the overall profitability of the three companies has improved in the year under study (2015).

The market value of equity to book value of liabilities of Nestle Plc (4.20), Nigerian Breweries Plc (12.74) and PZ Plc are higher than that of other companies. Equity to liability ratio indicates the proportion of owner's fund to long-term liabilities. Where debt is very high, equity to liability ratio will be very low and companies will have an obligation to pay interest to the creditors thereby increasing shareholders risk.

Sales revenue plays a key role in measuring the overall performance of a company because all aspects of a firm's operation depend on sales revenue. Sales to total assets ratio measures the power of the assets in generating income. The higher the ratio, the better the performance of a company. The sales to total assets ratio of Nestle Plc (1.27), PZ Plc (1.09) and Unilever Plc (1.18) are high, which indicates optimum utilization of assets in generating revenue.

The Z-score of Nestle Plc is 4.89 and Nigerian Breweries Plc is 8.90, which are considered safe. The Z-score of PZ Plc is 2.80, Cadbury Plc is 1.86, Unilever Plc 2.35 and Guinness Plc is 2.09, which are considered grey. Moreso, the Z-score of UACN Plc is 1.11, Flour Mills Plc is 0.90, Lafarge Cement Plc is 1.38 and Ashaka Cement Plc is 1.63, which implies distress.
Based on the evidence of the findings, it could be concluded that Altman's Z-score is an effective tool for predicting bankruptcy of firms in Nigeria.

CONCLUSION

The aim of this study is to investigate the effectiveness of Altman's Z-score in predicting the bankruptcy of quoted manufacturing companies in Nigeria. Several studies have found that Z-score is the best statistical model for predicting firms' impending bankruptcy. The findings of the study revealed that apart from Nestle Plc with Z-score 4.89 and Nigerian Breweries Plc with Z-score of 8.90, other companies have Z-scores of less than 2.89 indicating that they are either grey or distressed. The research evidence proves that Z-score is a very important tool in identifying companies with deteriorating performance in Nigeria.

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APPENDIX 1

S/N	COMPANY	RETAINED EARNINGS #'000	EBIT #'000	SALES #'000	TOTAL ASSETS #'000	MARKET VALUE OF EQUITY #'000	BOOK VALUE OF TOTAL LIABILITIES #'000	CURRENT ASSETS #'000	CURRENT LIABILITIES #'000	CA-CL WORKINGCAPITAL #'000
1	NESTLE PLC	23,736,777	33,747,243	151271,526	119,215,053	340,842,080	81,207,979	48,714,686	59,731,857	-11,017,171
2.	PZ PLC	4,570,787	6,651,022	73,126,070	67,387,914	510,206,166	23,715,470	42,170,067	19,562,981	22,607,086
3.	CADBURY PLC	1,153,295	1,577,412	27,825,194	28,417,005	1,610,558,215	16,131,708	12,744,984	11,651,634	1,093,350
4.	UNILEVER PLC	1,192,366	4,639,690	59,221,748	50,172,484	8,181,381,925	42,169,231	21,007,814	34,607,653	-13,689,839
5.	UACN PLC	5,181,667	7,607,493	73,145,987	128,655,328	19,928,964	54,513,305	49,060,318	41,081,631	79,78,687
6.	FLOUR MILLS PLC	8,870,246	10,215,767	308,756,256	343,260,830	2,729,222,080	255,850,435	123,604,166	179,214,204	-55,610,038
7.	NIGERIAN BREWERIES PLC	37,218,500	62,229,154	293,905,792	356,218,676	23,435,724.408	183,897,173	53,303,819	140,079,105	-86,775,286
8.	GUINESS PLC	7,827,014	15,667,379	118,495,882	122,246,632	9,065,445,760	73,905,256	33,511,512	46,100,344	-12,588,832
9.	LAFARGE CEMENT PLC	17,882,099	40,487,978	267,234,239	453,012,397	22,045,725,680	276,860,668	73,876,647	89,387,506	-15,510,859
10.	ASHAKA CEMENT PLC	2,761,360	3,209,246	17,414,893	70,376,125	27,993,175	17,360,887	19,988,994	7,396,978	12,592,016

SOURCE: ANNUAL REPORTS, 2015

APPENDIX 2

S/N	COMPANIES	WC/TA	RE/TA	EBIT/TA	MVE/BVL	Sales/Total Assets
1.	NESTLE PLC	-0.0924142608	0.1991088911	0.2830787065	4.1971501347	1.2688961855
2.	PZ PLC	0.3354768631	0.0678279936	0.0986975498	2.1513643457	1.0851511148
3.	CADBURY PLC	0.0384752017	0.0405846781	0.0555094388	0.998380466	0.9791740544
4.	UNILEVER PLC	-0.2728555158	0.0237653372	0.0924749709	1.9401306903	1.1803630851
5.	UACN PLC	0.0620159858	0.0402755726	0.0591308041	0.3655798158	0.5685422294
6.	FLOUR MILLS PLC	-0.1620051959	0.025841125	0.0297609459	0.1066725597	0.8994800135
7.	NIGERIAN BREWERIES PLC	-0.2436011693	0.1044821693	0.1746936873	12.74392859101	0.8250712604
8.	GUINESS PLC	-0.102978968	0.0640264183	0.1281620503	1.226630723	0.9693181731
9.	LAFARGE CEMENT PLC	-0.0342393698	0.039473752	0.089374989	0.7962751025	0.5899049138
10.	ASHAKA CEMENT PLC	0.1789245429	0.0392371703	0.0456013456	1.6124276945	0.2474545593

SOURCE: AUTHORS' COMPUTATION, 2017

APPENDIX 3

S/N	COMPANIES	1.2 WC/TA 1.2 X1	1.4 RE/TA 1.4 X 2	3.3 EBIT/TA 3.3X 3	0.6 MVE/BVL 0.6 X 4	0.999 Sales/TA 0.999 X 5	TOTAL Z-SCORE	Zone
1.	NESTLE PLC	0.110897113	0.2787524475	0.9341597315	2.5182900808	1.2676272893	4.89	Safe
2.	PZ PLC	0.4025722357	0.094959191	0.3257019143	1.2908186074	1.0840659637	2.80	Grey
3.	CADBURY PLC	0.046170242	0.0568185493	0.183181148	0.5990282796	0.9781948803	1.86	Grey
4.	UNILEVER PLC	-0.327426619	0.0332714721	0.305167407	1.1640784142	1.179182722	2.35	Grey
5.	UACN PLC	0.074419183	0.0563858016	0.1951316535	0.2193478895	0.5679736872	1.11	Distress
6.	FLOUR MILLS PLC	-0.1944062351	0.036177575	0.0982111215	0.0640035358	0.8985805335	0.90	Distress
7.	NIGERIAN BREWERIES PLC	-0.2923214032	0.146275037	0.5764891681	7.64635715461	0.8242461891	8.90	Safe
8.	GUINESS PLC	-0.1235747616	0.0896369856	0.422934766	0.7359784338	0.9683488549	2.09	Grey
9.	LAFARGE CEMENT PLC	-0.0410872438	0.0552632528	0.2949374637	0.4777650615	0.5893150089	1.38	Distress
10.	ASHAKA CEMENT PLC	0.2147094515	0.0549320384	0.1504844405	0.9674566167	0.2472071047	1.63	Distress

SOURCE: AUTHORS' COMPUTATION, 2017