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Emerging Markets Queries in Finance and Business

Methods for Risk Identification and Assessment in Financial Auditing

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Abstract

Identification and assessment of audit risks, which may be encountered by a company, is a very important step in the audit procedure. The risk is actually a threat to society, something that could happen, the threat resulting from a specified event, so something has to happen for the risk to become "alive". The key to success is knowledge, but the key to success in the global context is the ability to adapt your knowledge to the trend. If, until now, methods for risk identification and assessment in financial audit used by auditors are classic, they need to upgrade and level up to the next step. The present paper presents three methods for risk assessment in financial auditing: ARM, Bayes' theorem and belief function, managing to conclude that for adapting to the technology that it is in constantly change, computer-assisted audit techniques are becoming slowly –slowly a necessary evolution.

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Keywords: Risk assessment; ARM; Bayes' Theorem; Belief function; CAAT.

1. Introduction

In a world where the technology advanced in a fast forward time and it manage to change our live in an alert rhythm, where the future computers are managed by thoughts, where the auditing is accomplished at the level of techniques and policies from innovation area, we are asking ourselves what can offer us insurance and what

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is the meaning of this insurance. Roberts and Dwyer (1998) is telling us that „reasonable assurance" is the keyword in audit effort. The aim of *obtaining the reasonable assurance* is informing on true and fair view of the financial reporting, but users has to know that auditors don't offer a guarantee of 100% of the fairness of the financial reporting and a small level of risk is always present (Arens et al., 2012).

To obtain the reasonable assurance, the auditors must go through several necessary steps of assessment of the company, and even by going to these steps, most of the time this is not enough.

The assessment process of risks in auditing has the following 5 steps (Balaniuk et al., 2012):

- Defining the universe of the audit;
- Identification and measure of the risk factors;
- Establishing a mechanism and a scale for the risk factors for the audit unity;
- Classification of the audit unities according to the risk total (the obtained score);
- Developing an audit plan based on the classification and on the rank of the audit universe.

The non-conventional models must respect these steps for a good assessment of the risks, and also for offering a good methodology for comparison with other methods/models, but in the same time it must be according with the market tendency and to be adaptable to the market techniques in this explosive technology.

With the evolution of the audit process, the auditors must take into consideration the development of simple procedures for aiding the undertaking work, but in the same time to guarantee the assurance and to certify the performed procedures. This is the reason from where researchers came to the involvement of statistical tools and methods in the audit process because experts concluded that mathematical and statistical calculations provide greater public safety so experts in the field accept more easily the development process and acceptance of new technologies and inventions.

Our aim is focused on the statistical methods and instruments by introducing them into the audit field for achieving a forecast of where this whole technology is going through.

2. Audit risk model (ARM)

Audit risk includes 3 components: inherent risk, control risk and detection risk. The interconnection of the three components of the audit risk, can be seen in the figure below (Hayes et al., 2005), expressing how much audit evidence should be collected (or not) by the auditor for providing that "reasonable assurance".

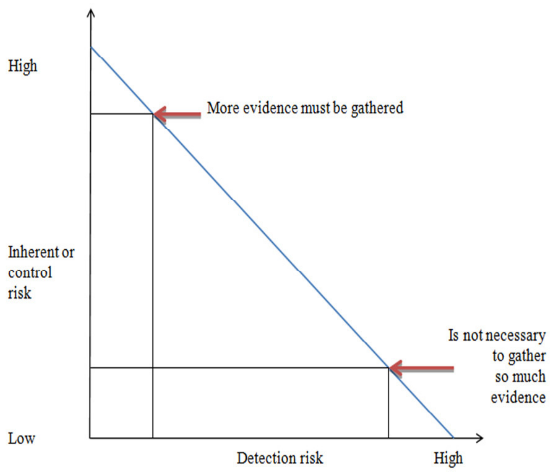

Fig. 1. Relation between inherent, control, and detection risk

In practice, the auditors used an *audit risk model*, also known as ARM, for assess the way the audit should be performed and how long it should be given for the following step.

One of the relations that we run across is:

$$A_R=R_{MM} \text{ x } D_R \quad (1)$$

Where:
A_R=Audit risk
R_{MM}=Risk of material misstatement
D_R=Detection risk

Risk of material misstatement it is:

$$RMM=IR \times CR \quad (2)$$

Where:
I_R=Inherent risk
C_R=Control risk

In this situation:

$$A_R= I_R \times C_R \times D_R \quad (3)$$

This is the relation which determents if the inherent and control risk are high (meaning 100%), this means that the control systems of the company are really low and the audit risk will have a low level (around 1%). The level of 1% show that the auditor grant a credibility of 1% (where 1% is the lowest level and 100% is the highest level) that the financial reports were prepared correctly and show the true and fair view of the company.

When the inherent and control risk are set at low values (35%, and 20%) it will be applied the same principal, the audit risk can be set at a level of 5%, what mean that the detection risk will be:

$$DR=0.05\div (0.30 \times 0.20) =71,42\% \quad (4)$$

2.1. Detection risk assessment

Detection risk can be control by the auditor through (Genete, 2005):

- proper planning of the audit;
- establishing the correct nature, term and spread of the work;
- identification and assessment of the performance of the audit procedures.

When we are going on the extended version of the ARM, detection risk can be split in two components (Rittenberg et al., 2013):

$$D_R=T_D \times A_P \quad (5)$$

Where:
T_D=tests of details risk
A_P=substantive analytical procedures risk

When the auditor uses this extended version of the audit risks, it can determine T_D as being a calculation of:

$$T_D = A_R\div (I_R \times C_R \times A_P) \quad (6)$$

For example, we have the following situation:

A_R=6%
I_R=45%
C_R=25%
A_P=70%

In this situation, the auditor will calculate that T_D is equal with 6 %÷ (45% × 25% × 70%), T_D=76,19%.

This model allows the recognition that the detection risk incorporates nature, term and spread of the audit procedures, and, also, substantive tests that is performed to reduce audit risk to an acceptable level.

2.2. Inherent risk assessment

Even if the international audit standards doesn't identify any components of the inherent risk, Kinney (1989) in his paper *Achieved audit risk and the audit outcome space* makes a distinction between two components of the inherent risk:

- Inherent risk that can't be decreased, reduced by the control procedures (IRNC – inherent risk not decreased by the control);
- And inherent risk that can be decreased, reduced by the control procedures (IRC – inherent risk decreased by the control).

With other words, some of the inherent risks can be reduced (decreased) through internal control systems, and others can't be minimized (decreased) through the internal control system.

In this context, when we calculate the risk of material misstatement the formula becomes:

$$R_{MM}=IR_{NC}+ (IR_C \times C_R) \quad (7)$$

Where the assessment of IRNC, IRC and CR are measured on a probability scale from 0 to 100 (Miller et al., 2012). While IRNC is the likelihood that a material misstatement that could occur in the financial statements may not be detected, prevented or stopped by the control, IRC and CR is an error of the internal control systems to reduce the potential misstatement that could occur. If the risks will be assessment periodically, than the auditors would not take into consideration the option of controlling the IRNC and IRC, but would take into consideration the control of the possibility of mitigate the IRC. Any information that is linked to the control (which is relevant and shows "a leak in the system") should minimize the risk of material misstatement, as a result of assessment of IR.

2.3. Control risk assessment

There is a straight line between the quality of the internal control system and the appearance of the risk of material misstatement.

Leslie (1984) classifies the control risk in two components: *preventive control risk* (PCR) and *detective control risk* (DCR). Where preventive control risk it is the risk which appears at the control what it design for preventing the occurrence of the errors, and detective control risk appears at the control system which is projected to detect the errors what may occur.

With other words, if the internal control system it is designed for preventing the occurrence of problems (risks) in the company then we are taking about a preventive control risk and if the internal control system is projected to resolve the effects of the problems (risks) after they appear then it is a detective control risk.

3. Bayes' Theorem

Bayes' Theorem is a supreme achievement for humanity, can be called a revelation, it all depends on how it is perceived math for you. No one should pass through life without knowing what Bayes' theorem is and how it can be applied in every element of life. It should be emphasized, however, that science always investigating new concepts, new hypothesis so that science does not always provide 100% certification (Zaiceanu and Hlaciuc, 2013).

Thomas Bayes discovered the theorem; this was written in a newspaper under the name "*An Essay toward Solving a Problem in the Doctrine of Chances*". The paper was discovered postmortem by his friend Richard

Price and published in 1763 (Bolstad, W. 2007). Bayes' theorem isn't the only statistical method used in auditing, but researchers proved that it is the most efficient in this field. In practice, we can also find bound Stinger theorem, which is a non-parameter of 100(1- α) %, and it is used to determinate the superior limit of belief for a fraction of errors from a crowd. In 1989 *National Research Council's panel report on Statistical Models and Analysis in Auditing* declared that the bounding of the link Sting was never proved in a satisfactorily way. The report is an excellent study on these related issues (Meeden and Sargent, 2007).

Phua et al. (2005) believes that research algorithms is an issue that should be resolved in the future, but at almost 10 years after this statement it appears that has not yet reached a general rule accepted by everybody. The author suggests that if we want to successfully prevent fraud then Naïve Bayes complex algorithm should be implemented in everyday applications and should be considered the only viable solution.

Bayes proposed the following theorem: if an event was happened of p times, and failure of q times, than the probability that a single line from the process to change between a and b it is (Todhunter, 1865):

$$\frac{\int_a^b x^p (1-x)^q \, dx}{\int_0^1 x^p (1-x)^q \, dx} \quad (8)$$

Bayes offered the principles after we should guide ourselves for calculating the probability to reach an event. The formula from our days is:

$$P(E \mid C) = \frac{P(C \mid E)P(E)}{P(C)} \quad (9)$$

Where

- P (E|C) is *posteriori* probability. Shows which is the experience for an event to determine what is true or what is false;
- P (E) named *priori* probability. Is based on theoretical knowledge and not on the empirical events, represents the event E which took place because the event C already occurred;
- P (C|E) is the *likelihood*. Verifies the most probable value (the best) of the event C, the one for which the event E has an maximum value;
- P(C) is the *record*. Is the event C, which already occurred.

Theorem is a conditional probability of the event "E" that will happen only if the event "C" has already occurred. This means that whenever we add new information, if we know that the event "C" will happen, no matter what, you have to find out what events are "E", resulting from the addition of new information.

For example, we are taking into consideration an audit mission realized on human resources, where there is a probability of 70% that the employees not to be qualified or they don't have the necessary abilities for recording some specific operation. This mean that is a 0.70 probability that the employees to make a mistake that can affect the fair view of the company, and a probability of 0.30 that the error will not occur. We assume that only 15% from the total employees is working in the Financial-Accounting Department, then the probability for the human error to occur in the financial reporting is:

P(HR/AM=+)=(P(AM=+|HR)*P(HR)) / (P(AM=+|HR)*P(HR)+P(MA=+NoHR)*P(NoHR)) *(10)*

Where:

HR=human resources

AM = Audit mission

P(HR/AM)=(0.70*0.15)/(0.70*0.15+0.30*0.85)=0.105/(0.105+0.255)=0.292 *(11)*

Relying on the information that 70% from the employees are qualified, then the auditor will obtain a result which suggest that is a probability around 0.29 that the human error will have an effect on the financial reporting of the company. It should be taken into consideration that the result of 0.292 is only for those 15% of employees that works in the Financial-Accounting Department, so the probability should be considered low.

Knowing the three components of audit risk and analyzing them, we realize that there are two events that may occur in practice:

- Material misstatement occurs – This means that IRC and DCR failed to detect the error in time and it does not work in the normal parameters and should be investigated, what does not work within the internal control system; or
- Material misstatement will not occur. Means that the preventive control risk is framed in normal parameters and the internal preventive control system works according to the requirements.

4. Belief function model

Estimation theorem assesses the parameters of a specific distribution that are known. The values that are obtained from the estimates are called estimators (or estimate). The intervals in which, there are with a certitude probability, the estimated value is it call *belief function*.

Shafer and Srivastava (1990) declare that the belief intervals are reports originally in the 17th century, but since in the eighteenth century, Bayes' theorem became populated, belief intervals were neglected. Same like the Bayes' theorem, belief functions are based on mathematical models of probability, but while the Bayesian theorem assess a probability through answering a straight question, belief functions values the probability through connection questions and then considerate the probability of implying them in the interest problem (Srivastava and Mock, 2002). Belief function method offers flexibility and adaptability to combine different evidence from different sources.

The belief function occurs from the necessity of estimating a Θ parameter, which is unknown to the population $P(\Theta)$, and although it is information thereof cannot be used without the overall image size of the estimated error probability. Most of the time Θ parameter is associated with the variable X.

In this condition, we can define a belief function for a Θ parameter which is associated to a population, any bounded interval $\Upsilon = (a, b)$ (a, b values are calculated from the sample that is used for estimation, and are the ends of the interval), for which the probability can be express of $\Theta \in \Upsilon$. If α is a value of the bounded interval (0, 1) and $P(\Theta \in \Upsilon) \geq 1 - \alpha$, then we can declare that Υ is a belief interval for the Θ parameter, with a belief level of $1 - \alpha$.

After the statistical observation of the sample, the two limits of the interval can be determinate numerically. The interval that fits to the Θ parameter it has the property that covers the value Θ in $100(1 - \alpha)$ from cases. The level of significance of α is less than the chances Θ of are higher to be within this interval (in general $\alpha \leq 0, 05$). The probability given by the value $1 - \alpha$ is the guaranteed probability of the bounded interval, with the acceptable values being in general of over 0, 95.

5. Computer-assisted auditing techniques

The general analytical procedures used by the auditor include trend analysis, financial reporting analysis, statistical analysis, and data mining analysis and reasonableness tests. Data mining is the process of trying to discover the patterns, of repetitive elements in a large set of data. Use methods of artificial intelligence, statistics, databases and computer learning. The ultimate goal of data mining is to extract information from a set of data and turn them into a structure easy to understand and use in the future. It offers the security, integrity, data quality and a certain tolerance, and can be used to detect intruders and analyze audit data (Thuraisingham, 1999).

Trend analysis is the analysis of changes in an account balance over time. Analysis of financial reports shows to the auditor the comparison of the financial accounts. Reasonable testing is necessary to analyze the account balances and the changes that occur in a certain accounting period, in terms of “reasonable”. Data mining is a set of computer-assisted techniques, using sophisticated statistical analysis, including artificial intelligence techniques to examine large volumes of data in order to show hidden or unexpected information or models. For these tests auditors use in general *computer-assisted auditing techniques* (CAAT). Technological software that exists on the market, gives the auditor a set of tools to automatically examine the economic entity environment. Audit software enables the auditor to quickly get an overview of the operations of the entity and pursue only those specific areas of interest.

Audit procedures are usually available for standard business applications such as accounts of receipts and payments, payroll, general documents or inventory management. Programs can be created separately for each transaction or can be created as an integrated package of programs running all the same code (Cascarino, 2012).

6. Conclusions

Risk assessment in financial audit is a complex process that shouldn’t be traded lightly or to be skipped. Although in practice the model that is the most widely used is the international standards models, we cannot declare that it is the most secure because, as mentioned, the safety must be demonstrated, and the statistical methods are the easiest way to show that innovative techniques and policies can be included in the financial audit, and to be adapted to this century of technological innovations. Given that there is a need to have the knowledge required calculating the complexity of the statistical methods, it is proposed to development CAAT software that can do this for auditors without requiring the auditor to accumulate new knowledge in order to perform their profession.

Developing software that can be used easily by auditors, it eliminates the subjectivity that exists in practice, leaving the possibility for the specialist to form a proper audit opinion, based on results that contain very few errors (even daring to declare that the probability is approaching zero) giving them a proper risk assessment and a "reasonable assurance". The human factor cannot be completely removed from the equation because when interpreting the results is necessary the human capital and the professional experience of them, which can’t be done by a computer, although we don’t know what future will offer us.

When the auditor decides to apply CAAT it must define its objectives and to choose his need specific software. In this world where the new applications (for mobile or laptop) and gadgets appear every day, creating specific and specialized software for CAAT has become child's play. The only requirement is to have established a set of rules to comply with national and international standards and regulations. Before applying CAAT, the auditor should obtain reasonable assurance of the integrity, reliability, utility and safety thought using a proper planning, testing and obtaining evidence of the financial statements. Also, it must be ensured that the CAAT has not been altered and can be used with confidence.

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References

Arens, A., Elder, R., Beasley, M., 2012. *Auditing and Assurance Services 14th Edition.* Editura Pearson Prentice Hall, New Jersey, p.250

Balaniuk, R., Bessiere, P., Mazer, E., Cobbe, P., 2012. *Risk based Government Audit Planning using Native Bayes Classifiers.* Article in the book *Advances in Knowledge-Based and Intelligent Information and Engineering Systems*, Editors Grana M., Toro C., Posada J., Howlett R.J., Lakhni J., Editor IOS Press, Spain, p.1314

Bolstad, W. 2007. *Introduction to Bayesian Statistics, 2nd Edition,* John Wiley & Sons, New Jersey, p.6

Cascarino, R., 2012. *Auditor's Guide to IT Auditing 2nd Edition.* Editor Wiley, Canada, p.119

Genete, L.D., 2005. *Evaluarea riscului în auditul financiar contabil. Metode cantitative și metode calitative.* Analele Științifice ale Universității "Alexandru Ioan Cuza", Iași, Tomul LII/LIII, p.60

Hayes, R., Dassen, R., Schilder, A., Wallege, P., 2005. *Principles of Auditing. An Introduction to International Standards on Auditing, 2nd Edition*. Editor Prentice Hall, England, p.213

Kinney, W., 1989. *Achieved audit risk and the audit outcome space*. Auditing: A journal of Practice and Theory, Volume 8, Supplement, p. 67-84

Kirkos, E., Spathis, C., Manopoulos, Y. 2007. *Data mining techniques for the detection of fraudulent financial statements.* Expert Systems with Applications, an International Journal, Volume 32, Issue 4, May 2007, p.995-1003

Leslie, D. 1984. *An Analysis of the audit framework focusing on inherent risk and the role of sttistical sampling in compliance testing.* Auditing Symposium VII: Proceedings of the 1984 Touche Ross/University of Kansas Symposium on Auditing Problems, p. 089-125 (90).

Meeden, G., Sargent, D. 2007. *Some Bayesian methods for two auditing problems.* Revista Communication in Statistics: Theory and Methods, 36, Issue 15, p. 2741-2760

Miller, T., Cipriano, M., Ramsay, R., 2012. *Do auditors assess inherent risk as if there are no controls?* Managerial Auditing Journal, Volume 27(5), May, p. 450

Phua, C., Lee, V., Smith, K., Gayler, R. 2005. *A Comprehensive survey of data mining-based fraud detection research.* Artificial Intelligence Review, Computational Engineering, Finance, and Science, p.1-14

Rittenberg, L., Johnstone, K., Gramling, A., 2013. *Auditing: A Risk-Based Approach to Conducting a Quality Audit 9th Edition.* Editor Engage Learning, USA, p. 289

Roberts, R., Dwyer, P., 1998. *An Analysis of Materiality and Reasonable Assurance: Professional Mystification and Paternalism in Auditing*, Journal of Business Ethics, Volume 17 (5), April, (567-578), p.569

Shafer, G., Srivastava, R., 1990. *The Bayesian and Belief-Function Formalisms: A General Perspective for Auditing*. Auditing: A Journal of Practice & Theory, Volume 9, Supplement 1990, p.120-121

Srivastava, R., Mock, T. 2002. *Belief Functions in Business Decisions – Studies in Fuzziness and Soft Computing.* Editing House Physica-Verlag, Germany, p.181

Todhunter, I., 1865. *A History of the Mathematical Theory of Probability: From the Time of Pascal to that of Laplace.* Editing House C.J. Clay at M.A. University Press, Cambridge and London, p.294-295

Thuraisingham, B., 1999. *Data Mining: Technologies, Techniques, Tools, and Trends*. Editing House CRP Press LLC, USA, p.46

Zaiceanu, A.M., Hlaciuc, E., 2013. *The Applicability of Bayes' Theorem in Audit Risk.* European Journal of Accounting, Finance & Business, Volume 1, Issue (1), June 2013, p. 100-111.