

**O.J. Omolekan<sup>1\*</sup>**, **E.O. Ajayi<sup>2</sup>**,  
**O.L. Kazeem-Bayo<sup>2</sup>**, **H.B. Babalola<sup>2</sup>**

<sup>1</sup>University of Ilorin, Nigeria, Ilorin

<sup>2</sup>Osun State University, Nigeria, Osogbo

\*e-mail: o.omolekan@gmail.com

## FINANCIAL DISTRESS PREDICTION IN NIGERIAN OIL AND GAS INDUSTRY: A MULTIVARIATE APPROACH

The oil and gas sector are in no doubt a very sensitive and equally a very important sector and majorly the main stay of Nigerian economy. Recent dropped in the prices of oil in the international market is of great concerned to all oil producing and exporting countries of which Nigeria is a major player. Colossal cost implications of collapsed business are enormous, detrimental, anti-economic growth and development but preventable if the early warning distress signals can be predicted. Thus, this study predicts financial distress in Nigeria oil and gas firms using multivariate approach. Longitudinal design was adopted for the study. Data were extracted from Nigeria Stock Exchange (NSE) fact books from year 2000 to 2018. Information obtained were arranged and collated in ratio analysis. Multiple discriminant analysis (MDA) was used to predict the early warning signals and post-prediction differences were tested using t-test. The prediction results revealed the failure early warning signals in the study area to be earning before interest and tax (EBIT), working capital (WCA), and TAR with strong prediction accuracy. The study concluded that Nigerian oil and gas companies are susceptible to failure given the early warning signals identified. It is recommended that the sampled firms should take into cognizance the identified early warning signals to prevent financial distress and take preventive measures towards rejuvenation.

**Key words:** Early warning signals, financial distress prediction, MDA, oil and gas firms, rejuvenation.

О.Дж. Омолекан<sup>1\*</sup>, Е.О. Аджайи<sup>2</sup>,  
О.Л. Казим-Байо<sup>2</sup>, Х.Б. Бабалола<sup>2</sup>

<sup>1</sup>Илорин университеті, Нигерия, Илорин қ.

<sup>2</sup>Осун мемлекеттік университеті, Нигерия, Осогбо қ.

\*e-mail: o.omolekan@gmail.com

### Нигерияның мұнай және газ өнеркәсібіндегі қаржылық апаттарды болжау: көп өлшемді көзқарас

Мұнай-газ секторы, сөзсіз, өте сезімтал, өте маңызды сектор және Нигерия экономикасының тірегі. Жақында халықаралық нарықта мұнай бағасының құлдырауы барлық өндіруші елдерді, соның ішінде Нигерияны қатты алаңдатып отыр. Құлаған бизнестің орасан зор қаржылық салдары экономикалық өсу мен дамуға кедергі келтіретін орасан зор, зиянды. Бірақ апат туралы ерте ескерту сигналдарын болжау мүмкін болса, оның алдын алуға болады. Осылайша, бұл зерттеу Нигерия мұнай-газ компанияларының қаржылық қиындықтарын көп өлшемді тәсілді қолдана отырып болжайды. Зерттеу үшін бойлық әдіс қолданылды. Зерттеуге арналған деректер 2000-2018 жылдар аралығындағы Нигерия қор биржасынан (NSE) алынды. Алынған мәліметтер жүйеленіп, салыстырмалы талдау арқылы салыстырылды. Ерте ескерту сигналдарын болжау үшін көптік дискриминантты талдау (MDA) пайдаланылды, ал болжаудан кейінгі айырмашылықтар t-тесті арқылы тексерілді. Болжам нәтижелері зерттеу аймағындағы сәтсіздік туралы ерте ескерту сигналдарына пайыздар мен салықтарға дейінгі кіріс (EBIT), айналым капиталы (WCA) және болжам дәлдігі жоғары TAR кіретінін көрсетті. Зерттеу нәтижесінде Нигериялық мұнай-газ компаниялары анықталған ерте ескерту сигналдарына байланысты банкроттыққа ұшырауы мүмкін деген қорытындыға келді. Іріктемеге енгізілген фирмаларға қаржылық қиындықтарды болдырмау және қалпына келтіру үшін алдын алу шараларын қабылдау үшін анықталған ерте ескерту сигналдарын ескеру ұсынылады.

**Түйін сөздер:** ерте ескерту сигналдары, қаржылық дағдарысты болжау, MDA, мұнай-газ компаниялары, қалпына келтіру.

О.Дж. Омолекан<sup>1\*</sup>, Е.О. Аджайи<sup>2</sup>,  
О.Л. Казим-Байо<sup>2</sup>, Х.Б. Бабалола<sup>2</sup>

<sup>1</sup>Университет Илорина, Нигерия, г. Илорин

<sup>2</sup>Государственный университет Осун, Нигерия, г. Осогобо

\*e-mail: o.omolekan@gmail.com

### Прогнозирование финансовых бедствий в нефтегазовой промышленности Нигерии: многомерный подход

Нефтегазовый сектор, без сомнения, является очень чувствительным и в равной степени очень важным сектором и основной опорой нигерийской экономики. Недавнее падение цен на нефть на международном рынке вызывает серьезную обеспокоенность всех стран-производителей и в том числе и Нигерии. Колоссальные финансовые последствия рухнувшего бизнеса огромны, пагубны, препятствуют экономическому росту и развитию, но их можно предотвратить, если можно предсказать сигналы раннего предупреждения о бедствии. Таким образом, это исследование прогнозирует финансовые затруднения нефтегазовых компаний Нигерии с использованием многомерного подхода. Для исследования был использован продольный метод. Данные для исследования были получены из Нигерийской фондовой биржи (NSE) за период с 2000 по 2018 год. Полученная информация была систематизирована и сопоставлена с помощью сравнительного анализа. Множественный дискриминантный анализ (MDA) использовался для прогнозирования сигналов раннего предупреждения, а различия после прогнозирования проверялись с использованием t-критерия. Результаты прогнозирования показали, что сигналы раннего предупреждения об отказе в изучаемой области включают прибыль до вычета процентов и налогов (ЕБИТ), оборотный капитал (WCA) и TAR с высокой точностью прогноза. В исследовании сделан вывод о том, что нигерийские нефтегазовые компании подвержены банкротству из-за выявленных сигналов раннего предупреждения. Рекомендуется, чтобы фирмы, включенные в выборку, учитывали выявленные ранние предупреждающие сигналы, чтобы предотвратить финансовые затруднения и принять превентивные меры для восстановления.

**Ключевые слова:** сигналы раннего предупреждения, предсказание финансового кризиса, MDA, нефтегазовые компании, восстановление.

## Introduction

The continuous entry and exit of companies are natural components in the economic system, while, a huge number of businesses have succeeded, others have struggled for survival and subsequently failed (Lakshan & Wijekoon, 2013). Interest in corporate financial distress prediction has grown rapidly in recent years due to the number of businesses that are collapsing majorly on the issues of finances. In most organization, corporate failure often results in major costs, which may be direct and indirect costs to stakeholders such as, shareholders, suppliers, customers, managers, creditors, employees, investors, auditors, and the community (Uchenna & Okelue, 2012). Likewise, financial distress leads to direct and indirect costs on the firm. Direct costs include tangible and any other expenses paid for the purpose of liquidation or a means of reorganization towards rejuvenation of the ill enterprise (Olaniyi, 2007). These direct costs include: lawyer cost, bankruptcy fees, accountants' levy and other professional services in a case of liquidation while loss sales because of perceived failure, which leads to decline in firms' profit, are classified as indirect cost. Customers are always willing to buy from the firms that are

stable to deliver on promise rather than the ones that might fail. In the same vein, suppliers are reluctant or less generous in offering credit facilities to the firms that might soon close their operation (Taliani, 2010). This impaired relationship has adverse effect on the firm and may even worsen the situation leading to bankruptcy.

Business failure is characterized by loss of job directly and indirectly, and this results to perceived job insecurity, while high profile staff will strive to move to a safer enterprise in the bid to protect their career. A lot of managerial time and opportunities were always lost dealing with distress or finding a way to get out of it (Uchenna & Okelue, 2012). In most distress cases, management concentrate its time and effort solving liquidity issues and short-term financing rather than long term shareholders' wealth.

Aside from the economic and financial cost, business failure is also associated with social cost and generally, failure ruins lives, cause depression, destroy health, leads to loss of confidence in its victims and pushes them to the edge of committing suicide and beyond (Thynne, 2006). Many of these costs can be ameliorated if distress could be pre-terminated before failure occurs and if estimate could

be made for firm's survival within a reasonable time frame.

The pronounced failure in the Nigerian banking sector (from 89 to 19 within 1990 to 2011), brewing, textile (from 124 to 45 between 1994 and 2005), agriculture, consumer goods companies and many more posed serious problems to the developing countries like Nigeria because the consequences are huge and capable of hindering expected growth and development. Early prediction and application of remedial measures will prevent most of these problems and one of the most paramount decisions in any business decision is its continuity and survival as number objective. The consequences of failure are enormous and far reaching on the business firms, its environment where it operates and the entire economy at large.

The oil and gas sector in Nigerian economy is estimated to worth over 3.3 trillion USD as at 2019 (Market research by IBIS World, 2019). Yet, this sector has really suffered great shocks and distress recently due to fluctuation in prices, under-utilization of capacity, exchange rate problems, vandalism of pipelines, inflation, unstable government policies and other disequilibrium in macro economy policy in the country. The low capacity utilization has led to unfavourable business climates for most oil and gas firms. Besides, the loan payment default published by "Thisday's Newspaper" on 10th of August 2015, which captured the list of defaulting customers in 16 Nigerian banks. The report shows a total amount of N238 billion as Non-Performing Loan (NPLs) in the Nigerian banking sector out of which N47.572 billion is accrued to oil and gas sector as bad loans (Obina, 2015). Nigerian economy still depends on oil production and prices for survival. Now, oil price is falling, which portends deep challenges for especially indigenous oil and gas firms in the country. Many organizations in this sector have experienced distress while consequently some have collapsed.

Meanwhile, many academic scholars and professional bodies have studied corporate collapse and have developed models and theories in the bid to predict corporate failures far ahead of times to curb the menace and consequences attributed to business failure. Yet, there seems to be divergence of interest among scholars as many researches resulted in contradictory opinions such as Atiya (2001) predict firms' failure with neural network model resulting in results. While Kogi (2003), Bello (2010), Adeyemi (2011) and Maishanu (2013) predict firms' failure based on stability of financial ratios and were of the

view that failure occurs because of capital inadequacy and lack of transparency. Besides, Enyi (2013) developed prediction model and compare the model with other solvency models focusing on profitability and liquidity index as early warning signals. In contrary, Adeyeye and Migiro (2015) attributed firms' failure to debt equity and financial structure using multivariate model. However, distress prediction and corporate survival issue is complex. Studying this area of business is encumbered, challenged, and motivated as no single theory exist to understand and explain corporate survival, no techniques guarantee effective survival prediction. Thus, over 40 years of bankruptcy prediction through multivariate statistical models, no sound agreement has been reached among prediction scholars on solvency prediction models variables. The need to resolve these disagreements and so also why the financial distress is associated with oil and gas industry motivated this study to investigate the existing solvency situations in the country, prediction models used, evaluate the models, and suggest appropriate models for corporate financial distress prediction.

To ensure sustainable economic growth, it is crucial to control the number of businesses that failed, corporate solvency must be controlled in the most effective manner to guarantee the systematic growth and continued existence of such organizations. However, to control a firm's liquidity therefore, it is imperative to make use of tools that are more proactive rather than reactive in their general approach towards detection and remediation of the possible danger. The most valuable tool for any business organization must be the one that gives an "advance" warning of an impending disaster rather than the sign of it, as symptoms only manifest when a patient is already under attack. The signs of possible corporate failure become evident months or years before the actual bankruptcy materializes. Actual prediction of declining business activities leading to bankruptcy gives room for corrective measures or actions by the stakeholders. This study, therefore, predict financial distress in the Nigeria oil and gas firms using Multiple Discriminant Analysis Model.

## Literature Review

### *Conceptual of Financial Distress*

Financial distress as a term is used in negative situations to describe the financial state of a firm faced with a temporary liquidity deficiency and with complications that arises in the fulfillment of the financial obligations on plan and to the full extent

(Galloway & Jones, 2006). In a broad perspective, it is viewed as a costly occurrence that affects the relationship with non-financial stakeholders and debtors (Harris & Gibson, 2006). Consequently, a company increases its weak access to fresh capital thereby bearing the increased costs of maintaining this disturbed relationship. In the view of Bwisa (2010), he argued that the advancement of financial distress theory is a process having specific dynamics while Gordon (2001) highlighted that, it is only one phase of the process, accompanied by failure then restructuring, and should also be defined in relation to security valuation and financial structure. The corporation encounters this situation when its earning generating ability becomes weaker and the sum of debt is greater than the value of the company's total assets (Charitou, 2002). Therefore, financial distress is a state when a firm cannot meet or face difficulty in paying off its financial obligations to all stakeholders. The chances of corporate financial distress increase when a firm's fixed costs are high, assets are illiquid, or there is a fall in revenues. These situations led most companies to bankruptcy and eventual collapse.

Gestel et al. (2006) categorized two types of financial distress, the first one is non-payment of a debt, and the second is an attempt to restructure debt to avoid the default situation. Financial distress arises when a company lacks the ability to fulfil its liabilities to the third parties. Increase in commercial banks and delisted of public companies non-performing loans in Nigeria is a distinctive phenomenon of corporate financial distress (Ayeni, 2012). Failure and financial distress is the outcome of chronic losses caused by a disproportionate increase in liabilities which is followed by reduction in the asset value (Gestel et al., 2006).

Financial distress has a sequence of successive stages characterized by a distinct set of opposing financial events. Each stage having a distress point continue the next distress point is reached (Turetsky & MacEwen, 2001). Each stage of financial distress technically is an interval between two distress points. The beginning of financial distress starts with having a volatile decrease from a positive cash flow to negative cash flow. The reduction shows the change to the next phase of financial distress leading to default. Technical default on debt leads to troubled debt restructuring usually reducing the risk of probable bankruptcy (Uchenna & Okelue, 2012).

#### *Business Failure Indicators*

A financially distressed company is one whose Earnings Before Interest and Taxes (EBIT) is lower

than its interest expenses (Olaniyi, 2007). Financial leverage encompasses the replacement of fixed-cost and debt for owner's equity in light of increasing equity returns. Financial performance is improved by financial leverage when financial business prospects are positive but negatively impact financial performance when things are going poorly (Bello, 2010). Therefore, increasing the ratio of debt to equity in a firm's capital structure implicitly makes the firm fairly less solvent and more financially risky than a company without debt.

Capital adequacy is the ability of a firm to have sufficient capital to finance its plans (Taliani, 2010). If a firm's capital is inadequate, then it must be able to successfully issue new equity, acquire new debt or merge. The amount of debt a company can successfully absorb and repay from its continuous operations, is referred to as the company's debt capacity (Thynne, 2006). The following are the firms' failure indices:

*Poor Cash Flow:* Many businesses have single most important reason for business failure (Robbins & Pearce, 2005). This problem arises when the cash inflow is not sufficient to cover the costs of production. It is important to note that, availability of fund to pay debts as at when due is most paramount in business survival not just ability to generate revenue to cover cost (Patrick & Ooghe, 2004).

*Poor Business Planning:* Many businesses before receiving loans or financial help from a bank have to put together a business plan. These plans take time and effort that is crucial for success. Poor information or bad planning on which the plan is to be based would likely lead to difficulties for the firm (Chiritou, 2002). Any businesses that based on faulty or poor plans will likely be in serious danger of failure.

*Reduction in Product Demand:* A fall in sales might be a sign that there is something wrong with either the price or the product or an aspect of marketing mix being used (Sipika & Smith, 2002). Often, falling sales could be due to competitors providing a better service or product. For any firm to revert this, it is important to identify the causes of fall in demand and developed appropriate measures to curb the menace (Moyer et al, 2006).

*Changes in fashion, taste and technology:* This can lead to fall in demand for products – the firm needs to be cognizant of these trends (Ayeni, 2012). Demand can fall for other reasons out of the firm's control. It might be as a result of change in economic climate of the country. People may intend to

cut down their spending due to economy downturn (Sipika & Smith, 2002).

*High Overhead:* High overheads can drive out any business very fast, since the golden principle for the successful business is to keep low overheads especially at the early stage (Argenti, 2003). Customer base diversification is an important influence in building the business, also being able to flexibly adapt to new trends and ideas is vital to staying in business (Eidleman, 2003).

*Lack of control over costs:* Production costs can rise for quite a number of reasons. It could be because of increase in prices of raw materials, increase in wages, and payment by businesses for meeting some new legislation or standard and so on (Whitaker, 2000). Most times, such changes could be in a firm's plan and they might also have the capacity to consider them but when unexpected rise in costs arise, it can catch a firm by surprise and result into insolvency (Kip, 2002).

*Uncontrolled Growth:* Another cause that may lead a firm to fail if not handled properly is uncontrolled growth. Unrestricted growth and expansion is dangerous for business survival (Robbins & Pearce, 2005). For a business to experience growth, proper planning must be in place. A professional management team to oversee the affairs of the firms, proper systems and control and flexible organizations is required for successful growth (Eidleman, 2003).

#### *Business Failure Models*

Models of business failure can be broadly categorized into two groups: qualitative models (based on an assessment of the company concern internally); and quantitative models (largely based on published financial information). They both attempt to point out characteristics, whether financial or non-financial, thereby differentiating between failing and surviving firms (Robinson & Maguire, 2001).

*Qualitative models:* These models rest on qualitative or non-accounting variables (Adeyemi, 2011). The "A" score model is one of the most used models and it is attributed to Argenti (2003), which proposed that failure process follows an expected sequence – Defect, Mistakes and Symptoms of failure. The failure process starts with the observable defect that leads to mistakes which causes reduction in cash in-flow and out-flows in the organisation. The mistakes will eventually turn out to showing of failure symptoms which symbolizes that the firm is already under attack.

*Quantitative models:* These models point out values of financial ratios differently marked between failing and surviving companies and can be used

subsequently to identify companies exhibiting failure characteristics (Kip, 2002). Financial indicators of impending failure that are commonly accepted are: high variability of income, assets in relation to low profitability, high gearing, poor capital and dividend liquidity, and low equity returns.

#### *Theoretical Review*

In the literature, five theoretical approaches were reviewed; Entropy, Bankruptcy and re-organisation, Cash management, Gambler's ruin and Credit risk theory (Kip, 2002; Kogi, 2003; Robbins & Pearce, 2005; Moyer et al., 2006; Taliani, 2010; Maishanu, 2013). The changes in the firm's financial position are the key pointer in the entropy theory. It is expected that firm's financial statement should be stable and sustain a state of equilibrium as a noticeable change in the asset and liabilities composition put the organisation in a state of survival dilemma (Kogi, 2003). This implies that such organisation is in a state of financial distress. The gambler's ruin theory views the firms' financial distress as a gamblers' who gamble or dabble into a particular activity with win or lose outcome. The gambler continues the game if the resources to play the game still exist and opt out of the game the moment the resources is exhausted (Kip, 2002; Taliani, 2010). In applying this theory, the probability that firm may experience a negative cash flow will lead them to bankruptcy. With this, a firms' net worth greater than zero implies that such firm will continue to survive until its experience a negative or downward cash flow less than zero.

However, theory of cash management emphasis the shortage of cash inflows and outflows needed to meet the firms' day-to-day need as a measure of financial distress (Robbins & Pearce, 2005). A continuous changes or persistent imbalance of firms' cash inflows in relation to cash outflows implies a cash management failure that resulted in financial distress. Besides, credit risk theory classified a firm as being financially distress in a situation when the firm's debtor declines in the payment of their debt which affect the payment of creditors (Atiya, 2001; Kogi, 2003; Tuncan et al., 2006). In a situation when the rate of default is high, it exposed the firm to credit risk, which may lead to financial distress. Bankruptcy and re-organizational theory deals with intrinsic and extrinsic values in the organisation i.e. if the firm can continue and still provide it operational function, then, liquidation is not an option and if the firm asset is worth dead than being alive, liquidation should be embraced (Taliani, 2010; Maishanu, 2013).

In this study, Gambler's ruin theory was not adopted because companies involved are structured corporate firms with no room for gambling. Entropy theory seems not appropriate because changes in statement of financial position are not sufficient to classify a firm as being distressed. Likewise, cash management theory, though related but it emphasized the management of short-term cash inflows and outflows imbalances as a main concern for every firm in financial distress. Credit risk theory emphasizes a situation where debtors are not paying or cannot pay back as the reason for distress is very rare in the corporate organizations. Bankruptcy and re-organization theory was adopted because of its applicability to the study. The goal of the study is to predict financial distress in quoted Nigerian's oil and gas firms through the evaluation of key financial ratios to reveal their asset strength and weakness towards bankruptcy or reorganization, remediation and rejuvenation.

#### *Empirical review*

Taliani (2010) also evaluated the Altman's model on corporate financial distress prediction in Kenya with specific interest on Commercial banks. The findings revealed that turnover and activity ratios were germane in financial distress prediction in banks in Kenya. The techniques maintained an accuracy level of 70% to 100% in year one and three respectively.

Bello (2010) examined the efficacy of MDA model in Nigerian Banks. The author adopted Expo Factor design for the study while the difference in classification status of banks was evaluated with the use of pair sample t test. The study concluded that MDA lack predictive capacity in differentiating healthy and distress Nigerian banks. The yardstick used in measuring the difference between the two classifications was not properly spelt out and the Expo factor design lacks adequate justification in the peculiarity of sampled observed.

Uchenna and Okelue (2012) assess the predictive ability of Altman's MDA in Nigerian Banking industry. The study also utilize unbalanced sample of three failed banks and seven healthy banks for a period of five years. Applying the Altman's MDA model, the results shows that, the model is appropriate in evaluating the financial status of Nigerian Banks. The study concluded that, MDA with the use of financial ratios has the predictive ability of Nigerian banks failure. It was also revealed that MDA does not only predict failure but shows that the distress signals are becoming obvious 12 to 24 months before the actual bankruptcy materialized.

Adeyeye and Migiro (2015) extends the frontier of their study by pooling 3 statistical models such as MDA, probit and logit technique in developing the health status in Nigerian Banks. The findings indicated that, the 3 techniques were plausible to determine banks health status in Nigeria. Capital adequacy, profitability, credit risk and liquidity were the significant key performance variables in the Nigerian Banks. The study concluded that identified early warning covariates determined based on the three techniques are effective to maintain and supervise sound and safe banks operations. Otherwise, a neglect of these co-variate exposed Nigerian banks to financial distress. However, the period for this study appears too short and times vary analysis not considered.

#### **Methodology**

This study makes use of longitudinal research design, and this design was adopted because different homogeneous elements were surveyed over a reasonable period of time. In addition, the study also benefited from hypothesis testing (i.e., Analytical and predictive) to enhance understanding of the relationship that exist among variables which is done using both qualitative and quantitative i.e., Corporate financial distress variables. The study focus on oil and gas companies quoted on the Nigeria Stock Exchange (NSE) fact books between year 2000 to 2018 because of the availability of needed financial historical data and prediction. Oil and gas sector was selected from the twelve (12) classified industries/sectors on the list of quoted companies in the Nigeria Stock Exchange fact books due to the number of companies under the sector, contribution to the economy and high probability of insolvency due to the capital requirement, foreign competition, fluctuations in global oil prices and operating working capital. Census of all the listed firms in Nigerian oil and gas was used for this study. The seventeen oil and gas firms comprise of three failed firms and fourteen active firms (non-failed firms). The failed firms were companies delisted from the list of NSE within the sampled period. The active firms were those companies that are continuously appearing on the list of NSE throughout the period of the study. The Multivariate technique i.e., Multiple Discriminant Analysis (MDA) was applied to a sample of fourteen healthy and three unhealthy companies within the sampled period. The unbalanced samples used was justified by past researchers such as Atiya (2001), Kogi (2003), Adeyemi (2011), Maishanu

(2013), Adeyeye and Migiro (2015) who used un-balanced samples for distress prediction.

The data extracted include financial ratio (i.e., Profitability ratio, liquidity ratio, leverage ratio and activity ratio); market-based variable (such as stock return, return standard deviation and book to market equity); and company specific variables (i.e., Company size, company age and company squared size) which constitutes the variables of the study. Since MDA uses matched pair, the two-group classification of firms to non-failed and failed group were matched by size and year to obtain a cutting score. Due to the nature of this research, multi-level analysis was used where fi-

nancial ratios were computed and the results were further processed using Multiple Discriminant Analysis (MDA) to predict financial distress in the selected sector. The Z-score which is a linear combination of weighted score with coefficients for classifications by discriminant function as distress, grey and healthy.

The model is presented in an equation given as:

$$Z = W_1X_1 + W_2X_2 + W_3X_3 \dots W_nX_n \quad (1)$$

Z = Discriminant Score,  
 $W_i$  = Discriminant weight for variable i,  
 $X_i$  = Independent variable i.

**Table 1** – Performance indices identified in Nigerian oil and gas firms

S/N.	Variables	Covariate	Code	Operational definition
1.	Profitability	Earnings Before Interest and Tax/ Total Assets	EBIT	Earnings Before Interest and Tax/Total Assets
2.		Return on Equity	ROE	NPAT before abnormal/ (Shareholders equity – outside equity interest)
3		Return on Assets	ROA	Earnings before interest/(total assets – outside equity interest)
4.	Liquidity	Working capital/ Total assets	WCA	Working capital/ total assets
5.		Retained Earning/Total Assets	RET	Retained Earning/Total Assets
6	Leverage	Debt ratio	DER	Total debts/total assets
7		Market Value of Equity/Total Liabilities	MET	Market Value of Equity/Total Liabilities
8.	Activity	Total asset turnover	TAR	Turnover/total assets

Note – compiled by authors

Therefore, the model generated was given as:

$$Z = W_1EBIT_1 + W_2ROE_2 + W_3ROA_3 + W_4WCA_4 + W_5RET_5 + W_6DER_6 + W_7MET_7 + W_8TAR_8 \quad (2)$$

Z = Discriminant Score

$W_i$  = Discriminant weight for variable i

To calculate the group cutting scores for unbalanced samples, the study adapts the formula given by Maishanu (2013) assuming misclassification cost:

$$Z_{cn} = \frac{N_A Z_A + N_B Z_B}{N_A + N_B} \quad (3)$$

where:  $Z_{cn}$  = Critical cut off score for unequal group sizes

$N_A$  = Number in group A (healthy firms)  
 $N_B$  = Number in group B (distressed firms)

$Z_A$  = Centroid group A

$Z_B$  = Centroid group B

The Z-scores is given as:

$$Z_{cn} = \frac{98*(-0.203) + 21*(0.950)}{119}$$

$$Z_{cn} = \frac{-19.894 + 19.95}{119}$$

$$Z_{cn} = 0.056/119$$

$$Z_{cn} = 0.0$$

*Note: The group centroid weighted scores of -0.203 and 0.950 were obtained from the MDA analysis using the SPSS.*

The group centroid functions generated from SPSS was multiplied by the number of firms in each category to develop the cut off score used in this study. Thus, with Zero (0) cut off score, it shows data standardization and classification of firms' financial health status which are categorized into three viz; A negative Z-scores implies an healthy firms; A positive Z-scores implies a distressed firms; while zero Z-score is classified as a zone of ignorance. For the purpose of this study, it is classified as 'Grey zone'.

## Results and Discussion

### *Financial Distress prediction of the Oil and Gas firms in Nigeria*

Multivariate statistical technique was used as discriminant between the two group – healthy and distress firms. The statistical test intends to show the

significance variation in the group centroid given by the discriminant scores for the two groups. The identified variables for performance in Nigerian oil and gas firms were evaluated using stepwise discriminant classification to show the important metrics in firms' financial health classification.

The analysis in the Table 2 revealed that, out of the eight performance indices evaluated, only five (i.e. ROE, EBIT, RET, WCA and TAR) shows that there is significant difference between the two group with p-value less than 0.05. This implies that all these ratios will be included in the computation since the assumption of lowering Lambda and F value minimum requirement is satisfied. Thus, F value less than one are expunged from entering into the next step of analysis. The processes continue with stepwise discriminant analysis until all the indices that are not used in financial health classifications were eliminated including collinearity indices.

**Table 2** – Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
ROE	.967	3.990	1	117	.048
EBIT	.950	6.105	1	117	.015
ROA	1.000	.057	1	117	.811
RET	.967	3.990	1	117	.048
DER	.991	1.058	1	117	.306
WCA	.969	3.805	1	117	.035
MET	.987	1.597	1	117	.209
TAR	.939	7.551	1	117	.007

Note – compiled by authors

**Table 3** – Summary of Canonical Discriminant function

Predictors Covariates	Function coefficients		
EBIT	- 8.746	Wilks' Lambda	.836
WCA	-0.499	Eigenvalue	.196*
TAR	9.255	Chi Square	20.720
(Constant)	-.883	Df	3
Group centroid canonical discriminant function		Canonical Correlation	.705
Group	Group centroids function	% of variance	100.00
0	-.203	Sig.	.000
1	.950		

Notes:

- 1) \*\*Classification results is 88.2% of original grouped cases correctly classified;
- 2) compiled by authors



Table 3 gives the summary of the findings obtained from the analysis. The stepwise discriminant analysis revealed three significant discriminators capable of classifying the centroid group. The predictors are EBIT, WCA and TAR with coefficient functions of -2.335; -0.075; and 2.483 respectively. These weights were useful in classifying firms. The discriminant function is significant showing a canonical correlation of 0.705. The square of the figure gives 0.497, the implication of this is that the model that include just three indices or covariates only explain about 50% variation in the dependent variable. The group centroid functions indicate a variance be-

tween the two groups and based on the results, the model shows a high predictive accuracy i.e. 88.2%. Hence, the cutting scores for classification based on the analysis are given as:

$$Z\text{-score} = -8.746(\text{EBIT}) - 0.499(\text{WCA}) + 9.255(\text{TAR}) \quad (4)$$

The discriminant scores were computed for the sampled firms for proper classification based on the information obtained from their annual reports and the data generated from the NSE fact books. The results of the computation were presented in Table 4 which represents post-prediction status.

**Table 4** – Summary of Financial Status (post-prediction status) using the cut off score

S/N	COMPANY	YEAR 1 Zscore	YEAR 2 Zscore	YEAR 3 Zscore	YEAR 4 Zscore	YEAR 5 Zscore	YEAR 6 Zscore	YEAR 7 Zscore	MEAN SCORE
1.	JAUPAUL OIL	1.0488	0.9425	-2.9998	-5.7527	-0.2927	-2.4454	-1.2176	-10.7171
2.	OANDO PLC	-3.0044	-2.9321	-2.9629	-2.8519	-3.5371	-1.6095	-3.9607	-20.8586
3.	AFROIL PLC	-1.8761	2.2729	0.7568	0.0613	0.4893	0.2165	1.9971	3.9177*
4.	BECO PETROLEUM	1.4426	1.0081	-3.3381	-4.9176	-4.0185	-8.3548	-1.6957	-19.8741
5.	CONOIL PLC	-2.9903	-3.0103	-6.1716	-5.9322	-1.2568	-4.1797	-3.8462	-27.3872
6.	ETERNA PLC	-2.8091	0.5376	0.5513	-3.8293	-8.5413	-4.5513	-6.1956	-24.8377
7.	FORTE OIL PLC	-2.9812	3.2899	3.2599	-3.5699	-	-	-	-0.0012**
8.	MOBIL OIL PLC	-5.7321	-2.6732	-2.5716	-5.9125	-3.5845	-4.3127	-6.4415	-31.2283
9.	MRS OIL NIGERIA	-	-	-6.4406	-5.2294	-8.2018	-20.9284	-1.4218	-42.222
10.	TOTAL NIGERIA	-3.7847	-1.1113	-3.3833	-3.5351	-11.1336	-3.7636	-15.9867	-42.6983
11.	AFRICAN PET. PLC	-6.5032	-6.3509	-5.0284	-3.2355	1.0004	1.0680	-3.7459	-22.7954
12.	AGIP	-6.1326	-2.9011	-4.0535	-4.2279	-1.8136	-0.9998	-1.7650	-21.8935
13.	NATIONAL OIL	-1.8097	-1.0342	0.9451	1.0208	0.6598	0.8230	1.4847	2.0896*
14.	UNIPETROL	-2.0015	-1.9910	1.1443	0.7814	1.0912	1.6118	1.0295	1.6656*
15.	TEXACO	-0.7967	-0.8491	-0.3197	0.9929	0.9820	-	-	0.0093**
16.	CHEVRON	-4.9143	-0.0174	-2.5191	-4.3010	-4.5302	-4.4550	-0.1212	-20.8583
17.	UNION VEN. & PET. PLC	-2.1122	-1.7234	0.9724	0.8550	1.2571	0.6583	1.5255	1.4325*

Notes:  
 1) \*Distress, \*\*Grey  
 2) compiled by authors

The summary of the analysis in the Table 4 revealed the post-prediction financial status of quoted Nigeria's oil and gas companies using the study's model. Each solvency ratio was computed against the predetermined weighted score to give the Z score values. Since the study takes into account seven years financial statement, the average yearly

captured scores shows that APoil Plc, National oil, Unipetrol and Union Petroleum Plc reported a mean positive scores i.e. > 0 (i.e. 3.917737, 2.089605, 1.665614, 1.432526 respectively) that is, it can be classified under the weak zone while Texaco reported a mean score of 0.009383 above Zero but very low (i.e. grey). This implies that it is heading

towards bankruptcy. This might have necessitated the merger in 2003. Forte oil gives a mean score of -0.00119 dangling on the border line between a grey and healthy financial performance firms. Other listed companies reported an average score less than zero (0) cut off score and they were regarded as healthy financial firms.

With the discriminant cut off scores as determined by the discriminators indices, the means score less than zero are regarded healthy performance, greater than zero as weak performance and zero as grey respectively. The results show that 4 companies (23.5%) were financially unhealthy with probability of failing if no rejuvenation is attempted. Only 2 (11.8%) is classified as grey and 11 companies (64.7%) are on healthy financial status. With 23.5% failure prediction, it shows that there is vulnerability of failure in Nigerian quoted oil and gas

firms. The colossal consequences of distress is far reaching as failure will lead to loss of job, direct and indirect cost, reduction in Gross Domestic Product (GDP) to mention but few that Nigeria is experiencing today. The trend analysis revealed that, distress signs are becoming obvious even before the seventh year. It is sufficed to say that, MDA does not only predict firms' failure, but also revealed most importantly, that the signs of an imminent danger or failure became manifested few years before the sampled companies failed.

To further test the vulnerability to failure of quoted Nigerian oil and gas sector, the difference between distressed and healthy firms was conducted through t – test analysis. To achieve this, the Z-score for each year were imputed against the cut off score as the test value. The test value of zero (0) for grey.

**Table 5** – T-test showing the Financial Health of Nigerian quoted oil and gas

COMPANY	MEAN Z SCORE	df	Test Value = > 0		Test Value = 0		Test Value = < 0		Remark
			t-value	Sig. (2-tailed)	t-value	Sig. (2-tailed)	t-value	Sig. (2-tailed)	
JAUPAUL	-10.717	6	2.966	.041	2.574	.026	2.181	.045	VS
OANDO	-20.8586	6	2.242	.038	1.791	.014	1.341	.002	VS
AFROIL	3.917737	6	-3.182	.330*	**	**	**	**	WP
BECO	-19.8741	6	4.001	.016	3.346	.029	2.691	.035	VS
CONOIL	-27.3872	6	6.292	.003	5.867	.004	5.442	.006	VS
ETERNA	-24.8377	6	1.264	.025	1.061	.034	.857	.044	VS
FORTE OIL	-0.00119	4	.775	.045	.390	.763**	**	**	HP
MOBIL	-31.2283	6	21.304	.000	18.621	.000	15.938	.000	VS
MRS OIL	-42.222	4	3.150	.035	2.950	.042	2.750	.031	VS
TOTAL	-42.6983	6	2.977	.041	2.747	.041	2.517	.026	VS
AFRICAN	-22.7954	6	1.557	.019	1.375	.040	1.192	.009	VS
AGIP	-21.8935	6	7.514	.002	5.438	.006	3.362	.028	VS
NATIONAL	2.089605	6	-5.865	.074*	**	**	**	**	WP
UNIPETROL	1.665614	6	-4.945	.089*	**	**	**	**	WP
TEXACO	0.009383	4	.890	.044	-.608	.576**	**	**	HP
CHEVRON	-20.8583	6	8.862	.001	6.633	.003	4.404	.012	VS
UNION	1.432526	6	-4.888	.088*	**	**	**	**	WP

Notes:  
 1) WP – Weak Performance (\*), HP – Healthy Performance (\*\*), VS – Very Healthy;  
 2) compiled by authors

Table 5 revealed the t-value of the financial health status of sampled companies. With a test value of greater than zero, AP oil Plc, National oil, Unipetrol and Union petroleum Plc returns a p-value  $> 0.05$ . Thus, the study fail to reject the null hypothesis ( $H_0: \mu > 0$ ). Therefore, the four (4) companies classified as bankruptcy/ weak performance. In a category of Zero value, Texaco and Forte oil have a p-value  $> 0.05$ . With this, null hypothesis is rejected ( $H_0: \mu = 0$ ). Thus, these two companies classified as Grey. This might have been responsible for the merger of Texaco Company in 2003. Other quoted sample firms have a p-value greater than 0.05 at less than zero cut off score value. The null hypothesis is rejected ( $H_0: \mu < 0$ ). On this basis, there is significant difference between distress and healthy oil and gas companies in Nigeria with respect to performance indicators i.e. using the financial ratios identified, the performance of the weak and healthy companies were not the same. This is in agreement with the work of Maishanu (2013) who of the opinion that there is a clear variance between healthy and distress firms.

#### *Discussion of findings*

The discriminant functions predicted are working capital/total asset, turnover/total asset and earnings before interest and tax/total asset with a cut off score. The Z model given as Z score =  $-8.746(\text{EBIT}) - 0.499(\text{WCA}) + 9.255(\text{TAR})$ . However, the results of the analysis revealed that four (4) firms (23.5%) are financially unhealthy/weak performance and are likely to experienced bankruptcy if no rejuvenation is attempted. Only two (11.8%) is classified as grey and 11 companies (64.7%) are on healthy financial status. With 23.5% failure prediction, there is susceptibility to failure in Nigerian quoted oil and gas companies. The colossal consequences of distress is far reaching as failure will lead to loss of job, direct and indirect cost, reduction in Gross Domestic Product (GDP) and the likes that Nigeria is experiencing today. The trend analysis revealed that, distress signs are becoming obvious even before the seventh year. However, MDA does not only predict business failure, but also show that the failure signals became obvious few years before the actual failure materializes. This result is in line with the study of Uchenna and Okelue (2012) who were of the opinion that, MDA not only fore-

cast business failure, but also revealed that, the failure signals of impending danger became manifested months before actual failure. Also, there is significant difference between distress and healthy oil and gas companies in Nigeria i.e. using the financial ratios identified, the performance of the weak and healthy companies were not the same. This result confirmed the submission of Maishanu (2013); Enyi (2013); Olaniyi (2007); and Bello (2010) whose studies affirmed the practicability of Multiple Discriminant Analysis prediction model in Nigerian Banking and Manufacturing sectors respectively.

#### **Conclusion**

Oil firms in Nigeria in maintaining and monitoring of oil and gas firms risks with 88.2% accuracy with emphasis on three major variables which are; working capital/total asset, earnings before interest and tax/ total asset and turnover/total asset with a predicted cut off score of Z-score =  $-8.746(\text{EBIT}) - 0.499(\text{WCA}) + 9.255(\text{TAR})$ . The study concluded that, Nigerian oil and gas companies are susceptible to failure with 23.5% financially weak companies and 11.8% grey. There is a clear performance difference between distressed and healthy companies. Besides, solvency ratios contribute significantly (especially the sales to total asset) to the financial health of sampled companies. However, the distress signs are obvious even before the seventh year and that financial ratio are good instrument to predict financial health status of quoted Nigeria's oil and gas companies.

In line with the findings and conclusion drawn above, the following recommendations were made to the policy makers and stakeholders:

I. The identified early warning signals (i.e. working capital/total asset, earnings before interest and tax/ total asset and turnover/total asset) should be given serious attention to prevent financial distress.

II. The sign of potential danger is evident months before actual failure materializes, efforts should be put in place by oil and gas firms for periodic cross sectional performance evaluation, prediction and early detection of financial distress warning signs to prevent bankruptcy.

## References

- Adeyemi, B. (2011). Bank Failure in Nigeria: A Consequence of Capital Inadequacy, Lack of Transparency and Non-Performing Loans. *Banks and Bank System*, 6(1), 99- 109
- Adeyeye, P.O., & Migiro, S.O. (2015). An investigation on Nigerian banks' status using early-warning signal. *Banks and Bank Systems*. 10 (1), 53 – 64
- Altman, E., & Hotchkiss, E. (2006). *Corporate Financial Distress and Bankruptcy: Predict and Avoid Bankruptcy, Analyze and Invest in Distressed Debt*. 3rd Edition, New Jersey: John Wiley & Sons.
- Altman, E.I. (2006). *Corporate financial distress and bankruptcy: Predict and avoid bankruptcy, analyze and invest in distressed debt*. Hoboken, NJ: Wiley.
- Argenti, M. (2003). Financial ratios as predictors of failure, *Empirical Research in Accounting: Selected Studies*, University of Chicago, Chicago, Ill., 71-111.
- Atiya, A. F. (2001). Bankruptcy prediction for credit risk using neural networks: A survey and new results. *IEEE Transactions on Neural Networks*, 12(4), 929–935.
- Bello, A. (2010). An Assessment of Multiple Discriminant Analysis Model in Predicting Corporate Failure in Nigeria. *Journal of the Department of Accounting*. Ahmed Bello University, Zaria 7(4), 45 – 64
- Charitou, K. (2002). "How stock prices react to managerial decisions and other profit signalling events, in the Greek mobile telecom market? ", 3rd International Conference on Applied Financial Economics, Samos island 2002
- Ebiringa, O.T. (2011). Bench marking Incidence of Distress in the Nigerian Banking Industry on Altman Scale. *Serbian Journal of Management* 6 (2), 221 – 230
- Eidleman, E.B. (2007). "A discriminant analysis of predictors of business failure," *Journal of Accounting Research*, Spring, Institute of Professional Accounting, Chicago, Ill., 167-179.
- Enyi, P. E. (2013). A comparative analysis of the effectiveness of three solvency management models. Department of Accounting, Covenant University, Ota, Nigeria
- Hur-Yagba, A.A., Okeji, F.I., & Bello, A. (2015). Analyzing Financial Health of Manufacturing Companies in Nigeria Using Multiple Discriminate Analysis. *International Journal of Managerial Studies and Research (IJMSR)*. 3(7), 72-81
- Janer, J. (2011). Bankruptcy Prediction and its Advantages Empirical Evidence from SMEs in the French Hospitality Industry. Unpublished Msc thesis. Department of Economics, Copenhagen Business School
- Kip, A.F. (2002). A methodology for predicting company failure in the construction industry, PhD thesis, Loughborough University of Technology, Loughborough.
- Kogi, S.K. (2003). An analysis of discriminant corporate failure prediction model based on stability of financial ratios. Unpublished MBA project. University of Nairobi.
- Lakshan, A.M.I., & Wijekoon, W.H.M.N. (2013). The Use of Financial Ratios in Predicting Corporate Failure in Sri Lanka. *GSTF Journal on Business Review (GBR)*. 2(4), 37 – 43.
- Maishanu, M. (2013). Predicting Bank Distress in Nigerian Banking Industry: A new Discriminant Analysis Model. *Journal of the Department of Business Administration, UsmanuDafodiyo University, Sokoto*4(6), 56 – 78.
- Milkette, R.O. (2001). "An empirical test of financial ratio analysis for small business failure prediction", *Journal of Financial Quantitative Analysis*, Mar., University of Washington, Seattle, 1477-1493.
- Moyer, G. M., Tuncan, M., Birgonul, T., & Dikmen, I. (2006). E-bidding proposal preparationsystem for construction projects, *Building and Environment*, 41(10), 1406-1412
- Olaniyi, T.A. (2007). Predicting Potential of Failure in Nigerian Banking Sector A Comparative Analysis Of FirstBank Plc, And Trade Bank Plc. *Babcock Journal of Management and Social Sciences*, Babcock University, 6(1), 64-73
- Patrick, S., & Ooghe, H. (2004). 35 years of studies on business failure: an overview of the classic statistical methodologies and their related problems, *The British Accounting Review*, 38(1), 63-93.
- Robbins, A., & Pearce, L., (2005). "Corporate Bankruptcy Prediction Models Applied to emerging Economies: Evidence from Argentina in the Years 1991-1998." *International Journal of Commerce and Management*, 17(4), 295-311.
- Sipika, C., & Smith, D. (2002). From Disaster to Crisis – the Failed Turnaround of Pan-American Airlines, Liverpool Business School, Liverpool, UK
- Taliani, I. J. (2010). Predicting financial distress in commercial banks in Kenya. Unpublished MBA project. University of Nairobi
- Thynne, K. (2006). Test of the Generalizability of Altman's Bankruptcy. Prediction Model, *Journal of Business Research*, 6(10), 53-61
- Uchenna, A.W., & Okelue, U.D. (2012). Detecting Early Warning Bank Distress Signals in Nigeria: A Multi-Discriminant Analysis Approach. *Research Journal of Finance and Accounting*. 3(6), 35 – 46.
- Whitaker, R (2000). The Early Stages of Financial Distress. *Journal of Economics and Finance*. 23(2), 123-133.