

Forensic Accounting Techniques and Fraud Detection in Nigeria: Evidence from Altman Z-Score Model Application in Oil and Gas Industry

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Abstract

This study investigated the nexus between forensic accounting techniques and fraud detection in Nigeria, using Altman Z-Score Model application in oil and gas industry as empirical evidence. The study period was between 2016 and 2020. The population of the study comprises of 11 listed oil and gas companies from which eight (8) were selected as sample size. The study employed ex post facto research design, making use of the annual reports and accounts of the oil and gas companies as the secondary source of data collection. Data obtained were subjected to both descriptive and inferential statistical analyses. One-Sample t-test was employed to confirm the Altman's Z-score result for Hypothesis 1 which revealed that the results of the original Z-score are not the same with the modified Z''-score. The results of the original Z-score revealed that all the sampled companies are in safe zone (equal or greater than 2.99). Since the modified, Z''-score can be used for almost all the manufacturing and varieties of corporations in which: when $Z'' < 1.1$, it signals a dangerous zone with high risk of bankruptcy, when $1.1 < Z'' < 2.6$ it denotes warning zone of bankruptcy risk; when $Z'' > 2.6$ it indicates that the company is in a safe zone, not at risk of bankruptcy; whereas the results of Z' score (1968) suggest that all the sampled companies are in safe zones except Japaul Gold Plc which was in distress/bankrupt zone (0.2444), the modified Z'' score revealed that on average values, Ardova (Forte oil) Plc and Japaul Gold fell within warning or gray zone (2.144 and 1.1878). More so, the multiple linear regression results show that red flag (REDF) has significant negative impact on fraud detection, while forensic investigative skill (FISK) reveals significant positive effect on fraud detection, FATE shows insignificant negative relationship since the listed oil and gas firms did not show any evidence of FATE. On overall, the sampled firms are predicted not fraudulent/bankrupt. The oil and gas companies are therefore counseled to uphold good financial management principles and policies. Investors are encouraged to invest in these sampled oil and gas companies in Nigeria that are predicted safe from fraud, bankruptcy and insolvency.

Keywords: Altman Z-score, modified altman Z'' score, forensic accounting, fraud detention, financial ratios, bankruptcy; oil and gas industry

1. Introduction

Stockholders and both potential and prospective investors have presently developed much attention pertaining to the degree of dependability on companies which are essential to them prior to venturing their capital into such companies. Therefore, credit alongside default rates of corporations are deemed to be of high significance to them as a preconditions put into considerations before investing into such listed firms (Odibi *et al*, 2015) [24]. It is now germane that the forensic accounting skills and techniques can assist in investigating fraud incidence as the independent auditors might not possess the requisite training in order to skillfully confront contemporary frauds such as white collar crimes like security fraud, misappropriation, insolvency, liquidation, deal disputes, and possible criminal financial transactions; including money laundering by systematized crooks (Gbegi & Adebisi, 2014) [11].

Although the global oil values recession has an effect on the global oil and gas firms' economic health (Rosdini & Nautika, 2017) [31], oil and gas sector is considerably essential to the global economy, it would therefore be interesting to fathom

how the companies respond and perform in critical economic conditions (Bracegirdle, 2019) [6] such as the recession of 2016 and Covid-19 pandemic effects on the globe.

Among the methods of analyses of the corporation's annual reports and accounts is forecasting its insolvency (Rosdini & Nautika, 2017) [31]. Insolvency falls into the categories of financial matters in today's economy because it considers the economic well-being or liquidity of companies (Taffler, 1983 in Tung & Phung, 2019) [8]. Companies are expected to predict the solvency and/or insolvency risk pertaining to every economic decision (Ramana *et al*, 2012). Every corporation's subsistence privilege could be forecasted with the aid of their annual reports and accounts analysis in order to assess red flags with respect to insolvency (Vikash, 2018) [38] and also to detect any existing fraud.

Among the studies carried out on bankruptcy and fraud are Sudana (2011), Purbaningsih (2013) [29], Sulphecy and Nisa (2013) [35], Nugroho (2014) [23], Altman *et al* (2017), Onakoya & Olotu (2017) [26], Rosdini & Nautika (2017) [31], Ningsih & Permatasari (2018) [22], Tung & Phung (2019) [8]. A lot of research works has been done in developed countries using

Altman Z-score model, but there exists dearth of materials in Nigeria pertaining this area. Also, many other sectors have been studied using both Altman Z-score of 1968 and modified Z-score, but there is also scarcity of such studies in oil and gas especially in Nigeria. The understanding of principles of bankruptcy does not suffice for company's subsistence, the skill to forecast the potential incident of corporate catastrophes is essential (Onakoya & Olotu, 2017) [26].

Also, there is dearth of materials in the usage of secondary data to measure and proxy fraud detection. Majority of the past studies used primary data (questionnaire) instead of seeking out for secondary data.

The red flags are essential methods for prompt fraud uncovering; nevertheless, they are not regularly employed by the auditors (Yucel, 2013 as cited in Elsayed, n.d.) and being essential method without regular usage connotes laxity and levity. There have been liberal use of initial and modified Z-score models without a generally accepted consensus. Commonsensically, where there is modification of any model, it is expected that the modified should prevail, but the few past studies in Z-score did not take cognizance of this. This study therefore compares the Z-Scores resultant outcomes computed from the annual reports and accounts of oil and gas industry in order to establish if there should be resultant preference over another.

Also, majority of studies carried out using z-score were conducted in developed and developing countries, but there is scarcity of materials in Nigeria which is part of what arouse interest for this study. There is a no uniformity in results because of diverse sectors, different in scopes, methods of analysis etc., but this current research studied oil and gas industry in Nigeria with special attention to listed oil and gas companies in Nigeria. It is against this backdrop that this study was carried out in order to examine the application of Z-score to predict bankruptcy in listed oil and gas companies of Nigeria.

The broad objective of the study is to examine the relationship between forensic accounting techniques and fraud detection using Z-score model as a fraud prediction tool in Nigerian oil and gas industry. The study seeks to achieve the following specific objectives: to determine if there is significant difference between the outcomes of original and modified Altman Z-score models for fraud prediction in Nigerian oil and gas industry, to examine what relationship exists between red flag and fraud detection in Nigerian oil and gas industry, to examine the extent to which forensic investigative skill affects fraud detection in Nigeria oil and gas industry and to investigate whether forensic accountants' engagements have significant effect on fraud detection in Nigerian oil and gas industry.

The Research Hypotheses are: there is no significant difference between the outcomes of original and modified Altman Z-score models for fraud prediction in Nigerian oil and gas industry, there exists no significant relationship between red flag and fraud detection in Nigerian oil and gas industry, forensic investigative skill does not significantly affect fraud detection in Nigeria oil and gas industry and forensic accountants' engagements do not have significant effect on fraud detection in Nigerian oil and gas industry. This study will be of immense importance to prospective researchers who have interest in forensic accounting as a discipline. It will also be of great significance especially to both prospective investors and shareholders to take and make informed decisions. The management of oil and gas companies will benefit from this study in that it will aid them

in assessment the results of their managerial skills and profit forecasting.

2. Materials and Methods

Empirical Review

Purbaningsih (2013) [29] carried out an investigation using Altman Z-Score Model with Current Status of Financial Ratio to asses of Consumer Goods Company (CGC) Listed in Indonesia Stock Exchange (IDX). The study's population was 33 CGC from 2009-2010 on IDX. The employed data was secondary from annual reports and accounts of the CGC. Paired t-test was conducted when test of hypotheses was carried out. The outcome revealed that there was a significant discrepancy concerning application of Altman Z-score and Current Ratio techniques when assessing the financial state of CGC quoted on IDX. Furthermore, there exists financial distress in CGC quoted on the IDX.

Sulphency & Nisa (2013) [35] carried out a study that assessed the solvency position of 220 companies listed in the BSE Small Cap Index using Z score. The outcomes disclosed that companies categorized safe were just seventy-nine in number. One hundred and seventeen of them fell in the category of grey while twenty four were in distress zone. A sector-wise analysis of the Z score revealed some interesting results. From the study outcome, it is obvious it is beneficial to the prospective shareholders during the time of making speculative choices.

Nugroho (2014) [23] did research on 'Financial Distress Prediction Analysis'. His study employed Modified Z-Score Model of Altman (2018). He made use of median yield – average score of the Group of companies that did not go bankrupt as evidenced which lower compared to the previous model of the bankruptcy. His outcome from the investigation reveals that there were ten industrial companies facing financial difficulty with seventy-eight in non-bankrupt state in the sector.

Sagho & Merkusiwati (2015) carried out an investigation on eleven banking companies and employed the model and techniques of Altman Z' Score. They found dissimilar outcomes that contradict aforementioned past works. The outcomes of their findings revealed that there were no established enterprises that were going to get involved in financial distress or fraud in next few years.

Tung & Phung (2019) [8] investigated on 'an application of Altman Z-score model to analyze the bankruptcy risk: cases of multidisciplinary enterprises in Vietnam'. Their work used Altman Z-score model and evaluated the insolvency threat of those studied multidisciplinary enterprises which data were obtained from approved annual reports and accounts of one hundred and eighty enterprises within Soc. Trang region. Their work utilized binary logistic regression in evaluating the effect of non-financial and financial factors on the bankruptcy risk of enterprises. Their outcomes from the investigation revealed that the two factors play veritable part not just as an operational managerial instrument of the commerce, but as well as proof for legislators to support the maintainable enlargement of commerce.

Ningsih & Permatasari (2018) [22] carried out a research which purposes to evaluate the variables from methods of Altman Z-Score Modification in forecasting financial distress in go public company automotive sub sector and component in the years 2012 to 2016. The outcomes of the exploration by the technique of Altman Z Score Modifications reveal that companies in the automotive sector and sub components of

nearly annually which were enterprises that were forecast to have gone through financial distress.

Rosdini, Rahardi & Nautika (2017) ^[31] took Studies in three Asia-Pacific countries on oil price and bankruptcy probability of oil and gas companies. Their research purposes to provide empirical proof pertaining to the impact of oil prices on the probability of bankruptcy in Indonesia, Singapore, and Australia. The probability of bankruptcy in their investigation was measured by Altman Z-Score of 1968. Their research work measured oil value by the amount of Brent crude. The study sample size is 20 manufacturing firms quoted at Indonesia IDX, Australian Securities Exchange (ASX) and Singapore Exchange (SGX) in the years 2013 to 2015 selected through purposive sampling. Their study outcomes indicated that by applying simple regression model, oil prices significantly impact the probability of oil and gas companies in Indonesia, Singapore, and Australia.

Forensic Accounting techniques: According to Okoye & Gbegi (2013) as cited in Okafor & Agbiogwu (2016) ^[36], Forensic accounting techniques encompass the usage of accounting, auditing with investigative skills to support in lawful issues. It as well comprises of two key mechanisms namely: Litigation and investigative services. According to Ile & Odimmega (2018) ^[15], forensic accounting techniques are made up of undercover technique, observation technique, net worth method, specific item evidence technique, interviewing, bank deposit method, examination and analysis of contracts and agreements, cash transaction method, among others.

Z-Score Models: The Z-score model for predicting bankruptcy was first issued in 1968 and modified in 2018 by Edward I. Altman, who was, at the time, an Assistant Professor, but now a Professor of Finance at New York University. According to him, the formula could be employed to forecast the likelihood that a company may be insolvent in the next two years. Z-scores become the apparatuses to forecast company failure to pay as well as simple to-compute regulating quantifier for the financial suffering level of firms in scholarly research. Z-score employs numerous company revenue and statement of financial position values to assess the financial well-being of a corporation.

Reliability of Z'' score Model: The fact is that Z'' model has merits above several other models because of its usage for every engineering, industrialized and non-manufacturing companies (Hopwood, *et al.*, 2013; Altman, 2018) ^[13]. More so, the modified, Z'' model as well uses insolvency risk forecast for companies not publicly quoted which shows little or no discrepancy among companies working in other sectors because of its no attention to sales/total assets. The Z''-score can be used for most industries and types of businesses (Altman, 2018).

So, with the Z-score model and its overall acceptance and application around the globe including Vietnam which evidences its dominance in analysis and appraisal of performances of businesses and industries and their sources of capital (Van, 2016 in Tung & Phung, 2019) ^[8].

The Altman Z-score is an algebraic instrument to develop which can speedily provide an image of the objective of a company's economic position (Bhavani & Tabi, 2017) ^[5]. Its uncomplicatedness in the computation, transparency and correctness dependably for a long time has been proved and associated to many research works due to correctness of

categorization, forecast and practice in accounting alongside finance for more than five decades (Altman, 2018).

There is latent for adaptation of the Altman z-score model by designing more unambiguously for the oil and gas industry, which will metamorphose into adoption of bankruptcy prediction models as a performance indicator. Using the Altman z-score model does indeed highlight influential characteristics in the determination of bankruptcy in the oil and gas industry (Bracegirdle, 2019) ^[6].

Red Flags: According to ACFE (2014), red flags are well thought-out as warning indicators which have to do with some specific financial statement fraud structures which elevate the consciousness of fraud likelihood nevertheless could not substantiate fraud reality. In this case, Altman Z-scores were used where the scores relating to warning and gray zones are classified as bankrupt and fraudulent signs (Elsayed n.d; Bhavani & Tabi, 2017; Vikash, 2018) ^[5, 38].

Forensic Investigative Skills

Forensic Accounting Investigative Skills: Ismail *et al.* (2018) define forensic accounting investigative skill as forensic accountant and the auditor's attribute and proficiency competences necessary and relevant to discharge technical and innovative tasks, especially with respect to identifying and analysing methods and procedures for fraud prevention, detection. IFAC-IES 3 (2005) defines forensic Accounting investigative skills as attributes that relate to competences in the areas of knowledge and ability required to conduct investigation into a company's financial records in order to provide evidence suitable for use at the court of law. According to DiGabriele (2008) ^[9], Davis, Farrell & Ogilby (2010) ^[7], forensic accounting investigative skills represent an exceptional skill sets and techniques developed for the purpose of detecting the evidence of fraud amongst other specialized knowledge areas.

From the above definitions, it means that, the specialized skills requirements expected of a forensic accountant should include but not limited to intellectual skills, technical and functional skills, interpersonal and communication skills, and organisational and business management skills (IFAC-IES 3.3, 2005). It then follows that the area of forensic accounting constitutes a specialized area that requires forensic accounting practitioners to possess certain core and enhanced skills alongside some crucial characteristics.

Forensic Accountants Engagement: According to Ibrahim (2018), forensic accountants' engagement refers to invitation of experts with accounting, auditing and investigative skills to examine, analyze, interpret and report financial information bordering on fraud discovery and other irregularities for use at the law court or administrative proceedings.

Fraud Detection: Fraud according to Taiwo *et al.* (2016) ^[36] could be regarded as the performance of dishonesty that brings about a person or society loss assets or any legitimate privileges. Fraud detection is literally a set of processes and analyses that allow businesses to identify and prevent unauthorized financial activity which can include fraudulent credit card transactions, identify theft, cyber hacking, insurance scams, and more. It encompasses pinpointing fraud early enough when perpetrated and comes in after fraud has failed to be prevented (Othan *et al.*, 2015). Therefore, fraud detection upsurges the supposed risk of getting caught thereby deterring people from engaging in fraudulent behaviour

(Jeppesen, 2019) [17]. Fraud detection is of paramount importance in fraud investigation and prevention since the accerelation with means by which fraud is detected can have a noteworthy effect on the fraud magnitude which in turn can aid curtail prospective fraud incidence (ACFE, 2020) [4]. One of the basic methods to detecting and in the long run preventing fraud is to recognize the elements which could pave way for fraudulent activities (Ghazili *et al.*, 2014, ACFE, 2018) [3]. Therefore, Cressey's fraud triangle model was a model propounded to explain reason individuals perpetrate fraud (Biegelman & Bartow, 2006; Riney 2018) [30].

Theoretical Review

The Fraud triangle: The fraud triangle was propounded by Cressey (1953) to explicate the incidence of fraud in establishments. According to Malimage (2019) [19], fraud triangle theory is widely held by scholars since it is useful in fraud behavioral analysis whether at personal or corporate echelons. Adebisi, *et al.* (2016) as cited in Okoye *et al.* (2019) [25] stated that it depends on the theory of fraud triangle to ascertain the fragile points in the commercial systems and to recognize likely suspects in cases of fraud.

Fraud Preventative Theory: This theory was projected to reduce the behavioral plan of any person to commit fraud. The proponents of the deterrence theory of punishment are Thomas Hobbes (1588–1678), Cesare Beccaria (1738–1794) and Jeremy Bentham (1748–1832) and supported scholars such as Ajzen & Fishbein (1980); Goosen *et al.* (1999) among others. The preventive theory is the idea of preventing the repetition of crime by disabling the offender through methods such as imprisonment, forfeiture, death punishment and suspension of the license. It will be supported by the utilitarian law reformers due to its humanizing influence on the penal law as cited in Ugwu, *et al* (2018). According to D'Arcy & Hearth (2011) as cited in Karuti (2020) [18], penalizing cheats and fraudsters could decrease the figure of fraudulent actions since staff may comprehend penalties of their activities. The tenets of theory of punishment of preventative and deterrence theory are: i. Pure cost benefit, ii. Deterrence and iii. Rehabilitation (Ostrom *et al.* 2004; Sidebottom, 2013; West Virginia University, 2007) [27, 33, 39]. The observed weakness as observed from the criticism of this theory is that preventative punishment has the detrimental consequence of strengthening initial fraudsters, or adolescent fraudsters, when detention is the penalty, by putting them in the association of harden criminals (Sidebottom, 2013; Karuti, 2020) [33, 18].

Nevertheless, when this theory is effectively and responsibly applied in line with it constructs it will enhance the worth of life of various stakeholders which fraudsters are deterred and prevented from fraudulent acts can grant the stakeholders their maximum benefits with the companies (Moyer, 2001) [20]. According to Economic and Social Council Resolution (2002), its application has proven over the years, advantages in terms of decreasing the expenditures which accompanied the official criminal justice structure in line with added social expenses which emanate from fraud.

The Fraud Preventative Theory is one of punishment theories where a fraudster is severely penalized either by imprisonment, death sentence, heavy fine which can deter and prevent a prospective or potential fraudster or the inflicted fraudster from repeating his fraudulent act. Listed oil and gas companies in Nigeria (Oil and gas industry) has stakeholders

among who are shareholders and stockholders which is an evidence that the industry is being run with other people's money and investment that need to be protected by the management of these listed oil and gas industry. Prevention as we know is not only cheaper, but better than cure. This theory is of relevance since it is investigating "Forensic Accounting Techniques and Fraud Detection in Nigeria: Evidence from Altman Z-Score Model Application in Oil and Gas Industry". The theory is relevant because if fraud is detected and it is assuredly traceable to the fraudster, he should be punished in order to deter and prevent intending fraudster from perpetrating the same act. This will aid even if frauds are not completely prevented they can at least be alleviated.

Gaps in the Literature

Majority of studies carried out using z-score did not show uniformity in results because of diverse sectors, difference in scopes, methods of analysis etc., but this current research studied oil and gas industry in Nigeria with special attention to the listed oil and gas companies in Nigeria. It used ANOVA to test if there is significant difference between original Z-score of 1968 and that of the modified of 2018. It as well made use of multiple linear regression, variance inflation factor (VIF) to test if there is multicollinearity problem.

Research Design

Ex-post facto research which best fits in because of the availability of historical data of the studied sampled companies was employed. The proxy to determine fraudulent, bankrupt or non-bankrupt state of the sampled companies was the result of the Altman Z-score computed on average values for years 2016-2020.

The year 2016 was chosen because of the 2016 economic recession in Nigeria. While year 2020 was because of the availability of the audited annual reports and accounts of the oil and gas companies. Year 2020 was also the year almost all the countries in the globe suffered effects of Covid-19 pandemic. The entire population is eleven, while sample size is 8 oil and gas companies which audited annual reports and accounts were available as at the time of this investigation. The sampled companies are Arдова plc, Conoil, Eterna, Japaul Gold, Mobil (11Plc), MRS, Seplat and Total Nig. Plc. The secondary data for the variables were obtained from audited annual reports and accounts of eight (8) sampled listed oil and gas companies in Nigeria. The period of coverage was 2016-2020.

The utilized techniques are Z-score model, multiple linear regression and variable inflation factor VIF. Analyses were carried out using SPSS Version 25 and STATA 13.

Model Specification

The study used the modified model of Altman (2018).

Whereas the Original old model is stated as below:

$$\text{Altman Z-Score} = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + .999X_5 \dots \dots \dots i$$

The Altman Z' Score Modified Method:

$$Z' \text{ Score} = 6.56 X_1 + 3.26 X_2 + 6.72 X_3 + 1.05 X_4 \dots \dots \dots ii$$

Where:

X1 = Working Capital/Total Assets (WC/TA)

X2 = Retained Earnings/Total Assets (RE/TA)

X3 = EBIT/Total Assets (EBIT/TA)

X4 = Market Value of Equity/Total Liabilities (MVE/TL)

Or Book value of equity to book value of debt (BVEBVL)
 $X5 = \text{Sales} / \text{Total Assets (S/TA)}$

Zones of Discrimination

If the value of Z-score is above 2.99, it means that it is evidently categorized among the “non-bankrupt” and financially healthy zone, if Z-score is less than 1.81 it implies that there is risk. Also, any zone in-between 1.81 and 2.99 evidences “prone or area of ignorance” or “gray area” owing to the vulnerability to blunder of categorization (Altman, 1968). With regards to the modified, Z’’ score, the zone of discrimination states that whenever Z-score value is more than 2.6 such entity is categorized as “ good, safe or non-bankrupt”. More so, any value from 1.1 to 2.6 implies grey zone or bankrupt risk owing to the vulnerability to blunder of categorization. But when Z’’ score is less than 1.1 such entity is ‘distress’ zone (Altman, 2018).

Summarily, any

- $Z'' > 2.6 = \text{Good, safe or non-bankrupt zone}$
- $1.1 < Z'' < 2.6 = \text{'Prone/Grey/Ignorance' zone}$
- $Z'' < 1.1 = \text{financial distress zone.}$

Owing to the above, Z-score is used for red flag as a proxy for measurement of fraud (Ng’ang’a, 2015) which is one of the signs of insolvency and bankruptcy. Therefore, where a company Z’’ score is good, safe and non-bankrupt it is adjudged non fraudulent, whereas when it prone or grey, or financial distressed it is impliedly adjudged fraudulent.

Model Specification for Fraud detection

$FRUD = f (REDF, FISK, FATE, FIRG, PBIT, FIRS)..... i$

$FRUD = \beta_0 + \beta_1REDF+ \beta_2FISK+ \beta_3FATE+ \beta_4FIRG+ \beta_5PBIT+ \beta_6FIRS..... ii$

FRUD= Fraud detection

REDF=Red flags

FISK=Forensic Investigation Skills

FATE= Forensic Accountant Engagement

FIRG= Firm Growth

PBIT= Profit before Interest

FIRS= Firm Size

f = functional notation

$\beta = \text{Beta Coefficient of the variables}$

$\beta_0 = \text{Constant}$

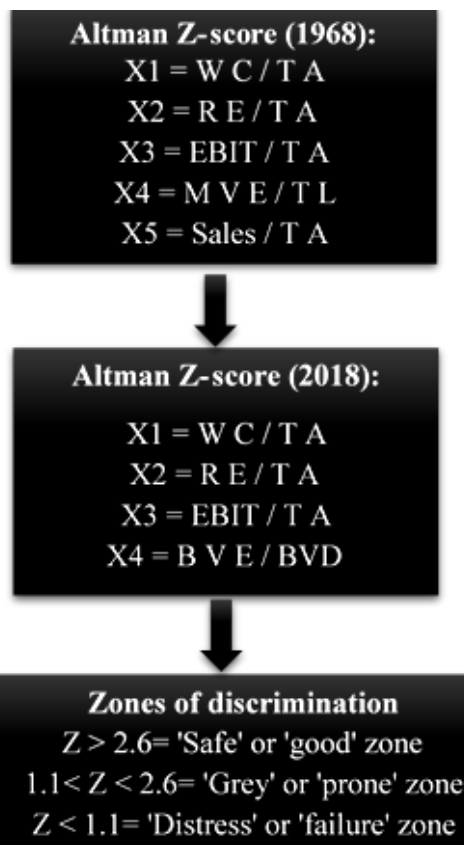


Fig 1: Altman Z-scores and the Zones of Discrimination

Source: Altman (1968; 2018) and Ningsih & Permatasari (2018).

3. Results

In an attempt to confirm if there is any significant relationship between the outcomes of original and modified Altman Z-

score models for fraud prediction in Nigerian oil and gas industry, the following computations were made:

Table 1: Population of NSE listed Oil and Gas firms in Nigeria

S/No.	Company	Ticker	Date Listed
1	Ardova (Forte Oil) Plc.	FO Oil	1978
2	Capital Oil Plc.	Capoil	August 11 th ,1989
3	Conoil Plc.	Conoil	1989
4	Eterna Plc.	Eterna Oil	March 8 th ,1998
5	Japaul Gold Plc.	Japauloil	August 10 th ,2005
6	11 PLC	Mobil Oil	1978
7	Mrs Oil Nigeria Plc.	MRS Oil	1978
8	Oando Plc.	Oando Oil	Feb.24 th ,1992
9	Rak Unity Petroleum Company Plc.	Rakunity	Nov.16th,1987
10	Seplat Petroleum Dev Co.Plc (MPN)	Seplat Oil	April 14th,2014
11	Total Nigeria Plc.	Total Oil	April 20 th ,1979

Source: <http://www.nse.com.ng/issuers/listed-securities/listed-companies> and *NSE Fact Book (2020)*. Or <https://ngxgroup.com/exchange/trade/equities/listed-companies/>

Table 2: Sample Size of the Study

S/NO.	Company	Ticker
1	Ardova Oil	Ardova Oil
2	Conoil	Conoil
3	Eterna PLC.	Eterna Oil
4	Japaul Gold	Japaul
5	11 PLC	Mobil Oil
6	MRS OIL NIGERIA PLC.	MRS Oil
7	SEPLAT Petroleum Development Co. PLC	Seplat Oil
8	Total Nigeria Plc.	Total Oil

Source: *NSE Fact Book (2020)*.

Table 3: Multicollinearity Test

Variables	VIF	1/VIF
FRUD	2.073	.482
PBIT	2.044	.489
REDF	1.055	.719
FISK	1.145	.787
FATE	1.271	.873
FIRG	1.391	.948
Mean VIF	1.50	

Source: STATA 13.

Table 4: One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Originalz	8	2.9748	1.10837	.39187
Modifiedz	8	3.7236	1.68927	.59725

Table 5: One-Sample Test

	Test Value = 11					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Originalz	-20.479	7	.000	-8.02516	-8.9518	-7.0985
Modifiedz	-12.183	7	.000	-7.27645	-8.6887	-5.8642

Table 6: The Results of Z-Score (1968)

S/NO.	Company Ticker	2016	2017	2018	2019	2020	Z-Score Mean	Remarks
1.	Ardova	3.3199	3.3299	3.3173	3.3096	3.3127	3.3179	Safe zone
2.	Conoil	2.6292	3.3551	3.6137	3.8687	4.6587	3.6251	Safe zone
3.	Eterna	3.3795	3.2544	3.2712	3.3283	3.4184	3.3304	Safe zone
4.	Japaul Gold	0.0257	-0.1548	-0.231	0.6338	0.9483	0.2444	Distress zone
5.	Mobil (11plc)	3.3198	3.3198	3.3215	3.3208	3.3189	3.3202	Safe zone
6.	MRS	3.3203	3.3202	3.3201	3.3204	3.3204	3.3203	Safe zone
7.	Seplat	3.3202	3.3202	3.3202	3.3202	3.3202	3.3202	Safe zone
8.	Total NIG.	3.3202	3.3202	3.3202	3.3202	3.3202	3.3202	Safe zone

Source: Researchers' computations using Z-score

The above table 6 indicates average outcomes (results) of the sampled listed oil and gas companies from 2016 to 2020. Going by the original Altman Z-score, Conoil is in safe zone with the average value of 3.6251. Eterna is categorized into safe zone having the average value of 3.3304. The same is true of Ardova Plc with the value of 3.3179. However, Japaul Gold is forecasted financial distressed zone since its average score is 0.2444 which is less than 1.1. Mobil Plc. is also in safe zone having the average Z-score of 3.3202. MRS is also predicted financially healthy based on its average value of 3.3203. The same is also true of Seplat with average value of 3.202. Total Nig. Plc. also produced 3.302 which placed both the former and latter in safe zone using the original (old) Altman Z-score model of 1968.

Table 7: The Result of Z''-Score (2018)

S/N.	Company Ticker	2016	2017	2018	2019	2020	Z''-Score	Remark
1	Ardova	0.9442	1.3446	2.4591	3.1872	2.7887	2.1447	Gray
2	Conoil	3.7055	3.9871	4.1959	4.3812	5.9206	4.4381	Safe
3	Eterna	3.1879	2.3932	2.4037	3.4392	2.8692	2.8586	Safe
4	Japaul Gold	0.6591	0.1552	-0.115	2.1655	3.0745	1.1878	Gray
5	Mobil(11 PLC)	4.5762	5.1159	7.0827	5.4749	5.5618	5.5623	Safe
6	MRS	3.7353	5.4119	4.9715	5.5484	5.7860	5.0906	Safe
7	Seplat	5.3888	4.0139	5.8119	5.7383	7.3693	5.6644	Safe
8	Total NIG.	2.2269	3.2498	2.9188	2.9971	2.8167	2.8419	Safe

Source: Researchers' computations using Z''-Score.

The above table 7 indicates average outcomes (results) of the sampled listed oil and gas companies from 2016 to 2020. Going by the modified Altman Z-score of 2018 (barely 5 decades after the original model), Conoil is in safe zone with the average value of 4.4381. Eterna is categorized into safe zone having the average value of 2.8586. As for Ardova Plc with the value of 2.1447, it is predicted into gray zone. Also, Japaul Gold is forecasted into gray zone since its average score is 1.1878. Mobil Plc. is predicted in safe zone having the average Z-score of 5.5623. MRS is also predicted

financially healthy based on its average value of 5.0906. The same is also true of Seplat with average value of 5.6644. Total Nig. Plc. also produced average 2.8419 which placed both the former and latter in safe zone using the modified Altman Z-score model of 2018. However, a close look at economic incremental trend that ensued in Japaul Gold in years 2019 and 2020 respectively suggests its future migration hope from gray zone to financially healthy (safe) zone. The categorization that places its z-score on gray zone is based on average for five (5) years because looking at its outstanding z-

score of 3.0745 in the negatively affected Covid-19 pandemic year against the z-score of 2.1655 in 2019 we can empirically believe that there is hope for the investors and prospective investors who may want to invest in Japaul Gold. Also, as for Ardova Plc, there is also an upward incremental trend from the year of recession (2016) in Nigeria (0.9442; 1.3446; 2.4591; 3.1872) until the decline to 2.1447 in year 2020, the negatively affected Covid-19 pandemic year against the z-score of 3.1872 2 in 2019. Incidentally one may opine that the decrease could be as a result of effect of Covid-19 pandemic.

Table 8: One Sample t-test Results

	Mean	Std. dev.	T	df.	Sig(2 tailed)	Mean diff	95% Conf. Interval of the Difference:	
							Lower	Upper
Originalz	2.9748	1.10837	-20.479	7	.000	-8.02516	-8.9518	-7.0985
Modifiedz	3.7236	1.68927	-12.183	7	.000	-7.27645	-8.6887	-5.8642

Source: One Sample Results using SPSS Version 25.

Descriptive Statistics

Table 8 (One Sample Results) reveals that the average for original z-score is 2.9748 while that of modified z-score is 3.7236 indicating the average difference of 0.7488. Also, the standard deviation value for original z-score is 1.10837 whereas that of modified z-score is 1.68927. The results reveal a significant difference in the mean z-scores of the original in comparison with the modified z-score $t(10) = -$

20.497, $p < 0.05$ (i.e. 0.000); $t(10) = -12.183$, $p < 0.05$ (i.e. 0.000). Hence, the average z-score of the modified is significantly different from the original z-score. Based on this the study rejects the null hypothesis one (H_{01}) which states that there is no significant difference between the outcomes (mean scores) of original and modified Altman Z-score models for fraud prediction in Nigerian oil and gas industry.

Table 9. Multiple Regression Results

Model		Coefficients ^a						Collinearity Statistics	
		Unstandardized Coefficients		Standardized Coefficients	T-test	Sig.	Tolerance	VIF	
		B	Std. Error	Beta					
1	(Constant)	-6.390	5.088		-1.256	.218			
	REDF	-1.955	.443	-.474	-4.411	.000	.719	1.391	
	FISK	1.500	.416	.370	3.602	.001	.787	1.271	
	FATE	-1.683	1.116	-.147	-1.508	.141	.873	1.145	
	FIRG	.678	.382	.166	1.775	.085	.948	1.055	
	PBIT	1.144	.565	.264	2.025	.051	.489	2.044	
	FIRS	-.298	.594	-.066	-.502	.619	.482	2.073	

a. Dependent Variable: FRUD.

Source: Output from SPSS Version 25.

The multiple regression table above reveals that Red flags (REDF) has significant (0.0000) negative relationship (-1.955) coefficient value with Fraud detection at 5% of significance. The table 4.1.3 as well discloses that Forensic investigative skill (FISK) has significant (0.001) positive association (1.500) with fraud detection (FRUD) at 5% level of significance. However, Forensic accountants engagement (FATE) shows insignificant (0.141) negative effect (-1.683)

on fraud detection because listed oil and gas companies in Nigeria did not engage any forensic accounting experts as they had no evidential fraudulent cases to engage them. The result of multicollinearity test revealed VIF mean of 1.50 implying absence of multicollinearity problem which proves according to Dub-Watson's rule of thumb of less than or equal to 2 as free from multicollinearity problem.

Table 10: Model Summary

Model	R	R Square	Adjusted R-Square	Std. Error of the Estimate	R Square Change	F-Change	df1	df2	Sig. F Change	Durbin-Watson
1	.852 ^a	.726	.676	1.02953	.726	14.541	6	33	.000	1.240

a. Predictors: (Constant), FIRS, REDF, FIRG, FATE, FISK, PBIT

b. Dependent Variable: FRUD.

Discussion

This study, having investigated the relevant variables in Altman Z-Score model and current status of financial ratios to evaluate oil and gas companies listed on the Nigerian Stock Exchange as at December 31st, 2020 discovered that there is virtually none of the sampled companies was actually predicted bankrupt/fraudulent using the modified Altman, Z''-score of 2018.

This study is in tandem with Sagho & Merkusiwati (2015) who carried out an investigation on eleven banking companies and employed the model and techniques of Altman Z'' Score. The outcomes of the findings revealed that there were no established companies that were going to get involved in financial distress. From the analysis of findings, this study does not corroborate Purbaningsih (2013) [29] whose study revealed financial distress in consumer goods company listed in Indonesia stock exchange.

The outcomes from this study's Z'' score is in tandem with Ningsih & Permatasari (2018) [22] whose study reveals that companies in the automotive sector and sub components of nearly annually which were enterprises that were forecast to have gone through financial distress were only two among the eleven (11) companies which implies that majority are safe just like the case of listed oil and gas companies which this study investigated.

Conclusions

The present work assessed the forensic accounting techniques and fraud detection in Nigerian: evidence from Altman z-score model application in oil and gas industry. When Altman Z' score 1968 tests were conducted for the period of 2016-2020 it was discovered on average values that all the sampled companies were in safe zone except Japaul Gold that was in distress zone. Also, when the modified Altman Z-score of 2018 test was conducted all the sampled companies were in safe zone except Ardova Plc. and Japaul Gold that were in gray and warning zone.

In another test using multiple linear regression, the dependent variable, fraud detection (FRUD) was measured using the results of modified Z'' score model to forecast whether the companies would be insolvent in the next two years or not. The predictors in the study are REDF, FISK and FATE while the control variables are FIRG, PBIT and FIRS.

Recommendations

Owing to the outcomes of the investigation, the test of formulated null hypotheses and analysis of the interpolation of the variables, the study recommends that

- i) In so far there is significant difference between original and modified z scores as shown in the one sample test, in assessing whether oil and gas companies may be fraudulent or not in the next few years, modified Z'' score model should be employed as a veritable tool.
- ii) Since red flags revealed significant negative impact on fraud detection, the sector should always pay attention to those early warning signs of fraud if there exist(s) any.
- iii) The oil and gas industry and the professional accounting bodies should encourage the forensic investigation skills by training the accountants and increasing the number of forensic accountants because they reveal positive effect on the industry.
- iv) The oil and gas industry should consider regular engagement of forensic accountants. This relationship shows insignificant negative effect because it was not evidenced in the annual reports and accounts that the

companies did not engage the service of forensic accountants in the five years under review.

Suggestion for Further Study

The present deals in Forensic Accounting Techniques and Fraud Detection in Nigeria: Evidence from Altman Z-Score Model Application in Oil and Gas Industry. It is advisable to embark on study to compare other bankruptcy and fraud detection techniques such as Springate (S-score), Zmijewski, and Ohlson models with the results of Altman Z-score model using the same sector. It is also necessary to increase the period of study. The same should also be done using other sectors like quoted Conglomerates and Consumer goods.

References

1. Abei YA. Impact of Internal Control on Fraud Detection and Prevention in Microfinance Institution. Master's Thesis 2021. Karistad University School of Business, Karistad, 2021.
2. Amaechi EP, Nnanyereugo EV. Application of computed financial ratios in fraud detection modelling: a study of selected banks in Nigeria. *Asian Economic and Financial Review*. 2013; 3(11):1405-1418.
3. Association of Certified Fraud Examiners (ACFE). Report to the Nations: 2018 Global Study on Occupational Fraud and Abuse, 2018. Available at: <https://www.acfe.com/report-to-the-nations/2018/default.aspx>.
4. Association of Certified Fraud Examiners (ACFE). Report to the Nations 2020 Global Study on Occupational Fraud and Abuse, 2020. Available at: 58 <https://acfepublic.s3-us-west-2.amazonaws.com/2020-Report-to-theNations.pdf>.
5. Bhavani G, Tabi C. M-Score and Z-Score for detection of Accounting Fraud, 2017: <https://www.researchgate.net/publication/318489930>.
6. Bracegirdle S. Using Altman z-score model to test bankruptcy in the oil industry, 2019. : <https://www.researchgate.net/publication/332622181>.
7. Davis C, Farrell R, Ogilby S. "Characteristics and Skills of the Forensic. Accountant," AICPA Publications, 2010.
8. Diep Thanh Tung, & Vo Thi Hoang Phung. An application of Altman Z-score model to analyze the bankruptcy risk: cases of multidisciplinary enterprises in Vietnam. *Investment Management and Financial Innovations*. 2019; 16(4):181-191. doi:10.21511/imfi.16(4).2019.16.
9. DiGabriele JA. 'An Empirical Investigation of the Relevant Skills of Forensic. Accountants,' *Journal of Education for Business*, 2008, 331-338.
10. Elsayed AA (n.d). Indicators of the Financial Statement Fraud (Red Flags). North central University Electronic copy available at: <https://ssrn.com/abstract=3074187>.
11. Gbegi DO, Adebisi JF. Forensic Accounting Skills and Techniques in Fraud Investigation in the Nigerian Public Sector. *Mediterranean Journal of Social Sciences MCSER Publishing, Rome-Italy*. Doi:10.5901/mjss. 2014; 5(3):243.
12. Ghazali MZ, Rahim MS, Ali A, Abidin S. A preliminary study on fraud prevention and detection at the state and local government entities in Malaysia. *Procedia-Social and Behavioral Sciences*. 2014; 164:437-444.
13. Hopwood W, Young G, Leiner J. Forensic Accounting and Fraud Examination. CPI Group (UK) Ltd, Croydon,

- CR04YY. ISBN 13: 9781121913998, 2nd ed, 2013. <http://create.mcgraw.hill.com>.
14. Ibrahim KFA. Effect of forensic accounting on fraud detection in the Nigerian deposit money banks Thesis, 2018. DOI:10.13140/RG.2.2.31884.67207. <https://www.researchgate.net/publication/336669553>.
 15. Ile CM, Odimmega CG. Use of forensic accounting techniques in the detection of fraud in tertiary institutions in Anambra State, Nigeria. *International Multi-Disciplinary Journal*, Bahir Dar, Ethiopia AFRREV 12 (1), ISSN 1994-9057, ISSN 2070-0083, 2018. DOI: <http://dx.doi.org/10.4314/afrev.v12i1.8>.
 16. Ismail AM, Azizan FA, Fahmi FM. Forensic Accountant Skills: An Empirical Investigation in the Malaysian Forensic Accounting Education Curriculum. *The Journal of Social Sciences Research*. ISSN(e): 2411-9458, ISSN(p): 2413-6670. 2018; (6): 247251. URL:https://arpgweb.com/journal/journal/7/special_issue .DOI:<https://doi.org/10.32861/jssr.spi6>.
 17. Jeppesen KK. The role of auditing in the fight against corruption. *Journal of the British Accounting Review*, 2019; 51(5):100798. <https://doi.org/10.1016/j.bar.2018.06.001>.
 18. Karuti JK. Forensic Accounting and Fraud Control in County Governments in Kenya: Evidence from Counties in Mt. Kenya Region. A Thesis Submitted in Partial Fulfillment for the Award of the Degree of Doctor of Philosophy in Business Administration and Management of Kenya Methodist University, 2020.
 19. Malimage K. Theories in Fraud Research: Suggestions for future research. *Journal of forensic and investigative Accounting* 11(1), 2019.
 20. Moyer IL. *Criminological theory: Traditional and nontraditional voices and themes*. Thousand Oaks, CA: Sage, 2001.
 21. Ng'ang'a KJ. The effect of forensic accounting services on fraud prevention in the insurance companies of Kenya. Unpublished M.Sc. Thesis submitted to the School of Business in the University of Nairobi, 2015.
 22. Ningsih S, Permatasari FF. Analysis Method of Altman Z Score Modifications to Predict Financial Distress on The Company Go Public Sub Sector of The Automotive and Components. *International Journal of Economics, Business and Accounting Research (IJEBA)*. 2018; 2(3):36. ISSN: 2614-1280, <http://www.jurnal.stie-aas/ijebar>.
 23. Nugroho MID. Analisis Prediksi Finansial Distress dengan Menggunakan Model Altman Modifikasi 1995. Skripsi. Universitas Diponegoro. Semarang, 2014.
 24. Odibi I, Basit A, Hassan Z. Bankruptcy Prediction Using Altman Z-Score Model: A Case Of Public Listed Manufacturing Companies In Malaysia. *International Journal of Accounting & Business Management*, 2015. www.ftms.edu.my/journals/index.php/journals/ijabm. 3(2), ISSN: 2289-4519. DOI: 10.24924/ijabm/2015.11/v3.iss2/178.186.
 25. Okoye EI, Adeniyi SI, James ON. Effect of forensic accounting on fraud management on selected firms in Nigeria. *International Journal of Economics, Business and Management Research*. 2019, 3(12); ISSN: 2456-7760 www.ijebmr.com p.149.
 26. Onakoya AB, Olotu AE. Bankruptcy and Insolvency: An Exploration of Relevant Theories. *International Journal of Economics and Financial*. 2017, 7(3), ISSN: 2146-4138.
 27. Ostrom CW, Ostrom BJ, Kleiman M. *Judges and Discrimination: Assessing the Theory and Practice of Criminal Sentencing*, 2004. 204024. 98-CE-VX-0008.
 28. Othman R, Aris NA, Mardziah A, Zainan N, Amin NM. Fraud detection and prevention methods in the Malaysian public sector: Accountants' and internal auditors' perceptions. *Journal of Procedia Economics and Finance*. 2015; 28:59-67. [https://doi.org/10.1016/S2212-5671\(15\)01082-5](https://doi.org/10.1016/S2212-5671(15)01082-5).
 29. Purbaningsih YP. Using Altman z-score model and current status of financial ratio to assess of Consumer Goods Company listed in indonesia stock exchange. The First International Conference on Law, Business and Government 2013, UBL, Indonesia III-169, 2013.
 30. Riney FA. Two-Step Fraud Defense System: Prevention and Detection. *Journal of Corporate Accounting and Finance*. 2018; 29(2):74-86. <https://doi.org/10.1002/jcaf.22336>.
 31. Rosdini D, Nautika RG. Oil price and bankruptcy probability of oil and gas companies (studies in 3 Asia-pacific countries). 3rd Accounting and business conference, 2017. Parahyangan International.
 32. Sagho MF, Merkusiwati NKLA. Penggunaan Metode Altman Z-Score Modifikasi Untuk Memprediksi Kebangkrutan Bank Yang Terdaftar Di Bursa Efek Indonesia. *E-Jurnal Akuntansi Universitas Udayana* 11(3) hal, 2015, 730-742.
 33. Sidebottom A. Understanding and Preventing Crime in Malawi: An Opportunity Perspective. Thesis submitted in support of a Ph.D. in Security and Crime Science. Department of Security and Crime Science University College London. Thesis submitted in support of a Ph.D. in Security and Crime Science, 2013.
 34. Sow ANG, Basiruddin R, Mohammad J, Rasid SZA. Fraud prevention in Malaysian small and medium enterprises (SMEs). *Journal of Financial Crime*. 2018; 25(2):499-517. <https://doi.org/10.1108/JFC-05-2017-0049>.
 35. Sulphrey M, Nisa S. The analytical implication of Altman's z-score analysis of BSE listed small cap companies. Published by Global institute for research education. G.J. C.M.P. 2013; 2(4):145-155.
 36. Taiwo JN, Agwu ME, Babajide AA, Okafor TC, Isibor AA. Growth of bank frauds and the impact on the Nigerian banking industry. *Journal of Business Management and Economics*. 2016; 4(1):1-10. <https://doi.org/10.15520/jbme.2016.vol4.iss12.232.pp01-10>.
 37. Ugwu CT, Chijioke E, Chigozie MP. Effect of forensic accounting on the performance of Nigerian banking sector: *Journal on Banking Financial Services & Insurance Research*. 2016, 8(5), <https://www.researchgate.net/publication/353783361>.
 38. Vikash S. Evaluation of Financial Health of RCFL of India through 'Z' Score Model. *International Journal of Research and Review*. www.ijrrjournal.com E-ISSN: 2349-9788; P-ISSN: 2454-2237, 2018, 5(8).
 39. West Virginia University. Education and Training in Fraud and Forensic Accounting: A Guide for Educational Institutions, Stakeholder Organizations, Faculty, and Students, 2007.