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The Role of Both Audit Rotation and Joint Audit on the Enterprise's Value

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Abstract:

The criticism of the audit profession and the financial scandals are the main factor for the appearance of new legislation. The Joint audit considered a way to mitigate the threats that affect the auditor independence. Audit rotation can improve audit process quality because audit rotation has a positive effect on the independence of the auditor. The data included 34 companies in 14 sectors during five years: so there are two factors the first factor is the time in years and the second factor is the companies. This study included a dependent variable the value of a firm and 12 independent variables. Random effects model and fixed effects model were performed to caption the information of the data. There is a statistical evidence that the audit rotation has a significance effect on increasing the value of a firm and positive effect on the auditor independence; while the joint audit has a non-significance effect on the value of a firm and the auditor independence.

Keywords: Joint Auff, ¯Audit Rotation, Random Effects, Fixed Effects, Panel Data, and Multi-Level Analysis of Variance.

1. Introduction

The criticism of the audit profession and the financial scandals are the main factor for the appearance of new legislation. The failure of audit processes leads to significant changes in auditing procedures (Stephan A. Fafatas, 2010) There are two reasons can threaten the auditor independence; firstly, the auditor shares in non-auditing tasks for the firm under auditing and secondly a long time for auditing the same firm (Garboua, 2014)

The Joint audit considered a way to mitigate the threats that affect the auditor independence (ICAEW, 2017) Also audit rotation affects the auditor's independence positively and could be mandatory or voluntary. The mandatory audit rotation means that the firm must change the auditors each period (5 years) while voluntary audit rotation gives the firm the whole freedom to change or leave the auditors (Diana & Magda, 2010). As well as the internal and external auditing can be used to improve the auditing process (Patrick veite& Markus Stigibauer, 2012)

Audit quality has the first priority in all business firms also auditor independence is considered the most important element for preparing the financial reports to protect the investors' rights. Audit quality consists of several elements: professional culture,

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independence, objectivity, professional doubt, appropriate expertise and skills, quality control procedures, efficiency and achievement accuracy. Also the interesting of human resources and staff training can be added as a factor to improve the audit quality.

The research problem is exploring the relationship between the joint auditing & audit rotation and their effect on the business firms. Also the effect of these two types of auditing on the auditor independence and his report to improve the quality of the auditing process.

The hypothesis of this research can be expressed as follows:

- There is a significance effect of applying the join auditing on increasing the value of a firm.
- There is a significance effect of applying the auditing rotation on increasing the value of a firm.

2. Previous Studies:

The previous studies have been divided into 3 categories; these categories can be expressed as follows:

1st Category:

This category presented the effect of joint auditing on auditing quality (ICAEW, 2017) / (Julia, 2010); (Vanstraelen, Schelleman, Hofman., & R. Meuwissen RA, 2011) (Deloitte, 2012)

From these researches, one can conclude that:

1- The auditor's report should be modified in order to help in applying corporate governance and also for improving the contact between the headquarters and stock holders through informing them with the proper and important information.
2- Using joint audit can lead to increase the accuracy of auditing report; so the external users can trust it.
3- The contents of the audit report should be included an explanation for auditing and how to evaluate it and how to treat the financial statements.

2nd Category:

This category presented the effect of audit rotation on audit quality (Arrunada & Candido Paz-Ares, 1997); (Garboua, 2014); (Hatfield, Jackson, & Vandervelde, 2017); (Diana & Magda, 2010); (Soo, Young, & Roger, 2010); (Ernst & LLP, 2011); (CFAQ, 2011)

From these researches, one can conclude that:

1- Mandatory auditing aims to improve the audit process because the auditor subjected to some dispersions from the managers that are audited, in addition to depending on one client that threaten its independence and biased as well as auditing bureaus owned by one person.
2- Some auditors are resorting to reduce audit fees to attract some customers, which is leading to a threat of independence and reduce the efficiency and the quality of the report.
3- In order to improve audit quality, the contact between auditing bureaus and auditing committee in addition to facing the policies and procedures and improving transparency and the contact between auditing committees and investors.

3rd Category:

This category presented the relationship between the joint audit, audit rotation and audit independence and their reflections on the value of the information through improving the firm's

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performance (Saibal Ghosh, 2010); (Stephens, 2010); (Fernando, M, J., & Elder, 2010); (peni & Vahamaa, 2010); (C.H. & D.V., 2011); (Costello & Regina Wittenber G, 2011); (Siagian & T., 2012); (Jouber & Fakhfakh, 2011); (Mikko Zerni, 2012); (Li, Tian, & Qi, 2012).

From these researches, one can conclude that:

1- There are a lot of reasons that affect the relationship between the auditor and the firm audited such as Governance structure, the role played by the domestic and international auditor and the relation between the joint audit and auditing fees.
2- The auditing size is a factor that determines the characteristics of audit quality process.
3- The auditors should be able to face the stress mode by the client.
4- The shape of ownership, independence control, corporate governance, management hierarchy and the size of the firm is considered from the main determinants of managing income.

From the three categories of researches one can conclude that:

1- The auditor should be trained in facing the situations of the clients.
2- The steps that should be followed to reduce the threats faced by the auditor independence.
3- Trying to find a relation between Joint audit and audit rotation to be benefited from both perspectives and trying to diminish these impacts of both perspectives.

3. Data:

The data are annual time series from 2005 to 2009 of 34 companies in 14 sectors in the Egyptian stock market. These companies had been selected in this study according to the following conditions:

- The company is considered applying the required auditing if there is more than one auditor shared in writing the financial statement.
- The company is considered applying the obligatory audit rotation if the time of auditing doesn't exceed five years.
- The researchers use the variable "Tobin's Q" to measure the value of a firm.

The following table (1) shows the list of 14 sectors and the number of companies in each sector.

Sector	Number of Companies
Construction and building materials	4
Chemicals	3
Communications	3
Industrial Goods and Services and cars	2
Clothing and textiles	5
Banks	3
Financial services other than banks	3
Housing and real estate	6
Food and drinks	1
Information Technology	1
Media	1
Gas and mining	1
Recreational activities	1
Total	34

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The Variables Used in the Analysis Are Listed Below:

The Dependent Variable (Y)

Y (Firm value) = (market value of equity + total liabilities) + total assets The Independent Variables (X's):

X_1 Indicator variable which takes 1 if the company has a joint audit and zero otherwise.

X_2 Indicator Variable takes the value 1 in the case of the application of audit rotation and zero otherwise. '

X_3 indicator variable takes the value 1 in the case of application of each of the joint audits and audit rotation, and zero otherwise.

X_4 natural logarithm of the market value of equity = market value of the share x number of shares in circulation

X_5 Variable to measure the probability of bankruptcy of the company using 2 score.

X_6 percentage of total assets in accounts receivable and inventory = (Accounts receivable + inventory) + total assets

X_7 Total accruals = earnings before extraordinary items - gain discontinued Operations.

X_8 variable net operating assets = shareholder rights (securities and cash in the market + total liabilities at the end of the year)

X_9 implicit commitment index = 1 - (percentage of the total property, plant and equipment to total assets)

X_{10} the natural logarithm index of the market value of the ordinary shares = market value per share x number of shares in circulation

X_{11} Index Leverage = totai liabilities + total equity

X_{12} debts ratio = Total liabilities + total assets

4. Methodology

The theoretical background of this paper is divided into two sections: the first section deals with the accounting methodology of the auditing, and the second section deals with the statistical methods which will be used in the analysis of data.

Firstly: Accounting Methodology

The impact of Joint Auditing on the Market Performance of the Business Firms:

Audit quality is considered the first point to protect the investor's rights and improving the efficiency of the stock market. The preparation of financial reports is facing many difficulties, which are due to the complexities in the projects environment, globalization and the new technology used. The audit process quality can be improved by using the following measures: The Fair Value Measurements, Financial Derivatives, Hedge Accounting, Consolidation, Good well impairment and the most important measure is Sarbanes- OXley (SOX). SOX measure displays many suggestions to achieve audit quality by increasing the importance and strength of Internal Control, the powers of audit committee's independence and the independence of the auditor. Also; legal supervision of the auditors can be used. The duration between them leads to a strong relation which causes threats of auditor's independence. Audit rotation makes auditor are not subject to any kind of threats and ome believe that the auditor can work for the company at most of 5 years.

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Process of audit quality and accuracy of audit reports and their impact on the value of the firm leads to the need for new legislation to regulate the audit profession.

In an effort to address essential concerns, the European Commission issued the Audit Directive, Which Achieves only minimum harmonization at the European Union level because member states are allowed to add national stipulations" (Julia and Rudolf, 2010).

Some researchers believe that there is a need for new legislation for preparing audit reports. Auditor independence is one of the most important factors to achieve the: audit quality process. Auditor independence means no pressures on him to produce an unbiased audit judgment.

The obligation to international auditing requirements specially ISA—220; titled “quality control audit of the financial statements" helps to alleviate these threats, where the requirements deals with specific responsibilities for auditor related to quality control procedures for the process of auditing the financial statements. These r requirements are:

"lSQC-l or national requirements are at least as demanding, deals with the firm's responsibilities to establish and maintain its system of quality control for audit engagement. The system of quality control includes policies and procedures that address each of the following elements:

- Leadership responsibilities for quality within the firm.
- Relevant ethical requirements.
- Acceptance and continuance of client relationships and specific engagements.
- Human resources.
- Monitoring.

It is intended that the auditor and audit firms will be subject to a quality assurance system. in light of that requirements company undertakes to review the establishment of a quality control system is designed to supply the company's reasonable under auditing to confirm that the company and its employees respond to audit requirements and the various legislation and legal requirements. According to their quirements of lSA—220 audit team must apply the quality control procedures. Joint audits are a way to mitigate the threats to auditor independence. Joint audits are used to describe the situation in which there are two auditors are selected together to plan and implement the audit process. it should be noted that in the case of a relationship between the auditor and established under auditing must be done in aminimalistic as well be in a separate contract. The auditor should prepare the required documents of the audit to cover the auditing period and deliver a copy of those documents to the firm. As well as the necessary conditions of the contract that all reports submitted by the firm from auditor owned exclusively to the firm and subject to the uses and control in accordance with the laws and regulations.

The Relationship between Audit Rotation and Audit Process Quality:

The relation between audit rotation and audit process quality can be made by preference because audit rotation has a positive effect on the independence of the auditor. It decreases the duration of engagement of the auditor with the client. Long Duration between them leads to a strong relation which causes threats of auditor's independence. Audit rotation makes auditor

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are not subject to any kind of threats and ome believe that the auditor can work for the company at most of 5 years.

The researcher found that audit rotation has a negative effect on audit quality. Audit quality requires from the auditor to be aware of the activity of the client and the effects facing him so, the long the auditor stay with the client the better the auditing quality.

"Mandatory rotation of lead and reviewing partners sufficiently achieves the intended benefits of the fresh look and is less costly than mandatory audit firm rotation" (Hatfield, Jackson, & Vandervelde, 2017).

"Currently the majority of countries do not require audit firm rotation after a specified number of years and most regulatory bodies throughout the world favor that position" (Hatfield, Jackson, & Vandervelde, 2017)..

- **The proponent of audit rotation found that audit rotation:**

1- Minimizing the role played by the auditor.
2- Audit rotation considered a method used by media to have a contact with the external users which help the auditor in evaluating the financial circumstances of the audited firm.
3- Audit rotation enables a good vision for the financial statements of the client and enable for a link with the client.
4- Audit rotation helps in improving the competition in audit field.
5- The auditor and the client both suffer from large losses in case the auditing process fail and so the cost of audit rotation will be less in comparison with the custom cost and the losses arise from the bad reputation which is due to this failure.

The Opponents of Audit Rotation Found That:

1- There is no use to apply audit rotation because the increase in its sharpness can be faced by the efforts made by the auditor to rescue his reputation.
2- Mandatory rotation will lead to increasing the transformation cost and the processing cost of both the auditors and the clients because when the auditors start the business with a certain client, then the processing cost at the beginning of the year is higher than the other auditing processes. "Actually, it was found by the GAO that the audit cost was 17% of the total audit fees of the first year audit" (Jackson, Moidrish, & Roebuck, 2008).
3- The auditors prefer to treat the managers daily during the audit process which makes the managers aggressive in treating the auditor.

- The researcher found that the failure of some audit processes because there is not available information for the auditor about these clients and for the auditor to have good results for the audit process he should have information about the accounting system and the internal control system to be able to find the frauds, the audit quality increases nowadays with the increase in the auditor's experience, and the auditor become more aware of the client's information.

The Effect of Joint Audit and Periodic Audit on Audit Report:

Joint audit and periodic audit used to differentiate between many types of information that form the audit report. and the following figure shows this:

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The information of the audit report:

1- The field of the report.
2- The audit team.
3- The audit process.
4- The evaluation results.
5- Another disclosure.

The field of the report; the type of information focus on the auditor's role and the auditor's field; this information helps the users in understanding the role of the auditor and the purpose of the audit process and so, the following disclosures are important to achieve this aim:

a- Explaining the aim of the audit process as well as the audit risk.,
b- The disclosure of the auditor's responsibilities upon the traditional disclosures.
c- The disclosure of the auditor's responsibilities upon the manager's reports including the financial the statements of the client.
d- Determining the other elements & factors outside the audit process like the holistic view of the audited firms.

The Audit Team:

This type of information includes the information related to audit team and the audit engagement and the main information like:

a- The names of the participants in the audit plan and their signatures.
b- The manufacturing experiences that reflect the quality of the audit process.
c- The relation between the time done in auditing and the levels of audit team and the characteristics of the audited firm.
d- All the specialties (engineers, physicians, chemists, real estate evaluators) and its reflections on the quality of the audit process.
e- Information about the size of the firm regarding the value of the revenues.
f- information that affects the auditor's independence like the provisions of non-audit services in case of using joint audit.

The Audit Process:

This type of information helps the users in using the needed information in evaluating the clone jobs by the auditors and this to determine the reliability and the extent to which input and output of the audit process are correlated and from the main disclosures:

i- Evaluating risk of the audited firm and determining the field the auditor focus on during auditing.
ii- Evaluating and determining the significant sources of fraud.
iii- Evaluating and determining the sources of fraud; like:

a- The information that helps the users in better understanding.
b- The significant tests to determine the importance of each level.
C- The elements that the auditor depend on internal models and the managerial
d- The extent to which there is a dependence on the internal control of the clients during auditing using a certain way.

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e- The important disclosures in auditing plan and the audit plans.

The Results of the Evaluation:

This sort of information is related to the auditor's evaluation at the end of the audit process and so the users depend on these results, and from these disclosures:

a- The auditor's opinion in the quality of client's financial statements.

b- The auditor's opinion in the quality of client's internal control.

c- The auditor's opinion in being biased and his illegal optimum.

d- The auditor's opinion in the problems may be faced.

e- The auditor's opinion in the continuity of client's work.

f- The difficulties the auditor faces during auditing.

g- To what extent there is an interaction between the audited firm and corporate governance.

h- The information being disclosed.

Other Disclosures:

This includes the ethical point of view of the auditor upon the firm being audited and the auditor's point of view regarding the future activities of the firm, in addition to information about corporate governance, the continuity of the activity, how to manage risk and the internal control system. There are a lot of forms for the audit report like the ordinary report, the one statement report (pass, fail), the report that contains marks from (1) to (10) dealing with Justice and the quality of the contents of the financial statements, or the auditor's report in addition to extra information about any conversations between the auditor and investors in order to include certain paragraphs about the assurance of the financial statements.

Secondly: Statistical Methods

In a general linear model (GLM), a random sample of the individuals in each population is drawn. A treatment is applied to each individual in the sample and an outcome is measured. The data so obtained are analyzed using an analysis of variance table that produces an F-test. A mathematical model may be formulated that underlies each analysis of variance. This model expresses the response variable as the sum of parameters of the population. A linear model for a two-factor experiment could be

Y_{ijk}“ $=\mu+a_i+b_j+(ab)_{ij}+c_{ijk}$

where i= 1, 2, , l (the number of levels of factor 1), j = 1, 2, J (the number of levels of factor 2), and k 2 1, 2, , K (the number of subjects in the study). This model expresses the value of the response variable, Y, as the sum of five components:

μ the mean.

a_i the contribution of the ith level of a factor A.

b_j the contribution of the jth level of a factor B.

$(ab)_{ij}$ the combined contribution (or interaction) of the ith level of a factor A and the j^{th} level of a factor B.

e_{iik} the contribution of the kth individual. This is often called the error.

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In this model. the linear model is made up of fixed effects only. An effect is fixed if the levels in the study represent all levels of the factor that are of interest, or at least all levels that are important for inference.

The following assumptions are made when using the F-test in a general linear model.

1. The response variable is continuous.
2. The individuals are independent.
3. The eijk follow the normal probability distribution with mean equal to zero.
4. The variances of the eijk are equal for all values of i, j, and k.

The Mixed Model is a natural extension of the general linear model. Mixed models extend linear models by allowing for the addition of random effects, where the levels of the factor represent a random subset of a larger group of all possible levels. The two-factor linear model) could be enlarged to include a random block effect.

Covariates (continuous) and/or nested effects can also be included in the mixed model to improve the accuracy of the fixed effect estimates. The general form of the mixed model in matrix notation can be expressed as follows (Brown & Prescott, 2016):

y=Xfl+Zn+£

where

y = vector of responses

X = known design matrix of the fixed effects

B =unknown vector of fixed effects parameters to be estimated

Z =known design matrix of the random effects

u =unknown vector of random effects

a =unobserved vector of random errors

Assuming that: ***u ≈N(0,G), ε ≈N (0,R) and Cov[u,ε]:0***

Where: G variance-covariance matrix of u and R variance-covariance matrix of the errors ε.

The variance of y, denoted V, can be defined as follows:

V = Var[y]= var[Xβ+ zμ+ ε]= 0+ Var[Zu+ ε]: ZGZ'+ R

In order to test the parameters in B, which is typically the goal in mixed model analysis; the unknown parameters ((5, G, and R) must be estimated. Estimates for [5 require estimates of G and R. In order to estimate G and R, the structure of G and R must be specified.

The following assumptions are made when using the F-test in a mixed model.

1. The response variable is continuous.
2. The individuals are independent.
3. The random error follows the normal probability distribution with mean equal to zero.

A distinct (and arguably the most important) advantage of the mixed model over the general linear model is flexibility in random error and random effect variance component modeling (note that the equal—variance assumption of the general linear model is not necessary for the linear mixed model). Mixed models allow you to model both heterogeneous variances and correlation among observations through the specification of the covariance matrix structures for u and s. The variance matrix estimates are obtained using maximum

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DOI: https://doi.org/10.56830/IJNZ1133

likelihood (ML) or, more commoniy, restricted maximum likelihood (REML). The fixed effects in the mixed model are tested using F-tests.

Types of Mixed Models

Several general mixed model subtypes exist that are characterized by the random effects, fixed effects, covariate terms, and covariance structure they involve. These include fixed effects models, random effects models, covariance pattern models, and random coefficients models.

Fixed Effects Models

A fixed effects model is a model where only fixed effects are included in the model. An effect (or factor) is fixed it the levels in the study represent all levels of interest of the factor, or at least all levels that are important for inference. No random components are present. The general linear model is a fixed effects model. Fixed effects models can include covariates and/or interactions. The two-factor experiment model gives an example of a fixed effects model. The fixed effects can be estimated and tested using the F-test.

Random Effects Models

A random effects model is a model with only random terms in the model. An effect (or factor) is random if the levels of the factor represent a random subset of a larger group of all possible levels. The random effects are not tested, but estimates are given.

Determining the Correct Model of the Variance-Covariance of Fixed Effects

A fixed effect (or factor) is a variable for which levels in the study represent all levels of interest, or at least all levels that are important for inference. The fixed effects in the model include those factor for which means, standard errors, and confidence intervals wilt be estimated and tests of hypotheses will be performed. Other variables for which the model is to be adjusted may also be included in the model as fixed factors. Fixed factors may be discrete variables or continuous covariates (Little, 2016).

The correct model for fixed effects depends on the number of fixed factors, the questions to be answered by the analysis, and the amount of data available for the analysis. When more than one fixed factor may influence the response, it is common to include those factors in the model, along with their interactions. Difficulties arise when there are not sufficient data to model the higher-order interactions. In this case, some interactions must be omitted from the model. It is usually suggested that if you include an interaction in the model, you should also include the main effects involved in the interaction even if the hypothesis test for the main effects in not significant.

A Model-Building Strategy

There are three main components of a mixed model:

The Fixed Effects Component:

The fixed effects component of the model consists of the fixed factors, the covariates, and the interactions of fixed factors and covariates. The strength of evidence for the true effect of each fixed effects term is given by the probability level of the corresponding F-test.

International Journal of Accounting and Management Sciences
Vol.2 No.1 January 2023
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The Random (Subject) Component:

The random factors include all random factors and interactions of random factors with fixed factor variables or covariates. The importance of each random term is more subjective. Inclusion or exclusion of a random term is often decided by comparing the magnitude of the estimates. Relatively small estimates may, in some cases, be removed from the model.

The Covariance Pattern of Repeated Measurements:

The covariance pattern indicates the pattern of the residual error of repeated measurements. The pattern should usually be Diagonal if a random model is specified. Patterns can be compared by examining the AIC value for each pattern.

The goal in building a mixed model should be finding the simplest model that best fits the observed data. A reasonable top—down strategy for building a model might include the following steps:

1- Specify all the fixed effects. covariates. and potentially important interactions in the Fixed Effects Model.
2- Specify either the Random Model or the Repeated Covariance Pattern as the circumstances dictate.
3- Compare the random terms to see if any are clearly negligible (less than 20 times smaller than the others).
4- 6. Examine the fixed effects terms F-tests tests. Iteratively remove interaction terms from the fixed effects model that has large probability levels.
5- 7. Compare the AEC values. Keep the pattern with the lowest AIC value.

Multiple Comparisons of Fixed Effect Levels

If there is evidence that a fixed factor of a mixed model has difference responses among its levels, it is usually of interest to perform post-hoc pair-wise comparisons of the least-squares means to further clarify those differences. It is well—known that p- value adjustments need to be made when multiple tests are performed. Such adjustments are usually made to preserve the family-wise error rate (FWER), also called the experiment-wise error rate, of the group of tests. FWER is the probability of incorrectly rejecting at least one of the pair-wise tests.

Family-Wise Error Rate (FWER) Control - Bonferroni Adjustment

The Bonferroni p-value adjustment produces adjusted p-values (probability levels) for which the FWER is controlled strictly (Westfall et al, 1999). The Bonferroni adjustment is applied to all m unadjusted (raw) p-values (p_j) as fir. = $P_i(m\ p_j\ ,\ 1)$

That is, each p-value is multiplied by the number of tests in the set (family), and if the result is greater than one, it is set to the maximum possible p-value of one. The Bonferroni adjustment is generally considered to be a conservative method for simultaneously comparing levels of fixed effects.

Study Results:

As mentioned above the data consists of the dependent variable Y and 13 independent variables and the factors were the years (2005- 2009) and the companies. A multiple regression model with a weighted variable has been performed. The first model used the

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variable companies (C) as a weighted variable and stepwise was applied. The fitted model can be expressed as follows: .

$Y=1336-0619C_2$—$0.601C_3+0.030C_4-0.850C_5+0.254C_5+0.877C_7+0.491C_8-0.829C_{10}$ 0.01 $5C_{10}$- $1.148C_{11}+4.415C_{12}$-$1.295C_{13}$-
$-1.600C_{14}-1.473C_{15}-1.128C_{15}-1.433C_{17}-1.381C_{13}-1.420C_{15}-1.719C_{20}-1.309C_{21}-1.480C_{22}-1001C_{23}-1.234C_{24}+1.297C_{25}$
$+0.530C_{25}-1.788_{C27}-0.551C_{23}-1.151C_{29}+0.511C_{30}-1.284C_{31}-1.005C_{32}-0.349C_{33}+0.186C_{34}-2.898X_{1o}+ 2.189X_8+ 1.320X_9$

From this model it was found 11 companies have a positive relationship with the dependent variable and the other have a negative effect. Also a multiple regression model with variable years as weighted variable was applied; the fitted model can be expressed as follows:

$Y=1.984-0.588X_1 -3.105X_{10}+ 2.970X_8-0.284Y_{2005}+0.207Y_{2007}-0.336Y_{2003}-0.529Y_{2009}$

From both model it's clear that the most important independent variables were X_1, X_8, X_9, and X_{10}.

In the next section we will present the results of applying the mixed model with fixed effects and with random effects. The following table shows the results of the fixed effects and the random effects models.

Table 2: Information Criteria of Fixed Effects and Random Effects Models

Information Criteria	Fixed Effects	Random Effects
Akaike's information Criterion (AIC)	190.507	170.295
Hurvich and Tsai's Criterion (AICc)	222.815	170.775
Schwarz's Bayesian Criterion (BIC)	209.158	172.959
R-squared	0.475	0.698

The Akaike information criterion is a measure of the relative quality of a statistical model, for a given set of data. As such, AIC provides a means for model selection. AIC is founded on information entropy: it offers a relative estimate of the information lost when a given model is used to represent the process that actuality generates the data. AIC is deals with the trade-off between the complexity of the model and the goodness of fit of the model. AIC does not provide a test of a model in the sense of testing a null hypothesis. AIC can tell nothing about how well a model fits the data in an absolute sense. When all models fit poorly AIC wilt not give any warning of that. In the general case, the AIC is

AIC = 2k — 21::(L)

Where k is the number of parameters in the statistical model and l. is the maximized value of the likelihood function for the estimated model.

Given a set of candidate models for the data, the preferred model is the one with the minimum AIC value. Hence AIC not only rewards goodness of fit, but also includes a penalty that is an increasing function of the number of estimated parameters. This penalty discourages overfitting (increasing the number of free parameters in the model improves the goodness of the fit, regardless of the number of free parameters in the data-generating process).

International Journal of Accounting and Management Sciences
Vol.2 No.1 January 2023
Print ISSN: 2834-8923 Online ISSN: 2832-8175
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AICc is AIC with a correction for finite sample sizes:

AICC= AIC+ $\frac{2k\,(k+I)}{n-k-I}$

Where n denotes the sample size. Thus, AlCc is AIC with a greater penalty for extra parameters.

(Burnham & Anderson, 2020) strongly recommend using AICc, rather than AIC, if n is small or k is large. Since AICc converges to AIC as n gets large, AICc generally should be employed regardless (Brockwell & Davis, 1987). Using AIC, instead of AICc, when n is not many times larger than k2, increases the probability of selecting models that have too many parameters, i.e. of over fitting. The probability of AIC over fitting can be substantial, in some cases (Brockwell & Davis, 1991)

The Bayesian information criterion (BIC) or Schwarz criterion (also SBC, SBIC) is a criterion for model selection among a finite set of models. It is based, in part, on the likelihood function, and it is closely related to Akaike information criterion (AlC). When fitting models, it is possible to increase the likelihood by adding parameters, but doing so may result in over fitting. The BIC resolves this problem by introducing a penalty term for the number of parameters in the model. The penalty term is larger in BIC than In AIC.

The BIC was developed by Gideon E. Schwarz, who gave a Bayesian argument foradopting it. It is closely related to the Akaike information criterion (AIC). In fact, Akaike was so impressed with Schwarz's Bayesian formalism that he developed hisown Bayesian formalism, now often referred to as the ABIC for "a Bayesian Information Criterion" or more casually "Akaike's Bayesian Information Criterion". The BIC is an asymptotic result derived under the assumptions that the data distribution is in the exponential family. Let:

- X = the observed data;
- n = the number of data points in x, the number of observations, or equivalently, the sample size;
- k = the number of free parameters to be estimated. if the estimated model is a linear regression, k is the number of regressors, including the intercept; p(x|k) = the probability of the observed data given the number of parameters; or, the likelihood of the parameters given the dataset;
- L= the maximized value of the likelihood function for the estimated model.

The formula for the BIC is:

—2*Inp(x|k) ≈ BIC= 2*lnL+kln(n)

Under the assumption that the model errors or disturbances are independent and identically distributed according to a normal distribution and that the boundary condition that the derivative of the log likelihood with respect to the true variance is zero, this becomes (up to an additive constant, which depends only on n and not on the model):

BIC = n * In (6^2_e)+ k *ln(n)

where 6^2_e IS the error variance.

The error variance In this case IS defined as $\hat{\sigma}_e^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \hat{x}_i)^2$

One may point out from probability theory that 6: is a biased estimator for the true variance 6^2_e Let 6^2_e denote the unbiased form of approximating the error variance. It is defined as

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$$\hat{\sigma}_e^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \hat{x}_i)^2$$

Additionally, under the assumption of normality the following version may be more tractable
BIC = X^2 + k * In(n)

Note that there is a constant added that follows from transition from log-likelihood to X^2 however, in using the BIC to determine the "best" model the constant becomes trivial. Given any two estimated models, the model with the lower value of BIC is the one to be preferred: The BIC is an increasing function off and an increasing function of It. That is, unexplained variation in the dependent variable and the number of explanatory variables increases the value of BIC. Hence, lower BIC implies either fewer explanatory variables, better fit, or both. The BIC generally penalizes free parameters more strongly than does the Akaike information criterion, though it depends on the size of n and relative magnitude of n and k. It is important to keep in mind that the BIC can be used to compare estimated models only when the numerical values of the dependent variable are identical for all estimates being compared. The models being compared need not be nested, unlike the case when models are being compared using an F or likelihood ratio test.

From table (2) it is clear that the best model to fit the data is the random effect model because the three tests Re smaller for the random effects model than the fixed effects model; adding to that the higher R-squared is coming from the random effects model.

Also analysis of variance for the dependent variable was carried out. Table (3) shows the results of ANOVA using most important independent variables against two factors (1) time in years and (2) companies.

Table (3): Analysis of Variance for Y - Type III Sums of Squares

COVARIATES	Sum of Squares	Df	Mean Square	F-Ratio	P-Value
X2	13.403	1	13.403	8.99	0.003
X3	0.008	1	0.008	0.01	0.942
X4	0.048	1	0.048	0.03	0.859
X5	1.455	1	1.455	0.97	0.326
X6	2.004	1	2.004	1.34	0.249
X7	0.009	1	0.009	0.01	0.963
X8	2.784	1	2.784	1.87	0.175
X10	1.965	1	1.965	1.32	0.253
X11	6.076	1	6.076	4.07	0.064
X12	0.928	1	0.928	0.62	0.432
MAIN EFFECTS					
A: Year	11.396	4	2.849	1.91	0.113
B: Company	83.773	33	2.59	1.70	0.020
RESIDUAL	180.494	121	1.492		
TOTAL (CORRECTED)	649.993	168			

All F-ratios are based on the residual mean square error.

The ANOVA table decomposes the variability of Y into contributions due to various factors. Since Type III sums of squares have been chosen, the contribution of each factor is

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Vol.2 No.1 January 2023
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measured having removed the effects of ali other factors. The P-values test the statistical significance of each of the factors. Since one P-value is less than 0.05, these factors have a statistically significant effect on Y at the 95.0% confidence level.it is clear that the most important variables are X2 (Indicator Variable takes the value1 in the case of the application of audit rotation and zero otherwise) and X11 (Index Leverage = total liabilities -=~ total equity) and the most important factor is the Company.

Conclusions:

In this article the author tried to explorer the effect of joint auditing and audit rotation on the value of a firm and auditor independence. Auditor independence is an indispensable in providing appropriate quality of financial accounting and auditing. The statistical analysis gives evidence that the audit rotation and the Leverage have a significance effect of the firm value. Also there is no significance effect of applying the joint auditing on increasing the value of a firm. Also there is a significance effect of applying the auditing rotation on increasing the value of a firm. The data included 34companies in 14 sectors during five years; so there are two factors the first factor is the time in years and the second factor is the companies. The statistical analysis showed that the factor companies have a significance effect of the value a firm, while the time has no significance effect on the dependent variable. This means that the value of a firm can differ from company to another. At the end of this analysis it is recommended to apply audit rotation to increase the value of a firm and increase auditor independence level.

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