PRACTICAL METHODS OF SELECTION AND CALCULATION OF SAMPLE SIZE FOR AUDIT SAMPLING

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Abstract

Audit sampling is very important part of audit works. No mater it is financial audit, internal audit and others kind of audit, audit sampling still need to be used by auditors. Sampling is a process of selecting a subset of a population of items for the purpose of making inferences to the whole population. Accounting populations usually consist of a large number of items (debts values, credit values), often totalling millions of monetary units, and a detailed examination of all accounts is not possible. Statistical sampling allows the auditor to draw conclusions supported by statistical inference. The results obtained for the sample extend, in probabilistic terms to the whole population, obtaining the confidence interval for the errors mean. It is critical that the selected sample to be representative for population.

The purpose of this study is to estimate the accounting misstatements related to debts values of 5121 account of an audited company. The study objectives regards determining the sample size to be verified, estimating accounting misstatements of the debts values for the entire population studied. using different statistical sampling methods.

Keywords: *financial auditing, statistical sampling, sample size, materiality, accounting misstatement, confidence interval*

Introduction

The financial audit represents the evaluation activity made by a qualified person prone to accurately record the fiscal and accounting financial data, to be honest and to undertake only credible economic transactions.

The basic feature of audit is independent of the entity or the auditing activity as well as the global appreciation of the reports issued by this following a critical analysis of its procedures and structures.

The main purpose of an audit mission is to increase the confidence of financial information users, the auditor having to express their opinion on financial reporting in accordance with General Financial Reporting Framework applicable (IFAC, 2013, pp.75).

The methodological approach of a financial audit mission to issue an opinion can be structured in four fundamental phases (Arens et al., 2012, pp. 162). In the first phase, the planning of the audit mission takes place, when the auditor has to set a threshold of significance, in the second phase shall be tested internal control system and performs a series of tests substantial of transactions, in the third phase apply analytical procedures and tests of details of account balances, and in the last phase occurs final review by the responsible mission and issue audit report (Arens et al., 2012, pp. 414-423).

For each of these stage, the auditor should obtain sufficient appropriate audit sampling regarding the existence and functionality of the internal control system, and the main assertions managers on transactions, account balances and other information reported (IFAC, 2013, pp. 405).

The theme chosen aims at studying the audit sampling and other selective testing methods and procedures as this is an extremely important issue especially for the professionals practice in financial audit. The practical procedures of sampling are at the basis of the audit proofs credibility or the financial auditors as well as the auditing entity management are equally interested in it. Moreover, all the users of the information published in the financial situations are interested in its credibility in order not to negatively influence their decisions. The importance of audit sampling is given by the fact that an integral examination of the accounting financial transactions and operations could take as much time as their realization.

1. Literature Review

In order to highlight the importance of knowing and using sampling in audit, we take into account the statistical sampling methods met in the specialized literature as well as the methods recommended by the ISA 530 [11], and the audit professional in Romania, issued by the Chamber of Financial Auditors of Romania (CFAR).

At the stage of knowing the units planning and organizing the audit work, the auditor needs to obtain enough data on the applied accounting system and on

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the internal control in order to adapt an effective work plan. Before proceeding on testing, the auditor needs to establish the sample size and the elements selected from the population being tested for each audit procedure.

When the auditor decides to test less than 100%, out of population aiming inferences on the total population it is used the term audit survey or survey auditing. Evaluating the audit survey results represents an essential part and often difficult for the audit process. In this way a series of questions rises as follows:

When is a sample size bigger enough to allow for evaluating the characteristics of a population? Does a sample correctly represent the accounting information?

A representative sample is that in which the auditing characteristics are approximately identical to those of the population. That means that the elements included in the sample are similar to those which remain out of it.

The auditor does not quantify a sampling risk in the non-statistical survey. In turn, he chooses to analyze the sample's elements which will provide, in the auditor's opinion and under the given circumstances, the most useful information. The conclusions on the whole population could be drawn in terms of a subjective judgment. For this reason, the non-probabilistic sampling is often called *"rationalized sampling"*. The statistical survey distinguishes from the neon-statistical survey as it allows for quantifying (measuring) the sampling risk within the survey planning and result evaluation by using a series of math patterns. During the courses of statistics, a statistical result is computed at the confidence level of 95%. The confidence level of 95% generates a sampling risk of 5%.

The auditor has the option to choose between a statistical and a non-statistical sampling technique. The three steps to follow, irrespective of whether a statistical or non-statistical technique will be employed, are sample size determination, selection of the sample, and the evaluation of the sample results (Guy et al., 2002:2; IFAC, 2012d ISA 530 par. 6-8).

Hitzig (2004, pp 31) points out that the implementation of a statistical or a non-statistical sampling technique is determined by the sample selection method, and should not simply be an arbitrary decision to apply/not apply statistical techniques, made by the auditor. In addition, the ISA on Audit Sampling 530 (IFAC, 2012d ISA 530 par. A9) indicates that the sample size cannot be used as a criterion to determine whether to use statistical or non-statistical techniques. The choice of non-statistical sampling techniques does not imply the use of smaller sample sizes in order to provide sufficient audit evidence (Crous et al., 2012, pp 257-258).

Gul (2008, pp259-260), mention some principal advantages of statistical:(1) statistical sampling will help the auditor to calculate a precise and reliable confidence level , (2) statistical sampling demands an auditor to properly plan an audit procedure in a systematic and scientific manner, (3) statistical sampling will permit the auditor to interpret sampling results in an objective manner base on the value of statistical precisions and reliability, (4) statistical sampling will permit an auditor to rely on a smaller sample than would have been the case if nonstatistical sampling was to be used.

A sample selection method that an auditor will prefer to use in the process of selecting a sample will largely depend on whether the auditor is using statistical or a nonstatistical sampling approach. However, there are some sample selection methods that can be used for both statistical and nonstatistical audit sampling approaches such as random sample selection method, systematic sample selection method or stratified sample selection method. On the other hand, haphazard, block, or directed sample selection methods are usable in situations where the auditor has chosen to use a nonstatistical sampling approach (Tate & Grein, 2009, pp.171).

Jaba et al (2014) determined the sample size of the customers to be verified, extracting the sample using SPSS 20.0 statistical program.

2. Paper Content

In the proposed study, we refer to the theoretical and practical methods used in the selection of the elements for the testing within an audit process. Here are some methods for selecting the sample, determining its volume and the confidence interval for the population average.

In this study, we analyze the financial statement of an audited firm.

Defining the population

The characteristics of the population are summarised below: 5121 account status (current bank account) of the audited company is as follows: N = 459 items representing the whole population, total credits = 72,566,389.00, total debts = 72,299,809.00. The sampling base is the debit balance. The difference between the accounting data and data from primary documents will be the "error" or "accounting misstatement".

The main objective

The main objective of audit sampling is to detect any kind of error or fraud that could happen in the company as well as financial statements. This involves testing the correctness of calculation by estimating the number of errors mean. The objective of the auditor, when using audit sampling, is to provide a reasonable basis for the auditor to draw conclusions about the population from which the sample is selected.

The variability of population

In devising their samples, auditors must ensure that the sample selected is representative of the population. If the sample is not representative of the population, the auditor will be unable to form a conclusion on the entire population. Before selecting

the sample, the auditor should evaluate the homogeneity of the population. It is determined by calculating the coefficient of variation $v = \frac{\sigma}{\bar{X}} \cdot 100$. If $v \leq 35\%$, population is considered homogeneous. If $v > 35\%$, population is heterogeneous, the variation is very high, the average is not representative and the group must be restored. Thus, the auditor will use to stratify the population to reduce the high variability of the elements, by dividing it into subpopulations. Reducing variation within each population allows the auditor to draw a smaller sample, keeping the same level of confidence and precision.

Establishing acceptable sampling risk of 5%.

Thus, the confidence level is set a priori to 95%, while in reality, for certain types of operations, such as unacceptable levels. An audit risk of 5% could also be very high in some cases. The auditor can determine the elements for each task or type of population, depending of their specific, and it is advisable to do so. Only in this way, the audit evidence obtained by analyzing the results of a representative sample may be relevant and credible.

The sample size

The sample size calculation was performed using several versions presented below.

Extraction of the sample and performing audit procedures

The sample extraction can be done using several selection methods. In the following we present three such methods.

Inferential statistics

The results obtained for this sample extend, in probabilistic terms to the whole population, obtaining the confidence interval for the number of errors mean.

3.1. Selection methods

3.1.1. First selection method (systematic selection of the sample)

This method involves selecting items using a constant interval between selections, the first interval having a random start. We assume that the auditor proposes to choose 10% of items to create the sample. Then, $n = 10\% \cdot N$=45 items for the sample. In this case, the sampling interval is $\frac{N}{n} = 10$. Thus, every 10th sampling unit is selected (from 10 to 10 starting from a first randomly selected item).

The auditor chooses, according to the audited company, a maximum materiality level. This level differs from one company to another, and is measured in units of currency.

When applying a statistical method, the audit authority will estimate most likely misstatement in the population and compare this to materiality in order to evaluate the results. It is expected that the actual known errors found will be corrected. If the obtained difference (accounting misstatement or error) between the accounting data and the primary documents data is below the materiality level, then it is said that the error is insignificant. If the accounting misstatement is greater or equal than materiality level, the error is significant. In case an significant error occurs, it must be either corrected, or displayed accordingly. Consequently, the auditor will consider it when providing the audit report (in this case the auditor's opinion may be full responsability or limited responsability).

For example, the auditor choose a sample of 45 items, 10%, randomly. Suppose for $n_0 = 40$ items, there was insignificant misstatements and for $n_1 = 5$ items, the errors were significant. Let, B, be a binary random variable:

$$B = \begin{pmatrix} 0 & 1 \\ \hat{p} & \hat{q} \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ \frac{40}{45} & \frac{5}{45} \end{pmatrix},$$

where $\hat{p} = \bar{X} = \frac{n_1}{n_0+n_1} = \frac{5}{45}$ is the error sample proportion and $\hat{q} = \frac{n_0}{n_0+n_1} = \frac{40}{45}$ is the correct sample proportion. The sample variance is $S^2 = \hat{p}(1-\hat{p}) = \hat{p} \cdot \hat{q} = \frac{5}{45} \cdot \frac{40}{45} = \frac{200}{45^2}$ and sample standard deviation will be $S = \frac{\sqrt{200}}{45} = 0{,}314$.

Assuming that the auditor selects without replacements sampling, then the confidence interval for whole population errors mean is

$$\bar{X} - Z_{1-\frac{\alpha}{2}} \cdot \frac{\sqrt{S}}{n} \cdot \sqrt{1-\frac{n}{N}} < \mu < \bar{X} + Z_{1-\frac{\alpha}{2}} \cdot \frac{\sqrt{S}}{n} \cdot \sqrt{1-\frac{n}{N}} \quad (1)$$

where

$\bar{X}$ = sample mean,

N = the whole population size,

n =the number of units being sampled,

$Z_{1-\frac{\alpha}{2}}$= a Z- normal value corresponding to confidence level $1-\alpha$, or to the α audit risk,

$\mu =$ the number of errors mean in the whole population (the expected error frequency or the expected number of misstatements, not their values).

In performing audit sampling procedures, the auditor is interested to estimate the confidence interval of the errors mean value that could occur in the debts of 5121 account.

Thus, the confidence interval is defined by the limits of:

$$\left[L_{inf\_accounting\_misstatement}; L_{sup\_accounting\_misstatement}\right]$$
$$= \left[\bar{X} - Z_{1-\frac{\alpha}{2}} \cdot \frac{\sqrt{S}}{n} \cdot \sqrt{1-\frac{n}{N}}\ ;\ \bar{X} + Z_{1-\frac{\alpha}{2}} \cdot \frac{\sqrt{S}}{n} \cdot \sqrt{1-\frac{n}{N}}\right] =$$
$$= \left[\frac{5}{45} - 1.96 \cdot \frac{0{,}314}{45} \cdot \sqrt{1-\frac{45}{459}};\ \frac{5}{45} + 1.96 \cdot \frac{0{,}314}{45} \cdot \sqrt{1-\frac{45}{459}}\right] =$$
$$= [2{,}4\%;\ 19{,}8\%]$$

The maximum number of misstatements the auditor can expect in the population, based on the sample, at a 95% confidence level, is 19,8%.

3.1.2. Second Method (block selection followed by a statistical or a non-statistical selection)

In situations when the auditor uses block selection as a sampling technique, many blocks should be selected to help minimise sampling risk. An example

of block selection is where the auditor may only examine the documents values that are higher than 500,000. For the rest of items, the auditors use the first method of selection or even use a non-statistical method, the mechanical one. Depending on the number of errors found, the sample can be increased.

3.1.3. Third Method selection (without replacement simple randomly selection)

Sampling without replacements provide the sample size to be extracted, calculated using the formula:

$$n = \frac{\frac{Z^2_{1-\frac{\alpha}{2}} \cdot S^2}{2}}{\frac{Z^2_{1-\frac{\alpha}{2}} \cdot S^2}{\Delta^2_{\bar{X}} + \frac{N}{N}}} \quad (2)$$

where $\Delta_{\bar{X}} = Z_{1-\frac{\alpha}{2}} \cdot \frac{S}{\sqrt{n}}$ is tolerable error,

$\frac{S}{\sqrt{n}}$ is standard error,

$S^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{X})^2}{n-1}$ is the sample variance estimator.

As neither $\Delta_{\bar{X}}$ nor S^2 are known, invariably depending on the sample size, the above formula can not be determined. In fact, empirically, however, it can be determined. Below are three alternatives for computing of the sample size.

3.2. Alternatives for computing of the sample size

3.2.1.Version 1 for computing of sample size (S is assumed to be known)

However, given the fact that the firm activity, procedures, the company employees, accountants have not changed in time, the auditor considers that historical data may be used to estimate the standard deviation in the population. In practice, the auditor will have to rely either on historical knowledge (standard deviation of the population in the past period) or on a preliminary sample (the standard deviation of which being the best estimate for the unknown value).

Based on a randomly selected sample of operations, the size of which has been computed according to the formula (2) and for a tolerable error $\Delta_{\bar{X}}$, defined by the auditor (at the level of the operations, e.g. 1% or 2% from total debts), the observed misstatement mean in the sample can be projected to the whole population, yielding the expected population misstatement. The sampling error can then be added to the expected population misstatement to derive an upper limit to the population misstatement at the desired confidence level (e.g. 95%).

3.2.2. Version 2 for computing of sample size (S determined from a pilot sample)

Version 2.1. The first step, for the auditor, is to filter the sampling base to eliminate the values exceeds the materiality. These items must be tested individually. Eliminating from the 459 items, those with debts values are greater than materiality, a new sampling basis is obtained.

The second step is to determine the standard deviation for the rest of items, named the pilot sample. The next step is to compute the tolerable misstatement, which is 1% of the total book value. From this information, the sample size can be determined as

$$n = \frac{1{,}96^2 \cdot 49{,}3^2}{7{,}81^2 + \frac{1{,}96^2 \cdot 49{,}3^2}{459}} = 29{,}881 \approx 30 \; units$$

If the sample size, *n*, exceeds 5% of the whole population size, then the Cochran correction form for the sample size can be used

Thus,

$$n_{Cohran} = \frac{n}{1+\frac{n}{N}} = \frac{30}{1+\frac{30}{459}} = 28 \; units$$

The 28 units will be included in the sample and will be tested. For an assumed risk of 5%, the auditor can expect accounting misstatement mean will be covered by the confidence interval shown in (1).

Version 2.2. Alternatively, the auditor could select a n' value of the sample (according to Method I of selection). The evaluation is sumarized in the table below:

No.	Data from primary documents	Accounting data	Difference (error, accounting misstatement)
1			
2			
⋮			
n'			

For these debts values, data from primary documents will be compared with the accounting data and the difference will be note, if it occurs. For this pilot sample, created randomly, the standard deviation, *S'*, corresponding to the errors found, will be calculated. A new value *n* will be calculated with (2) formula

$$n = \frac{Z^2_{1-\frac{\alpha}{2}} \cdot S'^2}{\Delta^2_{\bar{X}} + \frac{Z^2_{1-\frac{\alpha}{2}} \cdot S'^2}{N}}$$

where tolerable misstatement, $\Delta_{\bar{X}}$ is 1% of the total book value.

The auditor will compare this new *n* value, with the *n'* value used in establishing the tested sample. If $n \leq n'$, then it is no longer necessary to increase the basis for selection. If, however, $n > n'$, then the auditor will have to increase the sample with *n'* - *n* units.

3. Conclusions

When auditing a company, auditors use a combination of professional judgment and statistical sampling methods to estimate account balances. The concept of "sampling method" actually encompasses two elements: the selection method (statistical or non-statistical) and the actual sampling method, which provide the framework for computing sample size and allowing for projection of the results. There are various sampling methods available to auditors and ISA 530 [11] recognises, the standard itself covers the principal methods. In reality there are a number of ways in which sampling can be applied. If the audit authority is of the opinion that the sampling method initially selected is

not the most appropriate one, it could decide to change the method.

In the case study three selection methods were featured: a systematic selection of the sample, a block selection followed by a statistical or a non-statistical selection, respectively without replacement simple randomly selection. Also, there are three alternatives for computing of the sample size. We presented how the standard error and confidence interval are calculated, and the interpretation of the confidence interval. The latter is especially important for explaining findings to others who may not have much understanding of statistics. Future works includes stratification in a particular case of heterogeneous population.

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