

## DATA MINING DETECTION AND FRAUD PREVENTION IN NIGERIA'S DEPOSIT MONEY BANKS

OGBUEHI, ASITE

Department of Accounting, Faculty of Business Studies  
Ignatius Ajuru University of Education  
Rivers State, Nigeria.

And

PAAGO, LEDIBABARI

Department of Accounting, Faculty of Business Studies  
Ignatius Ajuru University of Education  
Rivers State, Nigeria.

### Abstract

*Billions of funds are lost in Nigeria's banking industry due to preventable fraudulent activities. Currently, data mining detection has become a veritable method to combat fraud and other akin activities. This research investigated the relationship between data mining detection and fraud prevention in Nigeria's Deposit Money Banks during the period 2013 to 2017. Fourteen listed banks were sampled and analyzed using regression analytical tool contained in SDAT-MS Excel. The results obtained generally showed a positive and insignificant relationship between the variables under investigation. The study recommended amongst others that bank management should establish and adopt more scientific data mining detection methods like the use Artificial Intelligence (AI) to combat bank fraud in Nigeria.*

*Keywords: Data mining, fraud prevention, audit committee, internal audit quality.*

### Introduction

Commercial banks are corporate financial institutions that accept monetary deposits from customers and effect withdrawals upon demand by the depositors (Ugwoke, 2010): According to Aigbokhaevbolo (2001), commercial banking activities in Nigeria started with the establishment of the African banking corporation by the British West Africa in 1892. Ekine (2008) posited that Nigerian commercial banks are mainly classified into old and new generation banks that have embraced development in Information and Communication Technology (ICT). Some of the products that have been adopted include Automated Teller Machine (ATM), Electronic Point-of-Sale (POS) terminal services, Internet banking and Mobile banking services which are SMS based (Ugwoke, 2010). The introduction of the on-line and electronic real-time banking services have resulted in new payment systems and fund transfers that give the banking customers the needed satisfaction in modern banking, however, these products are often threatened by frauds (Ogbulie, 2007).

Achaka, (2004) defined fraud as an actions of dishonesty, deceit, false claims, unlawful possession and dispossession of money, goods and services thereby causing the other party to be at disadvantage. Ochejele (2004) defined fraud as a deliberate step taken by one or more individuals who may be internal or external to a business organization, to deceive or mislead the organization with the objective of taking unfair advantage of money, goods and services.

Aderinokun (2007), states that Nigerian commercial banks lost 48 billion naira between 2001 and 2006 because of fraudulent activities. Nigerian Deposit Insurance Corporation (NDIC) reports of 2006 and 2007 posits that ₦4.88 billion and ₦10.05 billion respectively were lost to fraud occasioned by poor accounting system, weak internal control, inefficient supervision of subordinates, poor remuneration, perceived inequality in reward as well as disregard to know-your-customer (KYC) policies.

ICAN (2010) defines fraud prevention as the whole system of control, financial or otherwise, established by the management in order to carry on the business of an enterprise in an orderly and efficient manner, ensuring adherence to management policies, safeguarding the assets and secure as far as possible the completeness and accuracy of records. Campbell and Hartcher (2010) opine that fraud prevention is instituted in order to put management on alert towards likely problems and to ensure they are controlled before it get escalated to a big issue. Enofe (2017) assert that the measures of fraud prevention include corporate governance, internal control and banking ethics.

Closely related to fraud and its prevention is data mining. Currently, data mining is a popular way to combat frauds because of its effectiveness (Amanze & Onukwugha, 2017). According to Huaiq, John & Stephen (2002) data mining is a procedure that takes data as input and produces output in order to extract some usable information for future uses.

More so, data mining detection is the recognition of symptoms of fraud where no prior suspicion or tendency to fraud exists (John, Okokpujie, Anele, Olajide & Chinyere, 2016). Data mining as coined by Chaudhary (2013) is the process of extracting patterns from data by the use of sophisticated data search capabilities and statistical algorithms to unearth patterns and correlations that can be useful in a variety of applications. Data mining help organization spot inconsistent data, unusual transactions, missing invoices and deviant transactions (Ogwueleka, 2008).

Data mining methods are the most widely used technique for detection of financial statement fraud because it is capable of extracting novel patterns from large database by building models which can further be used for making crucial business decisions (Bhardwaj & Gupta, 2016). Data set for detection of fraudulent financial reporting consists of financial ratios from publicly available financial results of the organization. Belinna, Jerome, Xiaoguang (2008) used 148 financial reports out of which 24 were false reports. Cecchini, Aytug, Koehler & Pathak (2010) proposed a methodology to aid in detecting fraudulent financial reporting by utilizing only basic and publicly available financial data of 205 fraudulent companies. The data were gathered by using Accounting and Auditing Enforcement Releases (AAER). The fraud sample was matched with 6,427 non fraudulent companies. Ravisenkar, Ravi, Rao & Bose (2011) predicted the occurrence of financial fraud by using six data mining techniques to analyze data from 202 Chinese companies. More so, Gupta & Gill (2012) detected fraudulent financial reporting by using three data mining techniques to analyze data from 114 listed companies, 63 financial ratios were considered for fraud detection.

### **Statement of problem**

The banking sector globally plays an essential role in advancing the smooth growth of economic activities (Sruthi & Prasanua 2016). The recent use of computers, internet and other electronic devices for banking services in Nigeria has made certain fraudulent activities more

efficient, faster and easily concealed. For instance, Oehejele (2004) stated that the incidence of corporate frauds in Nigerian banking system has become more pronounced in this era of increasing globalization of financial markets and other economic institutions occasioned by the use of the internet and the computerization of banking services.

The statistics of failed banks in Nigeria show that the licenses of about 45 commercial banks were revoked by the Central Bank of Nigeria between 1994 to January 16, 2006. Due to court actions instituted by some of the closed banks, shareholders challenging the revocation of their banks licenses were unable to conclude the exercise and initiate the payment of deposits to depositors of the banks (<https://ndic.gov.ng/chosal-financial-instituions>).

The NDIC annual report 2012 cited in Olatunji, Adekola & Isaac, (2014) portrayed the incidence of fraud cases in the year 2012 involving the sum of ₦17.97 billion with contingent loss of about ₦4.52 billion. The contingent loss had increased by ₦455 million (10.9%) over ₦4.072 billion reported in 2011. The increase in the number of fraud cases could be said to be as a result of rising cases of fraud through ATM, internet banking and suppression of customers' deposits (NDIC annual report 2012). Udegbumam (2004) states that corporate frauds heavily undermine the business and profit of banks which most times result in highly risky and volatile financial environment that leads to the collapse of banks in Nigeria. Apparently, the amount of bank fraud seems to have increased progressively from 2011 to 2014 at a rate above 25% (NDIC, 2016) cited in Idogei, Josiah & Onomuhara (2017). In order to stay afloat in their commercial activities, banks in Nigeria install and utilize corporate fraud control, detection and prevention systems such as data mining detection approaches to fight the scourge of corporate bank frauds. However, researches have remained inconclusive on whether the corporate bank fraud detection control, and prevention systems are adequately available and utilized extensively.

Corroboratively, Akindele (2011) predicted that on average the bank sector in Nigeria was at a risk of losing a million naira every working day because of the occurrence of frauds that happen in diverse ways. Correspondingly, the Nigeria electronic fraud forum (2016) posted that ₦485, 194,350 was lost to fraudsters in 2013, while ₦6, 215,987,323 was lost through similar means in 2014, with 822 and 1,461 cases in each year respectively. A report by NeFF (2017) showed that a total loss of ₦2.19 billion was recorded by Nigerian Deposit Money Banks (DMBs) in 2016. This was broken down into ₦511.1 million lost across counter, ₦464.5 million lost to ATM fraud, ₦132.2 million lost to e-commerce fraud, ₦320.6 million lost to internet banking, ₦235.1 million lost to mobile banking, ₦243.3 million lost to POS, ₦83.7 million to web fraud, ₦10.1 million to kiosk fraud, ₦4.54 million to cheque fraud and ₦190.9 million to other losses.

These report also signified that fraud contribute immensely to the failure of most banks in Nigeria. With the efforts of the Independent Corrupt Practices and other Related Offences Commission (ICPC) and the Economic and Financial Crimes Commission (EFCC), which were introduced to combat fraud at various levels in Nigeria, it is regrettable that little or nothing has been achieved (Aibieyi, 2007).

Presently, fraud in the Nigeria banking industry is not properly investigated by the Central Bank of Nigeria, hence no adequate information regarding challenges of e-banking fraud incidences, detection and prevention. These challenges have become worrisome and

have generated debate among scholars (Amanze & Onukwugha (2017); Fadayo (2018); Olatunji, Adekola & Isaac 2014).

However, these studies which are entirely of Nigerian origin evaluated credit risk frauds. They scarcely investigated electronic bank frauds and data mining detection efficacy as well as fraud prevention using secondary data. These secondary data could be considered a more veritable data source since they do not have personal or individual bias and are ex-post facto in nature. Also, most studies almost not considered the geographical location of their studies, as the results may not be similar. Therefore, these acknowledged gaps provide the motivation for this present study on data mining detection and fraud prevention in the Nigeria's banking industry.

### **Purpose of the study**

The main purpose of this study is to investigate the relationship between data mining detection and fraud prevention in Nigeria's banking industry. The specific objectives are to:

1. Evaluate the relationship between net profit margin and audit committee of listed banks in Nigeria.
2. Determine the relationship between return on assets and audit committee of listed banks in Nigeria.
3. Investigate the relationship between net profit margin and internal audit quality of listed banks in Nigeria.
4. Determine the relationship between return on assets and internal audit quality of listed banks in Nigeria.

### **Research question**

The following research questions are raised to guide the objectives of the study. They include to:

1. What extent is the relationship between net profit margin and audit committee?
2. What extent is the relationship between return on assets and audit committee?
3. What extent is the relationship between net profit margin and internal audit quality?
4. What extent is the relationship between return on assets and interval audit quality?

### **Research hypotheses**

**Ho<sub>1</sub>:** There is no significant relationship between net profit margin and audit committee of listed banks in Nigeria.

**HO<sub>2</sub>:** There is no significant relationship between return on assets and audit committee of listed banks in Nigeria.

**Ho<sub>3</sub>:** There is no significant relationship between net profit margin and internal audit quality of listed banks in Nigeria.

**Ho<sub>4</sub>:** There is no significant relationship between return on assets and internal audit quality of listed banks in Nigeria.

### **Literature review**

#### **Fraud prevention**

Fraud is probably as old as money itself and has probably existed in this world for as long as human beings have inhabited it. Furthermore, fraud has been defined in different ways by different scholars and authors. Awe (2015) defines fraud as the intentional alterations of

records accompanied by the defalcation of asset in order to deceive certain group of people for the benefit of the perpetrator. Adeyo (2012) opines that fraud in the bank is possible with co-operation of an insider. The banks are expected to carry out their responsibilities with sincerity of purpose (Kawugana & Faruna, 2018). According to Chakrabarty (2013), fraud is any behavior by which one person intends to obtain a dishonest advantage over another where the person makes an illicit gain while the other party incurs a loss.

Fraud prevention is a function within the realm of internal audit group (Adetiloye, Owkoyo & Taiwo, 2016). Fraud should not go through and remain undetected in any accounting year where an effective internal control and corporate governance are in place. The triumvirate of fraud prevention, fraud control and detection and sound corporate governance are coalesced into the effective internal control system that banks employ. According to Ryan (2015), fraud prevention project involves the whole gamut of policies, rules, controls, ethics and code of conduct. Accordingly, the prevention strategic approach involves policy and procedures, assessing the size of the fraud threat, understand the types of risk posed by the fraud and focus resources on the most effective anti-fraud measures and assign responsibilities.

### **Measures of fraud prevention**

The concept of fraud prevention has been explained; therefore evaluating the literary explanations as they relate to this study becomes important.

### **Audit committee**

An audit committee is a mandatory internal control mechanism required in all listed firms to ensure effective enforcement of good corporate governance. The composition of the audit committee is an important issue since all its members need to have adequate experience in the areas of finance and accounts (ICRA, 2004). The audit committee comprising of a substantial majority of independent directors (at least two-third as per clause 49 of CAMA 1999 as amended) who also have finance and accounting expertise, is expected to play a very important role in ensuring proper disclosure and transparency as regards to financial performance, financial discipline and functioning of the bank (Pahuja, 2019). The audit committee is empowered to evaluate internal control mechanisms with external and internal auditors for fraud prevention. Responsibilities of an audit committee are to review the internal audit report and the result of the audit, selection and appointment of external auditors, and review the internal accounting controls and safeguard corporate assets (Petra, 2005). Audit committee plays an important role in ensuring the credibility of financial reporting (Wu, Habib & Weil, 2012). A competent, committed, independent and tough-minded audit committee has been described as one of the most reliable guardians of the public interest (Levitt, 2000).

Parker (1992) defines an audit committee as a committee appointed by a company as a liaison between the board of directors and the external auditors. The committee has a majority of non-executive directors and is expected to view an entity's affairs in a detached and dispassionate manner. IAASB (2013) identifies interactions between auditors and those charged with governance of the organization as one factor that may influence audit quality.

Mohiuddin and Karbhari (2010) claim that audit committee provide assurance through increased scrutiny, accountability and efficient use of resources and services as an advisory function aimed at performance improvement within the organization.

### **Internal audit quality**

The internal audit quality is an important instrument of management in almost all organization (Belo, Ayiob & Zahina, 2017). According De-Angelo (1981) audit quality is the market joint probability that a given auditor will both (i) identify a breach in the client accounting system (ii) report the breach that the auditor has both the technical competence to detect any material error during the audit process, and the independence to ensure that material errors and omissions are corrected or disclosed in the auditor's report. Internal audit quality is vital as it affects the reliability of the financial report and protects the interest of its owners. It promotes transparency of reports through higher voluntary disclosures (Barros, Boubaker & Hamrouni, 2013). The quality of internal audit is the ability of monitoring activity in the organization, conduct of internal auditors which are independent and objective to achieve organizational goal (Moellar, 2008).

Pointedly, Leelis and Pinheiro (2012) posit that the new orientation of internal audit quality focuses on partnership rather than punishment and requires significant changes in the behaviors and perceptions of auditors and auditees. Unegbu and Obi (2012) said that internal audit quality is part of internal control system put in place by management of an organization to ensure obedience to stipulated work procedure and as aid to management. Likewise, internal audit quality determines the reliability, reality and integrity of financial and operational information that comes from different organizational units, on which appropriate business decisions of management are based (Al-Swidi, Fadzil & Al-Matan, 2013).

### **Data mining detection**

Data mining detection is the process of discovering interesting and hidden patterns and extracting knowledge from large amounts of data (Gupta & Bhardwaj (2016). Data mining detections is also the process of gaining insights and identifying interesting patterns from data stored in large data bases in such a way that the patterns and insight are statistically reliable, previously unknown and actionable (Elkan, 2001). Fraud not only causes unimaginable financial losses but also pushes the organization by many steps backwards in this cut-throat competitive world (Gupta & Shardwaj, 2016). Any deliberate act of deceit involving financial accounts or misappropriations of organizations assets/resources for personal enrichment is termed financial fraud. The degree of this unlawful activity is directly proportional to the access one has to the system.

Thus to counter this menace, system has to be proactive and accordingly implement fraud prevention and detection techniques. Data mining being a process of extracting knowledge by learning patterns from the available data has been used widely for developing fraud detection system. It can identify useful and interesting patterns with efficacy, which can be used to find out any inconsistent behavior or fraudulent activity. Data mining detection is also a process that uses statistical, mathematical, artificial intelligence and machine learning techniques to extract and identify useful information and subsequently gaining knowledge from a large database (Turban, Aronson, Liang & Sharda, 2007). However, the selection of task relevant data is one of the most difficult for data mining tasks. In addition, there are numerous techniques for finding interesting patterns from large data set. Broadly, these techniques can be categorized into two, namely: predictive and descriptive.

### Dimensions of data mining detection

The concept of data mining detection has been defined severally. Below are the dimension applied in this research.

#### Net profit margin

The net profit margin describes the ratio of net profit to total sales. Net profit margin is calculated to measure the operating efficiency of the entity (Pandey, 2000). Thus, Net profit-margin is expressed mathematically as

$$\text{Net profit margin} = \frac{\text{net profit}}{\text{sales}} \times 100$$

According to Tulsian (2014), net profit margin is relevant in the comparison of the efficiency of a business organization. A very high net profit margin does not always indicate sound organizational efficiency and low net profit margin is not always a sign of organization down time.

Net profit margin ratio indicates the proportions of sales revenue that translates into net profit. For example, a net profit margin of 35% means that every ₦1 sale contributes ₦35 towards the net profits of the business. Net profit margin ratio is a very performance indicator of the profitability of an enterprise. It is one of the two elements that determine the return on assets, the other element being the sales turnover ratio. Measuring the net profit margin over several periods in comparison to industry benchmarks is crucial for identifying performance gaps that could be overcome to improve the profitability of the business in the future.

#### Return on assets (ROA)

The importance of return on assets as the general purpose financial ratio that measure the relationship of profit earned to the investment in assets required to earn that profit has become understood (Siminua, Circiumaru & Simioin). According to Lyn and Ailae (2008) return on assets shows the number of profits earned in relation to investment in total assets. The formula for the evaluation of return on assets could be stated as

$$\text{Return on assets (ROA)} = \frac{\text{net profit}}{\text{total assets}} \times 100$$

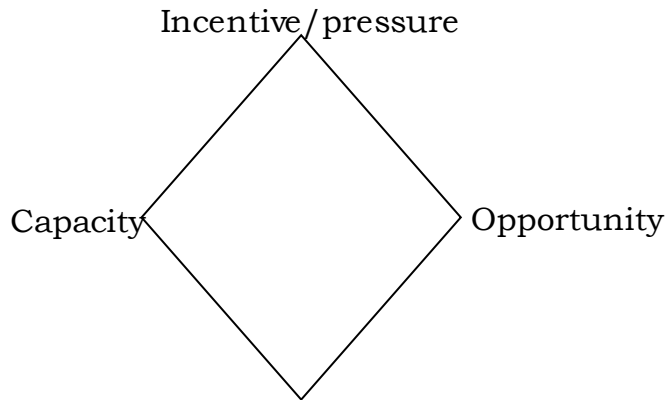
### Theoretical review

Below is the review of relevant theory upon which this research is anchored.

#### Fraud diamond theory

The theory that guided this research is the fraud diamond theory. Wolf and Hermanson (2004) introduced the fraud diamond model where they presented another view of the factors to fraud. The theory adds fourth variable "capabilities" to the three factor theory of fraud triangle. Wolf and Hermanson believed many frauds would not have occurred without the right person with right capabilities implementing the details of the fraud. They also suggested four observation traits for committing fraud:

- i. Authoritative position or function with the organization.
- ii. Capacity to understand and exploit accounting systems and internal control.
- iii. Confidence that the perpetrator will not be detected or if caught will get freedom easily.
- iv. Capacity to deal with the stress created within and otherwise good person when the bad act is committed.



### Rationalization

However, it can be criticized that though the fraud diamond added the fourth variable “capacity” to the fraud triangle to fill the gap in other theories of fraud. The model alone is an inadequate tool for investigating, deterring, preventing and detecting fraud (Gbegi & Adebisi, 2013). This is because the two sides of fraud diamond (incentive/pressure and rationalization) cannot be observed as important factors like national value and corporate governance are not considered. This research suggests a new fraud model to incorporate national value system and corporate governance.

### Empirical review

Below are empirical reviews of studies relevant to this research.

Bhardwaj, & Gupta (2016) investigated financial frauds and data mining based detection in India. Using descriptive analysis for the period 2009 to 2015, the finding showed that data mining measures is significant in fraud defection.

Husan & Desiyanti (2016) evaluated the financial performance on net profit margin at the Coal Company in Indonesia from 2011 to 2013. Using secondary data collected from listed coal companies in Indonesian Stock Exchange, The findings from descriptive showed that net profit margin has a significant relationship with other ratios like current ratio and sales growth ratio.

Eriotis & Frangoulis (2004) evaluated profit margin and capital structure of manufacturing industries in Greece covering the period 1995-1996. With descriptive analysis, the findings showed a negative and statistically significant relationship between debt to equity ratio and net profit margin.

Aktas & Unal (2015) investigated the relationship between financial efficiency ratios and stock prices in the insurance companies listed in Borsa Istanbul between Q1 2005 and Q4 2012. With the use of regression analysis, the findings from the Turkish based firm showed a statistically significant relationship between efficiency ratios and stock prices.

Issah (2015) investigated whether ROA, ROE and ROI together explain variations in the market prices per share of publicly traded banking institutions in Ghana for the period 2009-2013. Using regression analysis, the findings showed a significant linear relationship between ROA, ROE and ROI with market prices per share.

Akhor & Osgdale (2017) investigated the relationship between audit committee attributes and financial reporting lag in the Nigeria banking sector. With secondary data



collected from listed banks in Nigerian stock exchange from 2011 to 2015, the descriptive statistics and regression result showed that audit committee independence has a significant relationship with financial reporting lag.

Alhaji & Yusoff (2012) studied the roles of audit committee in promoting good corporate governance. With secondary data and regression analysis, the finding showed a positive and significant relationship between audit committee and corporate governance between 2000 to 2005 for Turkish listed banks.

Amin, Lukviarman, Suhardjanto & Setiany (2018) analyzed the effect of audit committee on earnings report. Using regression analysis on secondary data collated between 2011 to 2014 on 138 Indonesian companies showed a positive role of audit committee on earnings quality especially the right to control the monitoring mechanism.

Deribe & Regasa (2004) analyzed the factors determining internal audit quality, empirical evidence from Ethiopian banks. Using questionnaires administered to 160 internal auditors on 15 commercial banks. The findings on multiple regression showed that internal auditors and external auditors have a positive relationship with the performance competence and use of information technology.

Saleem, Zraquat & Okour (2019) investigated the effect of internal audit quality (IAQ) on enterprise risk management (ERM) in accordance to COSO framework. Using questionnaires administered on 126 employees in Jordanian firms and descriptive analytical method. The study found that there is a statistically significant relationship between the variables studied.

Al-Mateneh (2011) determined the factors responsible for internal audit quality in banks using questionnaires on the employees of banks listed in Amman stock exchange, Jordan. With descriptive analysis the findings showed that internal auditors in Jordanian banks are positively related to internal audit quality.

Eissa, Faozi, Anwar & Mosab (2019) investigated the impact of corporate governance mechanisms on financial performance of hotel companies: empirical evidence from India. Using panel data of 2013 to 2016, the findings revealed that audit committee size, audit committee diligence and institutional ownership have insignificant influence on EPS.

Elewa & El-Haddad (2019) investigated the effect of audit quality on firm performance: a panel data approach. With financial statements of non-financial firms listed as EGX100 during the period 2010-2019 and the application of the random effect model, the findings should that the big 4 audit firms and rotation have an insignificant impact on the ROA and ROE of the firm.

Omolaro (2014), studied the relationship between corporate governance and the performance of quoted companies in Nigeria. With 25 quoted companies studied within 2011 to 2012 and a regression analysis; the results showed that the predictive power of corporate governance on company performance is too low to be meaningful.

## **Methodology**

The ex-post factor research design was employed in this study to extract existing data on the proxies of the independent and dependent variables. The use of this design was also realistic since it is appropriate for behavioral science research and devoid of manipulation.

## **Sources of data**

The source of data for this research was the published annual financial statements and fact books of listed deposit money banks in Nigeria obtained from the Nigeria Stock Exchange

(NSE) situated at No. 13. Trans Amadi Industrial Layout Port Harcourt. This was the source of the secondary source of panel data employed for this study.

### Area of study

This study was conducted in the federal republic of Nigeria, Rivers state, Port Harcourt using publicly listed banks in the Nigeria Stock Exchange (NSE). The listed banks were chosen because of the availability of published fact book about their respective business activities in this location.

### Population of study

The target population for this study comprised of all licensed and listed commercial banks in Nigeria. However, available information from the Nigerian Stock Exchange (NSE) office at no. 13 Trans Amadi Industrial layout Port Harcourt showed the following 26 licensed banks.

<b>Commercial banks with international license and authorization.</b>	<b>Year Listed in NSE</b>
Access Bank Plc	1998
Fidelity Bank Plc	2005
First City Monument Bank Plc	2004
First Bank of Nigeria Ltd	1971
Guaranty Trust Bank Plc	1996
Skye Bank Plc	2005
Union Bank of Nigeria Plc	1970
United Bank for Africa Plc	1970
Zenith Bank Plc	2007
<b>Commercial banks with National license and Authorization</b>	
Citi Bank Nigeria Ltd	2005
Diamond Bank Plc	NA
Eco bank Nigeria Plc	2006
Heritage Bank Ltd	NA
Keystone Bank Ltd	NA
Stanbic IBTC Bank Plc	2005

Standard Chartered Bank Ltd	NA
Starling Bank Plc	1993
Unity Bank Plc	2005
Wema Bank Plc	1998
<b>Commercial Banks with Regional license and Authorization</b>	
Suntrust Bank Nigeria Ltd	NA
Providus Bank Plc	NA
<b>Non-Interest Banking License with National Authorization</b>	
Jaiz Bank Limited	NA
<b>Merchant Banking License With National Authorization</b>	
Coronation Merchant Bank	NA
FBN Merchant Bank	NA
FSDH Merchant Bank	NA
RAUD Merchant bank	NA

### Sampling method

The judgment or purposive sampling technique under the non-probability sampling method was employed in this study. This technique was chosen because of the desire to include only banks in the sample frame that are listed in the NSE and have accessible published annual financial fact book.

### Sample size of the study

To achieve the motive of purposive sampling techniques, the "census approach" was therefore used to count the banks that fulfilled the above conditions. The Nigeria stock exchange (NSE) daily official list showed that 14 banks were licensed and listed in the NSE as at December 2016 and therefore were employed as the sample size for the study.

### Method of data analysis

The linear regression analytical technique contained in the SDAT-MS Excel statistical tool was employed for analysis. The regression technique produced results for multivariate results.

**Variable operationalization and description**

Variable	Dimensions	Description
Independent: Data mining detection	1. Net-profit-margin: natural logarithm of the percentages of net profit to sales  2. Return on assets: natural logarithm of the percentage of net-profit to total assets	1. Spathis, Doupos & Zopounidis (2002); Fanning & Cogger (1998) 2. Kirkos, Spathis & Manolopoulos (2007)
Dependent: Fraud prevention	Measures: 1. Audit committee: natural logarithm of 2/3 of non-executive director  2. Internal audit quality: natural logarithm of internal audit members	1. Pahuja (2011), Patra (2005), Levitt (2000) 2. Alzeban & Gwilliam (2004); Faruk & Hassan(2014)

**Model specification**

The model specified for this study was done in line with the linear regressions. Thus, this model became imperative to enable the research establish the relationship between data mining detection and fraud prevention in Nigeria’s banking industry during the period 2013 to 2017. Therefore, the functional and econometric model specifications for this research are as follows:

**Functional form**

$$AUC = f(NPM) \text{-----(1)}$$

$$IAQ = f(ROA) \text{-----(2)}$$

Combining equations 1 and 2 gives

**Econometric form**

$$AUC = \mu_0 + \mu_1 NPM + \mu_2 ROA + \mu_{2t} \text{..... (3)}$$

$$IAQ = \mu_0 + \mu_1 NPM + \mu_2 ROA + \mu_{2t} \text{..... (4)}$$

From equations 3 and 4 it is expected apriori that  $\mu_1 \mu_2 > 0$

Where

AUC = audit committee

IAQ = internal audit quality

NPM = net profit margin

ROA = return on assets

$\mu_0$  = regression constant

$\mu_1 \mu_2$  = regression coefficient

$\mu_{1t}$  =stochastic error term

$\wedge$  = Statistical estimator

### Multivariate analysis

The linear regression tests were carried out on the hypotheses at 0.05 alpha levels.

#### Hypothesis 1 Test:

**Ho<sub>1</sub>:** There is no significant relationship between net profit margin and audit committee of listed deposit money banks in Nigeria.

#### SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.080179245
R Square	0.006428711
Adjusted R Square	-
Standard Error	1.67747901
Observations	70

#### ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	1.238077968	1.238078	0.439981	0.509374
Residual	68	191.3476363	2.813936		
Total	69	192.5857143			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	4.451998495	0.316320761	14.07432	7.95E-22	3.82079	5.083207	3.82079024	5.083206746
NPM	1.020674335	1.538757885	0.663311	0.509374	-2.04987	4.091218	-2.0498692	4.091217888

The result above showed a positive estimated coefficient intercept of 4.451998495. This value signified a positive relationship between net profit margin and audit committee. The estimated coefficient further indicated that an increase in net profit margin of 1.020674335, increased audit committee by 4.451998495. This revealed that a marginal increase in data mining of 1.0206, prevented fraud by a magnitude of 4.4519.  $R^2 = 60\%$  showed that the model was strong. And that 60% change in audit committee was caused by net profit margin. The remaining 40% could be accounted for by other factors not captured in the model but covered by the stochastic error term. Applying the decision rule with P value = 0.509374 greater than 0.05 alpha for a 2-tailed test showed that  $H_{o1}$  was insignificant and hence accepted while  $H_{A1}$  was rejected.

#### Hypothesis 2 Test

**HO<sub>2</sub>:** There is no significant relationship between return on assets and audit committee of listed deposit money banks in Nigeria.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.12232001
R Square	0.014962185
Adjusted R Square	0.000476335
Standard Error	1.670259804
Observations	70

ANOVA

	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2.881503	2.881503	1.032883	0.313085028
Residual	68	189.7042	2.789768		
Total	69	192.5857			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	4.826983478	0.28923	16.68909	9.65E-26	4.249834328	5.404133	4.249834	5.404133
ROA	0.023610224	0.023231	-1.01631	0.313085	0.069967677	0.022747	-0.06997	0.022747

The result showed a positive estimated coefficient intercept of 4.826983478. This value meant that a positive relationship exists between return on assets and audit committee. The estimated coefficient further revealed that an increase in return on assets of 0.0236102278, increased audit committee by a 4.826983478. That a marginal increase in data mining practice using applicable return on assets, all things being equal, prevented fraud by a magnitude of about 4.8269. R-square=61% showed that the overall model was strong. And that 61% change in audit committee was caused by return on assets, the remaining 39% could be attributed to other factors not captured in the model but covered by the stochastic error term. Applying the decision rule with P value =0.313085 greater than 0.05 alpha for a 2-tailed test showed that  $H_{02}$  was insignificant and hence accepted while  $H_{A2}$  was rejected.

**Hypothesis 3 Test**

**$H_{O3}$ :** There is no significant relationship between net profit margin and internal audit quality of listed deposit money banks in Nigeria.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.219334419
R Square	0.048107587
Adjusted R Square	0.034109169
Standard Error	0.979740531
Observations	70

ANOVA

	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	3.298806	3.298806	3.436645	0.068103
Residual	68	65.27262	0.959892		
Total	69	68.57143			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	4.877953026	0.184749	26.40316	1.83E-37	4.509292	5.246614	4.509292	
ROA	1.66606363	0.89872	1.853819	0.068103	-0.1273	3.459431	-0.1273	

The analysis showed a positive estimated coefficient intercept of 4.877953026. This value revealed a positive relationship between net profit margin and internal audit quality. The coefficient also revealed that a marginal increase in net profit margin of 1.66606363, all things being equal, prevented fraud by a magnitude of about 4.877953026. R-square = 84% showed that the overall model was strong. And that 84% change in internal audit quality was brought about by net profit margin. The remaining 16% could be assigned to other factors not captured in the model but covered by the stochastic error term. Applying the decision rule with P-value = 0.068103 greater than 0.05 alpha for a 2-tailed test showed that  $H_{03}$  was insignificant and therefore accepted, while  $H_{A3}$  was rejected.

#### Hypothesis 4 Test:

**$H_{04}$ :** There is no significant relationship between return on assets and internal audit quality of listed deposit money banks in Nigeria.

#### SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.20300738
R Square	0.041211996
Adjusted R Square	0.027112173
Standard Error	0.98328279
Observations	70

#### ANOVA

	<i>Df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2.825965	2.825965	2.922873	0.091892
Residual	68	65.74546	0.966845		
Total	69	68.57143			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	4.932219103	0.17027	28.96709	5.57E-40	4.592451	5.271987
ROA	0.023381587	0.013676	1.709641	0.091892	-0.00391	0.050672

The estimated coefficient intercept of 4.932219103 portrayed the existence of a positive relationship between return on assets and internal audit quality. The coefficient also showed that as return on assets increased marginally at 0.02338157, all things being equal, fraud was prevented by a magnitude of about 4.932219103.  $R^2 = 54\%$  indicated that the overall model was strong. And that 54% change in internal audit quality was caused by return on assets. The remaining 46% could be attributed to other factors not captured in the model but covered by the stochastic error term. Applying the decision rule with P-value = 0.091892 greater than 0.05 alpha for a 2-tailed test showed that  $H_{04}$  was insignificant and hence accepted while  $H_{A4}$  was rejected.

#### Conclusion

Given the findings for this research, the following conclusions were made:

- i. That there was the existence of positive and insignificant relationship between net profit margin and audit committee.

- ii. That there was the existence of positive and insignificant relationship between return on assets and audit committee.
- iii. That there was the existence of positive and insignificant relationship between net profit margin and internal audit quality.
- iv. That there was the existence of positive and insignificant relationship between return on assets and internal audit quality.

### Recommendations

Based on the findings and conclusions, the research made the recommendations:

- i. The management as well as board members of banks should endeavor to create more ingenious and effective methods of data mining detection in order to prevent more hidden frauds in the banking industry. This is because of the positive and insignificant relationship between the variables of study.
- ii. The banking industry regulators like NDIC and CBN should make more robust legislations to enable banks implement other electronic data mining detections such as artificial intelligence (AI) for fraud prevention through scientific methods. This is because of the positive and insignificant relationship between the variables of study. And because the current methods of data mining detection which involved financial ratio analysis employed by banks in Nigeria have become obsolete.
- iii. The stakeholders in the banking industry like employees, investors, customers and the general public should adopt the whistle blowing policy of the federal government of Nigeria. This could further mitigate fraud in the banking industry.
- iv. The employees in the banking industry particularly the managers should promote educate and practice the 2018 corporate governance code as promulgated by the financial reporting council of Nigeria (FRCN). This would act as an additional synergy for fraud prevention.

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