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# QUALITATIVE, SEMI-QUANTITATIVE AND, QUANTITATIVE METHODS FOR RISK ASSESSMENT: CASE OF THE FINANCIAL AUDIT

Laura-Diana RADU*

**Abstract**

*Risk assessment is a critical step in achieving and defining the audit. Under these conditions, the concerns for developing the best methods in this field are varied. Both at practical and theoretical level, in auditing, but also in other activities, are numerous qualitative, semi-quantitative and quantitative methods which try to estimate individual components of risk for a result to better reflect the reality. However, in our days, there is now a universally accepted method, able to predict and assess all events and actions carry risks. In this paper are presented, with examples, the three main categories of risk evaluation methods (quantitative and semi-quantitative and qualitative) and how they can be applied in auditing, trying to identify the method that best meets the actual requirements of a specific mission.*

**Key words:** auditing, risk evaluation, quantitative methods, qualitative methods
**JEL classification:** M41, M42, C11

## 1. Introduction

Risk assessment is a complex stage, regardless of the activity associated with it, because, beyond any statistical and mathematical calculations, implies a certain vision and an attempt to predict the future, to assess possible dangers, attacks and threats which could face an economic entity including the actions of those involved in its activities. In principle, risk assessment is a systematic process to identify and compare that to consider the organization's key assets, threats and vulnerabilities that can occur, the likelihood and consequences and protective measures that can be counteracted. This activity is often the most complex of the risk management process because of such factors as:

- opportunities and threats can interact in ways that cannot be anticipated (for example, behind the initial schedule may force consideration of a new strategy that ultimately leads to decrease the time allocated to project)
- a single risk can have multiple effects: additional costs, delays, penalties, reducing the quality of results;
- events which are opportunities for a person or organization (cost savings) may be threats to other (reducing profits);

* **Laura-Diana RADU** (glaura@uaic.ro), PhD, Researcher, "Al. I. Cuza" University of Iasi, Faculty of Economics and Business Administration.

- mathematical techniques used to quantify the risk may provide a time accuracy and safety unfounded.

In risk assessment, analysis and statistical calculations reported in frequency of occurrence of risks are designed to determine the likelihood of their occurrence. If there is relevant and reliable data available, subjective estimates may be used. To avoid confusion caused by subjectivism in the risk assessment can be consulted experts. Benefits of risk assessment phase are reflected in: provides the possibility to take comparisons with historical data or risk level in the field, can risk aggregation of several activities to provide a value for total risk, the knowledge level of uncertainty associated with results tracked and whether to be made when the decision risks.

The audit risk is that situations when the auditor expresses an inappropriate audit opinion when the financial statements are materially misstated. [IFAC, 2009, 19] In its determination is necessary to analyze the relationship between costs of views inconsistent with the facts and costs of achieving the additional tests necessary to reduce risk. Components of audit risk, according to International Standards on Auditing are [IFAC, 2009, 34-81]:

- *Inherent risk* is the susceptibility of an assertion about a class of transaction, account balance or disclosure to a misstatement that could be material, either individually or when aggregated with other misstatements, before consideration of any related controls.
- *Control risk* is the risk that a misstatement that could occur in an assertion about a class of transaction, account balance or disclosure and that could be material, either individually or when aggregated with other misstatements, will not be prevented, or detected and corrected, on a timely basis by the entity’s internal control.
- *Detection risk* is the risk that the procedures performed by the auditor to reduce audit risk to an acceptably low level will not detect a misstatement that exists and that could be material, either individually or when aggregated with other misstatements.

Based on the three risks mentioned is the size of the sample. Typically, audit risk is considered a constant (5%) and is used with the inherent risk and control risk in determining the risk of detection that allows the auditor to determine the sample considered relevant and plan work. To estimate risk, both in auditing and other fields, there are three broad categories of methods: qualitative, semi-quantitative and quantitative first of which is the most used even if not always provide an accurate mathematical model. The following sections are presented the three categories of methods and how they are applied in specific financial audit activities.

## 2. Qualitative Risk Assessment

Qualitative risk assessment methods can be used to identify assets to be detailed and bear a simple and rapid assessment. In this case, a single person or team can gather information. This assessment is used often when numerical data are inadequate or unavailable, resources are limited (budget or expertise) and time allowed is reduced.

Like any risk assessment, the quality begins with obtaining information on risk factors, followed by risk classification in terms like "acceptable" or "unacceptable" or classifications such as "low", "medium", "high". Once seen as risk for assets with a high risk will take mitigation measures, while the remainder will be subject to further examination by semi-quantitative or quantitative methods. These measures are based on a hierarchy of business activities and their associated risks.

Qualitative assessment does not require determining the likelihood of data, only estimates of potential losses. Some related items are discussed in this approach

- *threats* - what can go wrong or attack the system such as fires or fraud. They are present in any system.
- *vulnerabilities* - make the system more prone to attacks or the attacks may have more success and greater impact. For example, if fire, the presence of flammable materials is a vulnerability.
- *controls* - are counter-measures vulnerabilities and their effects may be manifested in the following forms:
    - controls - are counter-measures vulnerabilities and their effects may be manifested in the following forms;
    - preventive controls protect against vulnerabilities and attacks can cause failure or reduce their impact;
    - corrective controls reduce the effect of attacks;
    - detective controls discover attacks and trigger preventative or corrective controls.

After identification, the risks can be grouped by importance and likely to occur and represented in a matrix. One example concerns the approach was proposed by the United Stated General Accounting Office (Table no. 1).

*Table no. 1 – Risk Assessment Matrix*

| **Risk level** | **Probability of occurrence** | | | | |
|---|---|---|---|---|---|
| | **Frequent (A)** | **Probable (B)** | **Occasional (C)** | **Remote (D)** | **Improbable (E)** |
| I (High) | | | | | |
| II (Medium) | | | | | |
| III (Low) | | | | | |
| IV (Very low) | | | | | |

*Source:* [United Stated General Accounting, 1999, 22]

In this model the risks are organized by two criteria:

1. *by level of risk*:

Risk 1 – undesirable and requires immediate corrective action;

Risk 2 – undesirable and requires corrective action, but some management discretion allowed;

Risk 3 – acceptable with review by management;

Risk 4 – acceptable without review by management.

2. *by degree of probability*

- frequent - possibility of repeated incidents;
- probable - possibility of isolated incidents;
- occasional - possibility of occurring sometime;
- remote - not likely to occur;
- improbable - practically impossible.

While not providing accurate results, qualitative models for risk assessment are often preferred by professionals. They are more accessible and offer some advantages as: a greater range of work with uncertainty, discretion and requires less time for carrying out. [McNeil, Frey, Embrechts, 2005, 20] In our opinion purely qualitative assessment of risks, although widely used, including financial auditing, is superficial and general and lead ultimately to the numerical fit to capitalize on the result.

In auditing qualitative risk assessment involves estimating the qualitative detection risk level, after assigning a value of 5% audit risk by assessment type "Very low", "Low", "Medium" or "High" for control risk and inherent risk presented in introduction of this work (Table no. 2).

*Table no. 2 – Qualitative assessment of the risk of detection in audits*

| | | **Control risk** | | |
|---|---|---|---|---|
| | | High | Medium | Low |
| **Inherent risk** | High | *Very low* | *Low* | *Medium* |
| | Medium | *Low* | *Medium* | *High* |
| | Low | *Medium* | *High* | *Very high* |

*Source: [Cosserat, 2005, 138]*

Again, qualitative expression will be quantified in order to use the value obtained in determining sample sizes.

### 3. Semi-quantitative risk assessment

Semi-quantitative methods are used to describe the relative risk scale. For example, risk can be classified into categories like "low", "medium", "high" or "very high". Number of levels of risk can vary from 3 to 10 or more. In a semi-quantitative approach, different scales are used to characterize the likelihood of adverse events and their consequences. Analyzed probabilities and their consequences do not require accurate mathematical data. The objective is to develop a hierarchy of risks against a quantification, which reflects the order that should be reviewed and no real relationship between them.

We present further a model of risk assessment by semi-quantitative method, even if the authors, National Institute of Standards and Technologies, presented it as qualitative methods. In our opinion, risk estimation with numerical values and interpretation of results from qualitative considerations, falls the model into this category. It is presented as a matrix that takes into account the likelihood of producing threats and their impact. Risk level is categorized as High, Medium and Low. In the following example (Table no. 3) probability to produce threats are assessed on a scale from 0.1 to 1 (0.1 - low 0.5 - Average, 1.0 - high), and the impact on a scale from 10 to 100 (10 - low, 50 - 100 medium - high).

*Table no. 3 – Risk-Level Matrix*

| **Threat Likelihood** | **Impact** | | |
|---|---|---|---|
| | **Low (10)** | **Medium (50)** | **High (100)** |
| **High (1.0)** | Low<br>(1.0 x 10 = 10) | Medium<br>(1.0 x 50 = 50) | High<br>(1.0 x 100 = 100) |
| **Medium (0.5)** | Low<br>(0.5 x 10 = 5) | Medium<br>(0.5 x 50 = 25) | Medium<br>(0.5 x 50 = 50) |

| | | | |
|---|---|---|---|
| **Low (0.1)** | Low<br>(0.1 x 10 = 1) | Low<br>(0.1 x 50 = 5) | Low<br>(0.1 x 100 = 10) |

*Source:* [Stoneburner, G., Goguen, A., Feringa, A., 2003, 25]

As seen from Table no. 4, the risk lies in the range 1 to 100 and reflects the degree to which the system is exposed to vulnerabilities as:

- *high risk* (between 50 and 100) - require corrective action as soon as possible;
- *medium risk* (between 10 and 50) - are necessary corrective action and requires a plan for incorporating them into current business;
- *low risk* (less than 10) - decision-maker must consider what corrective measures are still necessary to adopt or accept the risk.

We consider that semi-quantitative assessment is useful especially as a quantification of risk is difficult and, to a considerable extent, the extreme. At the same time, qualitative interpretation is too subjective. The combination of the two models can be a solution in some cases, combining the specific advantages of each and decreasing their disadvantages. In addition, the implementation of risk assessment models through qualitative methods, the software is often resorting to using semi-quantitative methods, even if the result obtained will result in a qualitative assessment of risks.

In auditing semi-quantitative assessment involves the award of such assessments very low, low, medium, high risk for each component and then framing their numerical values. As discussed in the introduction of this paper, inherent risk is one of the components of audit risk. Inherent risk can be specific and general. Determination of general inherent risk are made at management level, accounting, auditing and business by formulating responses to sets of questions for each risk category. Specific inherent risk involves tracking areas corresponding to each class of accounts, and other sections of the audit as balances and accounts, interim financial statements and records at year end. Finally, the auditor should obtain a level of risk inherent in the responses obtained by combining the two components (general and specific) and the results are interpreted according to Table no 4.

*Table no. 4 – Factors associated with inherent risk*

| ***The number of specific inherent risks identified*** | ***The general level of risk inherent*** | | | |
|---|---|---|---|---|
| | ***Very low*** | ***Low*** | ***Medium*** | ***High*** |
| *0, 1, 2 risks* | *23 %* | *50%* | *70%* | *100%* |
| *3, 4 risks* | *50%* | *70%* | *100%* | *100%* |
| *5, 6 risks* | *70%* | *100%* | *100%* | *100%* |

Control risk arises where the auditor wishes to rely, in part or in full, on certain internal controls conducted by the organization. Evaluation can be done quantitative and / or qualitative, and the results are close, as exemplified in Table no. 5

*Table no. 5 – Risk assessment associated control*

| **Support provided by internal control** | **Risk level** | |
|---|---|---|
| | **Qualitative** | **Quantitative** |
| High - excellent control, both specific and compliance | Low | 10%-30% |
| Moderate - good control, but there are some shortcomings in the specific con- | Moderate | 20%-70% |

| | | |
|---|---|---|
| trol or compliance | | |
| Low - control deficiencies, specific and / or compliance | High | 60%-100% |

*Source:* [Robertson, Davis, 1998, 305]

*Non-sampling risk detection* should be considered when the analytical procedures are considered important to obtain audit evidence to achieve the mission. In Table no. 6 are presented sections involved and their confidence to be considered when planning the audit.

*Table no. 6 – Detection risk factors associated non-sampling*

| ***Audit sections*** | ***Certainty*** | ***Risk*** |
|---|---|---|
| *Stock and work in progress* | *moderate* | *56%* |
| | *Zero* | *100%* |
| *Debtors and creditors* | *moderate* | *56%* |
| | *Zero* | *100%* |
| *Sales, purchases and expenses* | *High* | *31%* |
| | *Moderate* | *56%* |
| | *Zero* | *100%* |
| *Wages and allowances* | *High* | *31%* |
| | *moderate* | *56%* |
| | *Zero* | *100%* |

After determining the inherent risk, control risk and non-sampling detection risk, sample size is set to be tested. They may be systematically or randomly selected to verify transactions or based on a sampling interval for checking balance sheet items. In table no. 7 are presented sample sizes and ranges to be used for different levels of risk.

*Table no. 7 – Sample sizes and sampling intervals*

| ***Intervals*** | ***Sample size*** |
|---|---|
| *78.4 – 100* | *53* |
| *58.5 – 78.3* | *48* |
| *43.8 – 58.4* | *43* |
| *33 – 43.7* | *38* |
| *24.9 – 32.9* | *33* |
| *18.9 – 28.4* | *28* |
| *14.4 – 18.8* | *23* |
| *11.1 – 14.3* | *18* |
| *8.5 – 11* | *13* |
| *6.6 – 8.4* | *8* |
| *0 – 6.5* | *3* |

After determining the sample size will be extracted elements to be considered by the auditor, based on statistical or non-statistical methods or non-statistical in order to be representative for the entire population that they represent.

*Another important issue to be considered at this stage is* tolerable error accepted by the auditor. *It is* the weight that the auditor can accept in population, remained at the same time, willing to use the estimated control risk and / or estimated amount of errors monetary from operations, determined during the planning. *[Arens, Elder, Beasley, 2006, 514] This weight affects the sample size by an inverse relationship (Table no. 8).*

*Table no. 8 – The risk - sample size*

| Element analysis | Sample size | |
|---|---|---|
| | **Decreases** | **Increase** |
| Risk estimates of control is low | X | |
| Risk estimates of control is high | | X |
| Accepted permissible error is small | | X |
| Accepted permissible error is high | X | |
| Deviation of expected share of the population is low | X | |
| Deviation of expected share of the population is high | | X |

The three components of audit risk are interrelated and, therefore, there are still many differences of opinion on the valuation method to be used. As stated earlier, the audit risk is considered usually takes a constant value of 5% and is used with the inherent risk and control risk in determining the risk of detection that allows the auditor to determine the sample considered relevant and plan work . Its objective is to set a level as low risk and at the same time, a corresponding relation between the risk and cost of audits.

Determining the relationship between the three main components of audit risk is carried by the following formula:

$$AR = IR \times CR \times DR$$

Where:

AR – audit risk;
IR – inherent risk;
CR – control risk;
DR – detection risk.

The result obtained for the audit risk can be expressed terms of quantity (percent) or quality ("low", "medium", and „high").

This model starts from the premise that the three components of audit risk are independent, which does not reflect reality. For example, management will establish a level of control so that it can be determined errors arising from the inherent risk. Under these conditions, separate assessment of inherent risk and control that will not provide a real level of risk.

## 4. Quantitative risk assessment

Making a quantitative risk assessment model is currently a topic discussed by many specialists from different fields, with more or less successful. In present, methods are varied most notably being *variance method, value at risk method (with several variants normal Delta method, historical simulation method, and Monte Carlo method), Delphi method, Bayesian method, belief functions method.* In terms of audit and this work presents particular interest last two methods and therefore present them below.

### 4.1. Bayesian method for risk evaluation

Bayesian risk assessment method was originally developed in the nuclear industry where the consequences of inadequate forecasts can be devastating and has been taken and adapted in many areas. It offers *the possibility to use personal and objective probability estimates changing as new data appear as elements of uncertainty are numerous, subjective and may be revised following the acquisition of information*. [Van Den Acker, 1996, 71] Bayesian models based on Bayes's theory have developed procedures to revise probability by changing the initial values based on experimental results. *The probability of an event is conditional on another event unknown or uncertain.*

A bayesian network is a graphical model probabilistic of relationships between a set of variables. There are several features that benefit their use in systems development [Anderson, Sweeney, Williams, 1999, 156-158]:

- *can use incomplete data set* which led to their use for developing intelligent systems;
- *allow study of causal relations* useful when a domain wants understanding and an opportunity to make predictions for some interventions;
- bayesian networks combined with Bayesian statistical techniques *facilitates combining domain knowledge with data*;
- bayesian methods are used with Bayesian networks and other models *offer an effective approach to avoid duplication of data*.

Bayesian method was first used in the audit of the Canadian Institute of Certified Accountants in 1980 and was taken over and adapted to different specific situations audit of a large number of researchers in the field. The general formula of Bayes's theorem, applicable to the audit, to calculate posterior probabilities that add additional information is [Van Den Acker, 1996, 73]:

$$P(E_i \mid A_j) = \frac{P(A_j \mid E_i)P(E_i)}{P(A_j)}$$

Where:

$P(E_i)$ – unconditional or prior probability of errors;

$P(E_i|A_j)$ – posterior probability (conditional) probability that the event's status if a related experiment results. In auditing the financial statements is the probability of acceptance based on evidence even if they contain errors (risk of incorrect acceptance auditor);

$P(A_j)$ – marginal probability of total or simultaneous trials involving acceptance, determined by the relationship:

$$p(A_j) = \sum_{i=1}^{n} P(E_i) \times P(A_j \mid E_i), iar\ j = 1, 2, ..., \mathrm{m}$$

$P(A_j|E_i)$ – conditional probability of error, given the financial statements on the basis of evidence (user acceptance undue risk).

*Example:* When assessing audit risk associated with accounts, the auditor has determined, based on experience, the following interpretation:

- probability forecast that there will be no errors associated with accounting, A1, given that accounting is correct organization: P(A1|E1) = 0.75;
- probability forecast that there will be errors associated with accounting, A2, given that accounting is correct organization: P(A2|E1) = 0.25;
- probability forecast that there will be no errors associated with accounting, A1, given that accounting organization is incorrect: P(A1|E2) = 0.30;
- probability forecast that there will be errors associated with accounting, A2, given that accounting organization is incorrect: $P(A_2|E_2) = 0.70$;

Probabilities of existence, lack of associated accounting errors, respectively, are subjective and are determined by analysis of company documents. They should allow a decision on the level of risk or to determine the collections of new information, if obtained are not satisfactory. Based on preliminary analysis of the evidence established that:

- likelihood that accounting organization to be correct is: $P(E_1)=0.65$ and
- likelihood of errors is: $P(E_2)=0.35$.

Based on two sets of probabilities can determine the risk associated with accounting.

The lack of errors probability based forecast is correct that accounting organization is determined by the relationship:

$$P(E_1 \mid A_1)=\frac{P(A_1 \mid E_1)P(E_1)}{P(A_1 \mid E_1)P(E_1)+P(A_1 \mid E_2)P(E_2)}=\frac{0.75\times 0.65}{0.75\times 0.65+0.30\times 0.35}=0.82$$

The likelihood that no errors if documents analysis this forecast is 0.82.

The likelihood of errors, based on forecast that proper accounting organization is determined by the relationship:

$$P(E_2 \mid A_1)=\frac{P(A_1 \mid E_2)P(E_2)}{P(A_1 \mid E_1)P(E_1)+P(A_1 \mid E_2)P(E_2)}=\frac{0.30\times 0.35}{0.75\times 0.65+0.30\times 0.35}=0.18$$

The probability that there are errors in the conditions under which analyzes accounting documents forecast that the accounting organization is correct is 0.18.

The probability of errors, on the basis of accounting is incorrect prediction that the organization is determined by the relationship:

$$P(E_2 \mid A_2)=\frac{P(A_2 \mid E_2)P(E_2)}{P(A_2 \mid E_2)P(E_2)+P(A_2 \mid E_1)P(E_1)}=\frac{0.70\times 0.35}{0.70\times 0.35+0.25\times 0.65}=0.60$$

The probability that there are errors in the condition under which analyzes accounting documents forecast that is 0.18.

The likelihood of errors, based on forecast that no proper accounting organization is determined by the relationship:

$$P(E_1 \mid A_2)=\frac{P(A_2 \mid E_1)P(E_1)}{P(A_2 \mid E_1)P(E_1)+P(A_2 \mid E_2)P(E_2)}=\frac{0.25\times 0.65}{0.25\times 0.65+0.70\times 0.35}=0.40$$

The probability that no error given that analyzes documents is expected of them is 0.40.

The probability that the statement certifying the accuracy is given by P (A1) by the relation:

$P(A_1)= P(A_1|E_1)P(E_1)+P(A_1|E_2)P(E_2)=0.75 \times 0.65+0.30 \times 0.35=0.60$ and the probability to be unfavorable $P(A_2)=1-0.60=0.40$.

Value resulting from the risk analysis is determined as the product of the probabilities of previously obtained, with relationship:

$P= P(A_1)\ P(E_1 \mid A_1) + P(A_1)\ P(E_2 \mid A_1) = 0.6\times 0.82+0.6\times 0.18=0.6$

Risk associated with accounting, according to Bayes's theorem, is 60%. In these circumstances the auditor may use the implementation of further analysis or can accept this value that combines the values obtained from the remaining risk categories to determine the sample size. If choose the first option, it must take into account the cost of obtaining additional information to determine if they are justified by the benefits. The *advantages* of this approach are: (1) *the possibility that all samples can be integrated* and (2) *the possibility* *that risk can be controlled and determined at various levels of decomposition and can be aggregated to obtain overall risk of financial statements*.

The most important *disadvantages* are: (1) *the difficulty of obtaining data entry, because function arguments must be mutually exclusive, which is not the case in auditing since some risks are interdependent*, (2) *time to determine the risk is very high if there is a very large number of variables*.

**4.2 Belief functions method for risk evaluation**

Belief functions have the origins in the 17th century in the author G. Hooper and J. Bernoulli papers and their study was continued by G. Shafer (1976), D. Gabbay and P. Smets (1998), G. Shafer and R. Srivastava ( 1990), P. Smets (during 1990-1998), R. Yager and others in 1994. It is based on probability theory and it is actually Bayes's theory approach in special conditions. [Srivastava, Mock, 2002, 2] There are three important features used in this model: basic probabilistic assignment (also called function-m or m-values), belief function and plausibility function.

*Basic probabilistic assignment* is a primitive form of evidence and theory lies in the interval [0, 1]. The main difference between the values m and probability is given that the probabilities associated with individual elements of a set, for example Θ, while the m-values is attributed to subsets of its elements. This is the measure of confidence associated with a subset of assumptions $A \in 2^{\theta}$ and cannot be divided into elementary components: *if there is evidence that supports a subset of hypotheses A and no evidence for another subset of Θ, m(A)=s and m(X)=0 for any X* $\subseteq$ *Θ with A* $\neq$ *0, then m m(Θ)=1-s, and the result obtained in 1-s is given all the assumptions that the set Θ and no denial of the hypothesis, ~ A.* [Florea, Boangiu, 2005, 158] The sum of values of m is 1. The value of basic probability assignment for a set a (m(A)) is given by the following relationships [Sentz, 2002, 13-14]:

$$m : P(X) \rightarrow [0,1]$$

$$m(\emptyset) = 0$$

$$\sum_{A \subseteq P(X)} m(A) = 1$$

*Belief function, noted by Bel, corresponding to a probability assignment functions m associate to any subset of hypotheses A of* $2^{\theta}$ *amount of belief each subsets of A based on m.* [Florea, Boangiu, 2005, 159] Formula relating belief function is:

$$Bel(A) = \sum_{b \subseteq A} m(B)$$

In belief function, sets of basic probability assignment values are not only each state, but also all possible combinations of these states. For example, m-values are assigning single items, sets of two, three or more items and entire sets Θ. If we consider a decision problem with n elements or possible states, represented by $\Theta = \{a_1, a_2, a_3, ..., a_n\}$, where the probability assigned to each state set $a_i$ is $P(a_i) \geq 0$ where i=1,2,3,...,n and the sum of all these probabilities is 1, Bel: $2^{\theta} \rightarrow [0, 1]$ is a belief function, if and only if the following conditions are met [Van Den Acker, 1996, 2]:

Bel (ø) = 0

Bel ( $\Theta$ ) = 1

$$\forall A_1, A_2, \ldots, A_n \subseteq \Theta,$$
$$Bel(A_1 \cup A_2 \cup \ldots \cup A_n) \geq \sum_i Bel(A_i) - \sum_{i<j} Bel(A_i \cap A_j) + - \ldots + (-1)^{n-1} Bel(A_{n-1} \cap A_n)$$

One consequence of this axiom is Bel(A)+Bel( $\overline{A}$ )≤1.

*Plausibility function* is a third element to consider when determining the belief function in risk assessment. It is noted by Pl and reflects the extent to which information from one source does not contradict a sentence considered true. [Campos, Cavalcante, 2003, 104] Relationship of calculation is:

$$Pl(A) = \sum_{B|B \cap A \neq \emptyset} m(B)$$

From previous formulas it obtains value for plausibility function based on belief functions: *Pl(A)=1-Bel(~A)* and *Pl(~A)=1-Bel(A)*, where ~A is the complement of A.

In general, Bel(A) ≤ Pl(A), when we consider sentence A true, then A is plausible, not to be true, necessarily, and otherwise. [Strivastava, Shafer, 1992, 259] Where Pl(A)=0 we are sure that A is false, while, if Bel (A) = 0 does not have enough evidence to believe true.
The structure of audit evidence generally corresponds to a network of variables with different levels of decomposition and using the belief functions is boosted by the possibility of representation of uncertainty resulting from the *partial ignorance* and *analysis of random*. The most important studies in this area are the authors R. Srivastava and G. Shafer which have discussed risk analysis in the accounts by making a three-level grouping [Strivastava, Shafer, 1992, 259-309]: financial statement level, each account level and audit objectives level. Based on these variables, they presented the possibility of audit evidence aggregation, useful especially if a sample is the basis for analysis and evaluation for more objective or more accounts.

The main *advantages* of using belief functions method for audit risk assessment and representation are [Strivastava, Shafer, 1992, 259-309]:

- risk assessment is based on plausibility function and interpretation of its components with the belief functions makes it more intuitive;
- representation constituents with positive, negative and mixed values better reflect reality
- representation on different levels of certainty for information from the same source makes it easier to distinguish between risk categories.

Two methods for obtaining the basic probability assignment for a set of elements have been proposed by experts in the field [Strivastava, 1995, 96]:

- directly by the decision maker on the basis of subjective judgment;
- from a compatibility relationship between a frame with known probabilities and the frame of interest.

*In the first case* if, for example, the auditor examined the accounts is recorded revenue and believes that they have a low confidence on the correctness of the value of 0.2 on a scale from 0 to 1 and no evidence that they are incorrect then balance accounts are believed to be correct. If we note the measure they are believed to be correct and ~ to the extent they are considered incorrect, we have the following sets of confidence m values: m(a)=0.2, m(~a)=0 and m(a,~a)=0.8, and their sum is 1. In audit it can interpret these values as the support the evidence obtained directly from the function arguments m-values. In the example above, the confidence on the correctness of the accounts is 0.2 and there is no reason to assign values to function that reflect their unfairness and 0.8 is related confidence whole set Θ={a,~a}. In this example, although the confidence for the correctness of the accounts of revenue is low, the overall situation is favorable.

*In the second case*, suppose that we have two compatible sets A and B. Each probability P(a) (a∈ A), must contribute to the formulation of a degree of confidence subsets F(a) of B consists of elements which a is compatible with. If there are several elements a to be compatible in both sets, they will contribute to trust for B. Formally, for each subset F of a set B, m (B) is the sum of probabilities that the relationship:

$$m(C) = \sum_{\Gamma(s)=B} P(a)$$

The value m is defined as the basic probabilistic assignment to fulfill the same conditions that were previously presented (their sum is 1 and $m(ø)=0$). For example, it can be used in the case of the risk assessment associated accounting job descriptions are used as evidence to show the decentralization of functions and to determine, in conjunction with evidence confirming studies, training of accountants. Assume that the auditor determines a low level for decentralization of accounting functions, such as 0.2 on a scale from 0 to 1 based on information received from the previous auditor, but he don't have other evidence of decentralization. In these conditions, $m_{AU}$(f)=0.2, $m_{AU}$ (~f)=0 and $m_{AU}$(f, ~f)=0.8, where f certify accounting function decentralization, and ~ f corresponds to its central organization. If the auditor collects additional evidence through analysis of job descriptions and believes that confidence on the decentralization of accounting functions provided by them is 0.4 and still have no evidence refuting the statement, the previous values are $m_{FP}$(f)=0.4, $m_{FP}$(~f)=0 and $m_{FP}$(f, ~f)=0.6.

In the situation presented, 40% is attributed to the likelihood of *a* and 60% is attributed to the whole set {a, ~a}. If we apply belief function formula:

$$Bel(A) = \sum_{b \subseteq A} m(B)$$

In the proposed example, we get:

Bel(a)=m(a)=0.6 and Bel(~a)=m(~a)=0 and

Bel( Θ )=m(a)+m(~a)+m({a,~a})=1.

One of the greatest *advantages* of the belief functions is given by the fact *that a zero value assigned to a variable, it is probably bad, but the lack of any evidence, while the probability theory, any null result is considered false.* [Strivastava, 1995, 99] This difference between approaches makes the theory of belief functions more flexible and suitable for risk assessment in audit.

After taking evidence from various sources, and assigning confidence, by the auditor, their aggregation is necessary to obtain the final value of the risk. To this end, researchers found the most appropriate theory Demspter for audit.

*Example 1*: We consider two classes of independent samples, *m1* and *m2* for an account appropriate factors inherent respectively, internal control showing that no errors:

- from inherent factors: $m_1$(a)=0.3, $m_1$(~a)=0 and $m_1$({a, ~a})=0.7 and
- from internal controls: $m_2$(a)=0.8, $m_2$(~a)=0 and $m_2$({a, ~a})=0.2

Where:

a - account A is correct;

~a – account A has errors.

If you combine the two categories of evidence, considered independent in this example, by applying Dempster's rule, we get the following values for the basic probabilistic assignment:

$$m(a)= m_1(a)\ m_2(a)+ m_1(a)\ m_2(\{a, \sim a\})+ m_1(\{a, \sim a\})\ m_2(a)$$
$$=0.3x0.8+0.3x0.2+0.7x0.8=0.86$$
$$m(\sim a)= m_1(\sim a)\ m_2(\sim a)+ m_1(\sim a)\ m_2(\{a, \sim a\})+ m_1(\{a, \sim a\})\ m_2(\sim a)=0$$
and
$$m(\{a,\sim a\})= m1(\{a, \sim a\})\ m2(\{a, \sim a\})=0.7x0.2=0.14$$

and belief and plausibility will be:

$$Bel(a)= m(a)=0.86,\ Bel(\sim a)=0$$
$$Pl(a)=1-Pl(\sim a)=1,\ Pl(\sim a)=1-Bel(\sim a)=0.14 \text{ and}$$
$$Bel(\Theta)=m(a)+m(\sim a)+m(\{a,\sim a\})=1$$

From the results obtained, the risk which the auditor associated account A is 14%.

*Example 2*: Suppose that the same inherent factors in providing the same basic values as a probabilistic allocation in the previous example, but by assessing internal control auditor found that 20%, there are errors in account analysis. In this case values will be:

- from inherent factors: $m_1(a)=0.3$, $m_1(\sim a)=0$ and $m_1(\{a, \sim a\})=0.7$ and
- from internal controls: $m_2(a)=0$, $m_2(\sim a)=0.2$ and $m_2(\{a, \sim a\})=0.8$

Combining them with get Dempster's rule we get:

$$K=1-[\ m1(a)\ m2(\sim a)+ m1(\sim a)\ m2(a)]=1-(0.3x0.2+0)=0.94$$

$$m(a)=\frac{m_1(a)m_2(a)+m_1(a)m_2(\{a,\sim a\})+m_1(\{a,\sim a\})m_2(a)}{K}=\frac{0.3x0+0.3x0.8+0.7x0}{0.94}=0.2553$$

$$m(a)=\frac{m1(\sim a)m2(\sim a)+m1(\sim a)m2(\{a,\sim a\})+m1(\{a,\sim a\})m2(\sim a)}{K}=\frac{0x0.2+0x0.8+0.7x0.2}{0.94}=0.149$$

$$m(a)=\frac{m1(\{a,\sim a\})\ m2(\{a,\sim a\})}{K}=\frac{0.7x0.8}{0.84}=0.5957$$

In this case, the values obtained for belief function and the plausibility are:

$$Bel(a)=m(a)=0.2553$$
$$Bel(\sim a)=m(\sim a)=0.149$$
$$Pl(a)=1-Bel(\sim a)=0.5957$$
$$Pl(\sim a)=1-Bel(a)=0.7143$$

Risk which the auditor assigned account is considered in this case 71.43%.

In both cases the auditor may proceed to collect additional evidence to reach a value of 95% or plausibility function can accept the value obtained to investigate other types of risks.

## 5. Conclusions

Audit risk evaluation and interpretation is still a subject of argument in more specialized environments and approaches outlined above are further evidence of the different ways for such activities. This trend is also due to the absence of rules to define exactly the sources of risk and how to understand them. International Auditing Standards provides, in our opinion, from this point of view, a subjective image, overall, on how the auditor should address the risk in carrying out the works and allow interpretation based on his knowledge and experience. Because no such classification is clear that there is no division into categories of influence of sources of risk. All this has led to concerns in the area to be directed primarily towards probabilistic interpretation of risk, in particular Bayesian theorem and belief functions described above. International literature, even when compared with other concerns, we cannot say that abound in such interpretations, these exist and some are famous, at least to theoretical level. If we consider the practical part of the problem, existing applications operates mainly on the same model of international standards, for various reasons, including the fear of creating conflicts and inconsistencies caused by legislation, the organizational context and other criteria more or less objective.

From the methods presented in this paper we consider belief functions method best suited to current requirements of the audit even it has the following limits:

- is difficult or even impossible to identify all potential sources of risk;
- all sources of information and all risk associated components contribute equally to the final value;
- award confidence on the accuracy of evidence is subjective, for assessing them by the auditor based on experience and knowledge he possesses, as with the standard model.

Even under those limits believe that belief functions method has significant advantages compared to the rest of interpretations:

- conduct a classification audit risk associated components on sources of information;
- consider three situations in which the auditor may encounter: one in which, following the documentation found reliability of evidence, the second they find their incorrect and the third not sufficiently aware of the company audited statement and therefore cannot give an opinion;
- provides a way to merge both the sources of evidence and the results obtained from their analysis;
- results are achieved through the objectives in the way of organization and functioning of accounting work, including evaluation of employees;
- provides flexibility. The auditor may collect and analyze certain evidence and, on this basis, to determine the risk.

All methods of risk assessment are, as we presented in this paper, advantages and disadvantages, and the solution is often not finding the perfect method (impossible, in our view), but the most appropriate, depending on the activity that is applied, able to identify and take into account as many situations involving risk and an objective assessment of their influences on the course of normal activity of the organization.

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