Research Article

Anchoring and Adjustment Effects on Audit Judgments: Experimental Evidence from Switzerland

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Abstract

Auditors are faced with the task of formulating opinions about the financial statements by maintaining an attitude of professional skepticism and using their professional judgment to determine the type and amount of information to collect, the timing and manner, and the implications of the information collected. The anchoring and adjustment heuristic describes the effect of estimates that start from an initial value, which is then adjusted to yield the final answer. Such adjustments are often biased towards the initial value for which reason it is called 'the anchor'. According to literature, heuristics and biases in auditing are mostly encountered in the course of analytical audit procedures and interviews with the client. This study reports the results of an experimental research design analyzing the audit judgment of 85 auditors in Switzerland. Four out of five experimental cases used in this paper are adapted from former studies in order to guarantee comparability among the findings. Based on the results of the experiment, the results indicate evidence on the existence of the anchoring and adjustment heuristic in Swiss audit judgments. Further, we could identify an influence of the audit company size (Big4 *vs*. Non-Big4), the auditors' experience, and the auditors' knowledge about behaviorism and anchor heuristic with regard of the anchoring and adjustment effect on audit judgment. The purpose of this paper is to provide background on the heuristics and biases approaches to decision making and to increase auditors' awareness of the anchoring and adjustment effects that can adversely affect audit judgments.

Keywords: Audit judgment; Heuristics and biases; Professional skepticism; Decision making

Introduction

Behaviorism is nowadays a pervasive topic in many disciplines of science and practice. During the last few decades, scientists and practitioners have been applying behavioral models to fields such as economics, medicine, psychology, sociology and politics. Research designs and methodologies from numerous studies in these fields were adapted to other fields of research such as audit, raising also the topic of behavioral audit. In the 1970s, US scientists of psychology such as Nobel laureate Tversky and Kahneman assessed behavior of people and set up heuristically models that has dominated the judgment and decision making literature ever since. They argued that humans make use of cognitive heuristics which reduce the complexity of making probabilistic judgments [1]. Based on these models, several behavioral studies have been conducted pursuing behavioral theory and methodology. Studies on behavioral audit date back to early 1980s, when research on heuristics and biases already seemed to peak. Nevertheless, in the 80s and 90s, several studies investigated on behavioral impacts on audit judgments, which helped to improve decision making in auditing [2-11]. According to the studies of Presutti [10] and Cheng [12], auditors are affected to the same heuristics and cognitive pitfalls as other people having limited cognitive ability dealing with probabilistic data in complex environments. It is thus important for auditors to understand behavioral aspects of audit in order to make appropriate judgments. Professional skepticism is an essential component of every audit and

the foundation for detecting fraud and maintaining an independent attitude [13]. While the concept of professional skepticism has been part of auditing standards for decades, there is increasing recognition of both the importance of professional skepticism and deficiencies in the application of professional skepticism [14,15]. However, only few notable studies on anchoring and adjustment effects on audit judgments have been published ever since.

Accordingly, the main purpose of this study is to illustrate the potentially detrimental effects on audit decision making of certain judgmental heuristics, or rules of thumb, which can lead to systematic judgmental biases. The aim of this study is to increase auditors' awareness of some of the subtle biases that can adversely affect audit decision making, and – hopefully - to improve their abilities to avoid such biases and maintain an attitude of professional skepticism in audit judgments. The current study adds to the existing literature in several ways: First, to the best of our knowledge, this is the first study analyzing the impact of auditors' experience and knowledge about behaviorism and anchor heuristic on the anchoring and adjustment effect on audit judgment. Second, this analysis extends prior research by distinguishing between Big4 and Non-Big4 auditors. Both are useful to auditing educators, showing that both knowledge about behaviorism and anchor heuristic and higher standardized audit procedures might lead to less biased audit judgment. Third, this is the first paper to analyze the anchoring and adjustment effects on audit judgments in Europe which contributes reducing the lack of

knowledge and awareness on this issue in Europe.

The remainder of the paper is organized as follows. The next section provides some theoretical background and a literature review on the bias of anchoring effects in financial audit. The third section addresses the research methodology, including the presentation of the hypotheses and the approach to data collection. The fourth section presents the empirical results, while the final section provides a discussion of the results and draws conclusions.

Background and Literature Review

Heuristics and biases

According to the Oxford English Dictionary, the word 'heuristic' originates from the Greek word heuriskein, which means 'to find'. It describes heuristic as "proceeding to a solution by trial and error or by rules that are only loosely defined" (Oxford English Dictionary, online). In a scientific context, Simon [16] described heuristics as limited rationality due to cognitive limitations. Simon argued that heuristics are simplified models of the complex world that enable people to make decisions more efficient. Tversky and Kahneman [1] see heuristics as 'mental shortcuts', which allow people to form judgments with incomplete information. Therefore, heuristics are not only restricted to laymen, also experts (e.g. partners in audit firms) are prone to biases. Nevertheless, the authors mention that heuristics (also known as rule of thumbs) are quite useful, but sometimes lead to systematic errors. These may occur when judgments are based on subjective assessments. Tversky and Kahneman provide an example about the estimation of distance. The closer an object appears to be, the sharper it is seen. This 'rule of thumb' may have some validity, since an object becomes sharper the closer it appears. Under circumstances of poor visibility, for instance, a subject might then overestimate the distance of the object. By relying on this heuristic, the subject's judgment suffered from systematic errors.

The word 'bias' is defined as a "systematic distortion of a statistical result due to a factor not allowed for in its derivation" (Oxford English Dictionary, online). Gilovich and Griffin [17] define biases as deviations from rational thinking. These deviations (i.e. biases) are underlying assumptions for a model or rules and the authors point out that most of the observed biases violate basic laws of statistics and probability. As a result, people may draw irrational or false conclusion from their model (i.e. heuristic). Returning to the example of the distance estimation, the bias here would be, among many others, the omission of the visibility condition in the model. To sum up, decisions are often based on beliefs about an outcome of uncertain events.

Kahneman and Tversky [1] define heuristics and biases as follows: "In making predictions and judgments under uncertainty, people do not appear to follow the calculus of chance or the statistical theory of prediction. Instead, they rely on a limited number of heuristics which sometimes yield reasonable judgments and sometimes lead to severe and systematic errors" [1]. They defined three heuristics which are used when predicting values and assessing probabilities:

Representativeness: This heuristic deals with some probability judgments, where people have to compute probabilities of instances [1]. However, a newer study of Kahneman demonstrated that in such judgments people often replace probability calculation with the assessment of resemblance [18]. The idea behind this heuristic is that a difficult question such as computation of probabilities is answered by easier questions. Tversky and Kahneman [1] provided the following example: "Steve is very shy and withdrawn, invariably helpful, but with little interest in people, or in the world of reality" [1]. Then they asked US citizens to assess the probability in Steve's occupation. The options given were a) farmer b) salesman c) airline pilot or d) librarian. No surprise, many participants chose 'librarian' as Steve's occupation as the description exhibits the highest similarity to the occupation of a librarian. From a statistical perspective, librarians may yield the weakest probability since the job is less common in the United States compared to the other professions.

Availability: Availability is used to assess "the frequency or probability by the ease with which instances or occurrences come to mind" [1]. In other words, people tend to judge upon the salience of information. One may assess, for example, the risk of lung cancer by recalling the occurrence among family and friends. Even though availability might be a good heuristic for assessing frequency and probability, retrieving instances or occurrences can lead to severe over- and underestimation of the truth [1]. The phenomenon of underestimation for instance has been observed in the demand for disaster insurance, e.g. foods or hurricane insurance. Richter, Schiller and Schlesinger argue that people's willingness to buy disaster insurance is very low since such catastrophes are unlikely to affect one. However, the authors outlined that people tend to buy more insurance in the aftermath of such incidents, even though the probability of catastrophes remains unchanged.

Anchoring and adjustment: This heuristic is often used when people are given an anchor (i.e. initial value, starting point) and need to make estimates. Whether that happens consciously or not, people tend to adjust their estimate from the anchor until they have reached an acceptable level. Supporting evidence comes from biases in evaluation of conjunctive and disjunctive events, insufficient revision of probabilities relative to Bayes'Theorem [1], and framing (problem restatement) effects [19]. It does not matter whether the anchor is random or a result of previous calculation, the adjustments from those anchors are often insufficient since these estimates are all biased toward the anchor [20]. An illustrative example of the anchoring and adjustment heuristic is the estimation of Gandhi's age at death. With an anchor of 114 years old, people overestimated his age at death while participants with an anchor of 35 years old, remarkably underestimated Gandhi's age [21].

As the anchoring and adjustment heuristic is subject to this study, the underlying theory is discussed in more detail. Following Wilson, Houston, Etling and Brekke [22], the anchoring and adjustment process is illustrated in (Figure 1) and described as follows:

The anchoring and adjustment process starts with a subject considering an anchor as a possible answer to derive from. Thereby, anchors could be expectations, information from the past or information provided by others (e.g. supervisors, experts etc.). According to Wilson, et al. [22], however, anchors do not necessarily have to be linked to the estimate. They argue that even arbitrary information can be taken as an anchor when better information is absent.

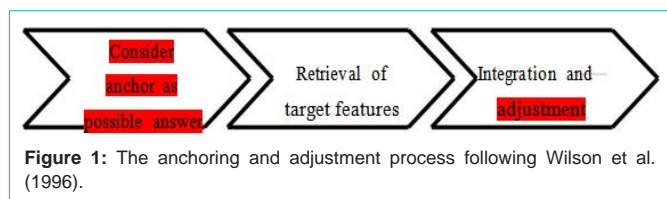Once an anchor has been considered as plausible answer, the

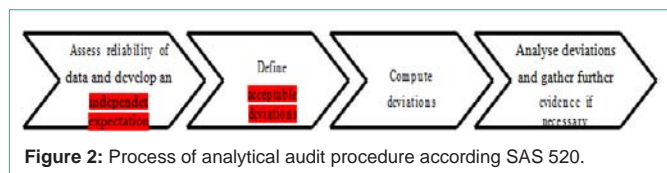**Figure 1:** The anchoring and adjustment process following Wilson et al. (1996).

Figure 2: Process of analytical audit procedure according SAS 520.

Table 1: Timing and purposes of analytical procedures.

Purpose	Purpose during phase		
	Planning phase	Testing phase	Completion phase
Assess premise of going concern	Secondary		Secondary
Detect material misstatements	Primary	Secondary	Primary
Reduce test of details	Secondary	Primary	
This table exhibits the purposes of analytical audit procedures for each phase of the audit			

subject begins to consult its memory and gathers information about the feature of the target [22]. Chapman and Johnson [23] state that this confirmatory search is a critical point in the whole anchoring and adjustment process as subjects tend to focus more on reasons of similarity between anchor and target than on reasons of difference. Asking subjects about the count of doctors in their neighborhood with a provided anchor of 3,000, people rather retrieve information and reasons from memory on why this number is consistent with the target. As a result, subjects already influence their estimate by the way of retrieving information [22].

The third step of the anchoring and adjustment process is about the integration of the target in the decision making process. At this point, subjects integrate their target value from the previous step into consideration and compare it to the anchor. Now subjects start to adjust away from the anchor until having reached sufficient adjustment in order to answer the questions [22]. However, many studies conclude that these adjustments are often said to be insufficient [1,2,24].

One might argue that from an economical point of view, these heuristics might be seen effective. However, all heuristics bear systematic errors and may lead to wrong conclusions. A better understanding of these heuristics may thus improve judgments and decisions when dealing with uncertainty [1].

Judgment and decision making in analytical audit procedures

As auditing is the research field of this study, it is important to discuss this environment with regards to behaviorism. The audit procedures, which are most affected by behavioral aspects like the anchoring and adjustment heuristic, are analytical procedures [4,7]. According to the International Auditing and Assurance Standards Board (IAASB), the analytical audit procedures are defined as "evaluations of financial information through analysis of plausible relationships among both financial and non-financial data" (ISA 520, Para. 4). Hence, analytical audit procedures involve comparison of the amounts recorded to auditors' expectations. Therefore, it is required that a single financial position or the relations between two and more positions are predictable ([25]; SAS 520, Para. A15).

According to the Swiss Audit Standards (SAS), analytical audit procedures can be deployed for the planning, execution and closing in audit (SAS 520, Para. A8, A10 and A13). Whereas analytical audit procedures for the execution of the statutory audit are facultative,

they must be deployed for the audit planning and completion phase. However, auditors are also encouraged to make use of analytical audit procedures during the testing phase. Especially for limited statutory examinations and reviews, auditors make often use of analytical procedures during the execution phase [26]. A detailed overview of the timing and purposes of analytical procedures is provided by (Table 1).

Since evidence from analytical audit procedures is often easier to obtain than test of details, they are also extensively used during the testing phase in practice [25]. The main purposes of analytical audit procedures are the following:

a)	To assess the ability of an entity to continue as a going concern

b)	To detect material misstatements in the financial statements

c)	To reduce test of details

Regarding point a), analytical audit procedures may be applied to financial and non-financial ratios in order to assess the likelihood of failure [25]. Such procedures are especially important during the audit planning as the auditor has to decide for the timing and manner of the work to be performed. Material misstatements in the financial statements can be detected by so-called 'unusual fluctuations'. Unusual fluctuations are unexpected material differences between the unaudited values and appropriate other data used in comparison (e.g. data of prior periods, industry benchmark, etc.). They occur when the auditor does not expect significant changes to the data compared but do exist, or vice versa [25].

The usual process of analytical audit procedures according SAS 520 can be illustrated as exhibited in (Figure 2). An auditor has to evaluate first the reliability of the data and form an expectation. Auditors acquire information from different sources that are relevant to a certain audit field. Such sources might be past audited figures, economic indicators, industry benchmarks, etc. Biggs and Wild [4] exempt unaudited figures as appropriate source since theory would violate the rule that auditors make independent evaluations. Unaudited book values are regarded as so-called 'management assertions' and require thus professional skepticism of the auditors involved. However, neither IAASB nor the Swiss Fiduciary Chamber explicitly exempts unaudited figures from the list of sources where auditors derive their expectations from [4,27]. It is the task of the auditor to assess the validity, relevance, and comparability of the outcome of such audit procedures (SAS 520, Para. A4 and A5). Once the auditor has gathered sufficient information about the audit field, he or she starts to develop an expectation. The expectation must be independent, which means that the auditor may not solely rely on

the client's data and maintain an attitude of professional skepticism [28]. Whereas an independent expectation of depreciations on non-current assets is rather easy to form, it may be difficult to do so for a new product launch. As an independent expectation requires sound knowledge of the client and industry, it is sometimes impossible to obtain sufficient evidence from analytical audit procedures [26]. The expectation can be either based on statistical inference and/or on their professional judgment.

The second step is the definition of acceptable deviations of the expected figure(s). The acceptable deviations need to be based on materiality and the risk of respective audit field. In a third step, the auditor compares the unaudited figure(s) with the expected value and checks whether the deviation lies within the set non-investigation region or not. As long as the computed deviation lies within the acceptable range, the auditor may complete the analytical procedure. Otherwise, it is necessary to obtain further evidence in order to explain the correctness and accuracy of the deviation in a fourth step (SAS 520, Para. A16). For deviations within the non-investigation region, the auditor may reduce the degree of test of details. Otherwise, auditors have to conduct further investigation to explain the difference. The extent of further investigation is left to the auditor and in dependence upon professional judgment (SAS 520, Para. A8 and A9).

According to Kartscher et al. [26] auditors often spend most time on step four instead on the first step, which is, however, the most important and most complex one. In step one, auditors are also deemed to be most prone to cognitive pitfalls such as neglecting statistical rules and anchoring effects produced by unaudited data. It is thus important that auditors are familiar with behavioral aspects in auditing.

Though, since time and cost constraints usually arise in audit, many auditors refrain from running statistical extrapolations [4,7]. Therefore, professional judgment and professional skepticism are crucial to develop 'good' expectations. Hence, an auditor must plan and carry out the audit in the knowledge that the financial statements may contain material misstatements. Thereby an auditor must scrutinize the client's information and documents for reliability. Furthermore, professional skepticism is insofar important as it prevents auditors from overlooking unusual circumstances and drawing generalized conclusions (SAS 200, Para. A18). Professional judgment is deemed important throughout the planning and performance of the audit since appropriate conclusions can only be drawn having sound knowledge and experience in auditing (SAS 200, Para. A23). However, the assessment of circumstances shall not solely rely on own expectations and experience of the auditor as these factors do not constitute appropriate measures (Framework of Assurance Engagements, Article 36).

Prior research

Even though many studies confirm the existence of anchoring effects in financial audit, they often reveal mixed results regarding the magnitude of such effects [4-8].

Joyce and Biddle [6] investigate the effects of anchoring-and-adjustment on probabilistic inferences in auditing judgment. They conducted six experiments to determine the extent of effects on practicing auditors' judgments. The authors conclude that auditors sometimes violate normative principles of decision making, but such violation cannot always be directly linked to anchoring effects, which indicates that unknown heuristics might be latent. An extension of this research by Wright and Anderson indicate anchoring effects as robust. Also Kinney and Uecker [7] reveal that the anchoring and adjustment heuristic is present in analytical review. However, they also observe that the anchoring effect does not always occur (i.e. insignificant results), and the magnitude of the anchoring effect is also influenced by other factors. These studies typify the somewhat confusing state of affairs about the role of heuristics and biases in auditing judgment.

Adapting the experimental case of Kinney and Uecker [7], where participants received two years of audited figures and biased unaudited figures, Biggs and Wild [4] demonstrate the anchoring effect among auditors in the performance of preliminary analytical review procedures. Both of these studies show that unaudited values, which should be ignored in independent evaluations, influence the investigative boundary values selected by auditors. These results suggest that the auditors are apparently unable or unwilling to ignore the anchoring information in their judgments. Even though the analysis of both studies yield significant results, Kinney and Uecker [7] state a higher level of significance. However, both studies provide some evidence, that the anchoring and adjustment heuristic pervades a variety of judgments and is merely applied to probabilistic inference.

Further, Butler [5] detects existence of anchoring effects in auditing as well; he scrutinized previous results with high significance levels [6,7]. Possible reasons for Butler's [5] different results might derive from the different statistical model applied (t-test instead of Chi-square test) and that all his participants have at least two years of experience in auditing, whereas the samples of the previous studies also include auditors with less experience including assistants. This finding is insofar interesting as this fact indicates that more experienced auditors are less prone to biases.

Kowalczyk and Wolfe [8] set out to examine in a going concern context whether a recommendation from a decision aid serves as an anchor from which auditors insufficiently adjust when confronted with additional information not accounted for by the aid. The results provide evidence that anchoring effects can occur with the provision of recommendations from the expert decision aid. An important implication of these results is that anchoring on the advice of an expert decision aid can result in improper attention given to audit evidence, which is inconsistent with the recommendation.

Moreover, Asthon [2] infers that the use of heuristic may be beneficial as it helps to simplify the decision making process and saves therefore time and cognitive effort. It is also possible that the use of heuristics may yield in acceptable judgment. However, even though heuristics can be efficient in decision making, the use of heuristics in auditing can lead to systematic errors and inconsistencies [1,2]. Nevertheless, the cost of the alternative assessment that eliminates the bias may outweigh the gained benefit [6,29]. This might be a reason why heuristically procedures are still employed in audit judgments. Especially because heuristics continuously applied in practice, a better understanding of heuristics would improve decision making under uncertainty [1,2,30].

The danger of relying on heuristics is also that the harmful effects of using heuristics often remain unrecognized. The reliance on heuristics is not restricted to laymen; also experienced people are prone to heuristics when thinking intuitively [1]. Ashton [2] concludes that also auditors were not even aware of employing heuristics in their decision making process [31,32].

There have been several studies on how to avoid contaminated judgment from a behavioral point of view. A study of Wilson et al. [22], for instance, outlined possible conditions that must be met preventing people from biased decision making. First, people must be aware of the existence of the bias. Furthermore, they must also be willing to correct the bias, having knowledge about the magnitude of the bias and having a certain level of self-control over their answers. Even if people are aware of the persistence of the biases and they have sufficient motivation to prevent them, it may be difficult to evaluate the magnitude of the bias and thus to tell by how much their answers have been affected. As a result, it is difficult avoiding anchoring effects even if people know they may occur [22]. In addition, Wilson et al. [22] also found evidence for anchoring effects even though the participants were told not to use the provided anchors when answering the questions. Interestingly, also people's motivation and physical condition has an effect on judgments. According to Epley and Gilovich [24], people tend to adjust more accurately for their answers when being motivated and mentally fit (i.e. no stress or signs of tiredness). Unfortunately, further conclusive results have not emerged over the 40 years of research on the anchoring and adjustment heuristic - the reason why adjustments tend to be insufficient remains unclear [24].

Methodology and Research Design

In order to examine the existence of anchoring and adjustment heuristic and to assess the extent of biased audit judgments in Switzerland we designed an experiment, which we conducted with auditors of ten different Swiss audit companies, ranging from local to multi-national audit firms. We also assessed the effects of anchoring and adjustment heuristic on audit judgments depending on the size of the audit firm the auditor works for (Big4 *vs.* non-Big4) and with regard to the years of experience of the subjects. Further, we analyzed if the knowledge about behaviorism and anchor heuristic influences audit judgment. This led to the following hypotheses:

Hypothesis 1: There are differences in Swiss audit judgment with regard to the bias deriving from the anchoring and adjustment heuristic.

Hypothesis 2: There are differences in Swiss audit judgments with regard to the anchoring and adjustment heuristic between Big4 and non-Big4 audit firms, since bigger audit firms have more standardized audit procedures which might result in less biased audit decisions.

Hypothesis 3: There are differences in Swiss audit judgments with regard to the anchoring and adjustment heuristic in respect of the auditors' experience, since auditors with more years of experience might tend to be less prone to biases deriving from the anchoring and adjustment heuristic.

Hypothesis 4: There are differences in Swiss audit judgments with regard to anchoring and adjustment heuristic in respect of the auditors'

Table 2: Anchor characterization of the experimental cases.

No. Case	Type of Anchor	Bias	Original Source
1	Internal Anchor	Mean-Reverting Level	Kinney and Uecker (1982)
2	External Anchor	Arbitrary Information	Own creation
3	External Anchor	Arbitrary Number	Joyce and Biddle (1981)
4	Internal Anchor	Formulation of Probability Estimate	Joyce and Biddle (1981)
5	Internal Anchor	Insufficient Adjustment from Own Anchor	Joyce and Biddle (1981)

knowledge of behavioral audit, since auditors with knowledge about behaviorism and anchor heuristic might tend to be less prone to biases.

Experimental design

For the purpose of testing these hypotheses we developed an online survey containing five experimental cases and a post experimental questionnaire regarding the participants' experience of being influenced by data or clients and knowledge of behaviorism, which is relevant to assess the importance of increasing the awareness of cognitive pitfalls in audit judgments. A link to that online website was send via email to randomly selected external auditors with the request to participate in our study. The participants were randomly assigned either to the control or experimental group. Thereby, the experimental group received the same information as the control group, except for the planned heuristics that we tested for. The survey was tested before it was sent out to the participants. During that pre-testing period, several students tested the survey and provided feedback that led to few minor but valuable adjustments to the final survey.

Once the participants accessed the website, they were provided with a brief explanation of the nature of the task before the five cases have been presented. Four out of these five experimental cases have been adapted from former studies in behavioral audit and one was created by our one. The five cases comprise different characterizations of anchors, which are shown in (Table 2).

In experimental case 1, participants were asked to set a range of possible values of gross profit percentage (i.e. the Lower Bound (LB) and Upper Bound (UB)) beyond which an investigation should be conducted in order to explain the apparent change in the gross profit margin. Depending on their condition, they were provided with different unaudited figures for the current year from which they had to define the range of possible values of gross profit in percent. Both groups received the same audited figures of the previous two periods. The two unaudited gross profit margins that served as anchors for the control and the experimental condition, being 14% and 23.1% respectively, were equidistantly and both equally likely in respect to the financial performance of the previous two periods considering the probability theory[*1]. Therefore, the likelihood of occurrence of the unaudited gross profit margins provided is mathematically equivalent.

The second experimental case presented information to estimate the fair value of a client's building employing the discounted cash flow model. Both groups received the same figures, whereas the experimental group was provided with additional information to that effect, that in the experimental condition the client mentioned that

Table 3: Variable definition.

No. Case	Variable	Definition
1	LB	Lower bound of indicated range of possible values of gross profit percentage the participants feel that an investigation should be conducted to 'explain' the apparent change in gross profit percentage for unaudited 2016 figures (in%)
	UB	Upper bound of indicated range of possible values of gross profit percentage the participants feel that an investigation should be conducted to 'explain' the apparent change in gross profit percentage for unaudited 2016 figures (in %)
2	FV	participant's estimate of the fair value of the building (in CHF)
3	MGTF EST	Participant's best estimate of Big Four clients per X that have significant management fraud (in CHF). *While X being 100 for the experimental and 1,000 for the control condition.*
4	GC	Participant's estimate on the probability of success of a company's proposed new product line, which is deemed necessary for the client to remain a going concern (in %)
5	PI	Participants were provided with eight statements about internal controls on which they had to indicate the extensiveness of the substantive tests they would perform in that engagement using a 10-point scale anchored on 1=minimum extensiveness to 10= maximum extensiveness of substantive testing procedure.

Table 4: The participants' demographic data.

	N			%	
Category of the audit firm					
Big Four	64			75.3	
Non Big Four	21			24.7	
Position					
Assistant	40			47.1	
Manager/Partner (CPA's)	45			52.9	
Gender					
Female	16			18.8	
Male	68			81.2	
	N	Mean	SD	Min.	Max.
Age	85	34.19	9.65	23	57
Years of experience	85	9.67	8.83	1	35

another company sold a similar building for an amount of CHF 10m. However, this information does not represent evidence and should not be taken into consideration for objective judgments.

In the third experimental case the control group was asked to estimate the incidence of significant management fraud being more or less than 10 per 1,000 (i.e. one percent). The experimental condition differed only in that the subjects were asked whether the incidence of management fraud among audit clients was more or less than 100 per 1,000 (i.e. ten percent). Both groups were then instructed to make a point estimate of the number of audit clients per 1,000 where such frauds have been committed. The purpose of providing a ratio in the first part of this experimental exercise was to set a starting point or anchor for the subjects' point estimates. These starting points (10 per 1,000 or 100 per 1,000), however, should be irrelevant for the point estimation.

The fourth experimental case asked participants to make an estimate of the probability of success of a proposed product launch. Both groups have being provided with the same four expert estimates about the success of the product introduction expressed in percentages. While the control group was given the expert's probability estimates of a successful launch, the experimental group received the expert's estimates in terms of failure (being 1-p). This exercise focuses on probability estimates for two types of complex events called 'conjunction' and 'disjunction'.

The last experimental case exercise presented eight different

internal controls regarding the sales process. The participants of both conditions were asked to indicate their extent of substantive tests they would perform for a material risk on a 10-point rating scale, ranging from minimal extent (1) to maximal extent (10). The experimental group was asked to determine their level of substantive tests in a condition where all eight internal controls were effective and in a second condition where two of these eight internal controls were changed to be not in place. The control group, however, has been only provided with the second condition (i.e. only six out of eight satisfactory internal controls).

For more details see the five experimental cases presented in the Appendix. Table 3 provides an overview of all dependent variables used in this study including a brief definition.

After the case exercises, all participants were asked the same post experimental questions. Those questions dealt with topics such as perception of influence, working under time and budget constraints, knowledge about behaviorism and personal data such as sex, age, employer, working position and years of experience in auditing. The participants were not able to get back to the experimental task when they were working on the post experimental questionnaire.

Participants

In total 103 external auditors participated and were randomly assigned to the control or experimental condition. Non-respondents might have different opinions therefore we compared the answers of the early and the late respondents. The comparison didn't show essential differences between the two groups which does not indicate non-response bias. However, 18 responses had to be eliminated due to non-completion of the survey. These records were deemed unusable as they did not contain crucial information such as the participant's age, sex, years of experience and the audit firm working for. The reported results are based on the responses from the remaining 85 participants from more than ten different Swiss audit companies. Thereof, 19% were female and 81% male representing all linguistic regions from Switzerland. Furthermore, the participant's age ranges from 23 to 57 with corresponding years of experience of one to maximum 23 respectively. 52.9% of the participants were Manager/Partner being licensed certified public accountants. Table 4 summarizes the demographic statistics of the participants of the experiment.

Results

Analytical statistics

In order to demonstrate the anchoring and adjustment effects

Table 5: Test of hypothesis 1 over all experimental cases.

No. Case	Variable	Condition	N	Median	Mean rank	U	z	*p-value (Exact Sig. 2-tailed)*	r
1	LB	C	43	15	51.62	532.5	3.331	0.001	0.361
		E	42	16	34.18				
	UB	C	43	19.8	53.23	463	3.922	0	0.425
		E	42	20	32.52				
2	FV	C	43	15,000,000	54.41	412.5	4.372	0	0.474
		E	42	11,145,000	31.32				
3	MGTF_EST	C	43	40	53.4	456	3.967	0	0.43
		E	42	90	32.36				
4	GC	C	43	60	48.66	659.5	2.171	0.3	0.235
		E	42	60	37.2				
5	PI	C	43	3	51.33	545	3.238	0.001	0.351
		E	42	2	34.48				
					This Statistics provided in this table derive from the M-W test with a significant level of .05.				

Table 6: Test of hypothesis 2 over all experimental cases.

Firm Group	No. Case	Variable	Control Condition			Experimental Condition			Test Statistics			
			N	Median	Mean rank	N	Median	Mean rank	*U*	*Z*	*p-value (Exact Sig. 2-tailed)*	*r*
Big4	1	LB	34	14	11.61	30	16	10.54	48.5	1.402	0.009	0.306
		UB	34	18	12.56	30	21	9.83	40	1.022	0.033	0.223
	2	UB	34	15,000,000	14.06	30	14,993,496	8.71	26.5	1.992	0.047	0.435
	3	FV	34	20	12.83	30	90	9.63	37.5	1.177	0.003	0.257
	4	MGTF_EST	34	60	13.5	30	59	9.13	31.5	1.641	0.107	0.358
	5	GC	34	3	13.44	30	1.5	9.17	32	1.596	0.14	0.348
Non-Big4	No. Case	Variable	Control Condition			Experimental Condition			Test Statistics			
			N	Median	Mean rank	N	Median	Mean rank	*U*	*Z*	*p-value (Exact Sig. 2-tailed)*	*r*
	1	LB	9	15	40.35	12	17	23.6	243	3.669	0	0.459
		UB	9	18	40.9	12	22	22.98	224.5	3.886	0	0.486
	2	UB	9	15,000,000	41.06	12	10,000,000	22.8	219	3.967	0	0.496
	3	FV	9	50	40.63	12	80	23.28	233.5	3.775	0	0.472
	4	MGTF_EST	9	60	35.85	12	60	28.7	396	1.551	0.122	0.194
	5	GC	9	3	38.56	12	2.5	25.63	304	2.876	0.004	0.36
						The statistics provided in this table derive from the M-W test with a significance level of .05.						

between the control and experimental group we ran a Mann-Whitney-U-test[*2] over all variables of the five experimental cases, because the collected data is not normally distributed. The results of the analytical statistics provided in (Table 5) indicate the existence of biased audit judgments.

As demonstrated in (Table 5), all experiments have significant results with regards to the existence of anchoring and adjustments effects in Swiss audit judgments. The results of the analysis exhibits statistically highly significant anchoring effects on LB (U= 532.500, z= 3.331, p= .001, r= .361), and UB (U= 463.000, z= 3.922, p=.000, r= .425) of the first experimental case. Even though from a mathematical point of view both conditions should have come to the same conclusion, the medians in LB (C= 15, E= 16) and UB (C=19.8, E= 20) differ significantly with a medium effect size.

Also the second experimental case, estimating the fair value of

a building employing the discounted cash flow model results in FV (U= 412.500, z= 4.372, p= .000) being highly significant. With r= .474, FV reveals the strongest effect of all variables tested. The additional information provided to the experimental group, which should not influence the objective judgments of an auditor, provokes a change in median fair value estimates of CHF 15,000,000 to CHF 11,145,000, which is 25.7% less.

In the third experimental case, this change of the anchor from 10 to 100 per 1,000 demonstrates the following statistics for MGTF_EST (U= 456.000, z= 3.967, p= .000, r= .430), with median management fraud estimation score for the control condition (40, i.e. 4%) and for the experimental condition (90, i.e. 9%), being more than double as high as in the control group. The number 10 or 100 is irrelevant for making an estimate. Therefore, the mean ratio should rather be the same in both groups.

Table 7: Test of hypothesis 3 over all experimental cases.

Experience	No. Case	Variable	Control Condition			Experimental Condition			Test statistics			
			N	Median	Mean rank	N	Median	Mean rank	U	Z	p-value (Exact Sig. 2-tailed)	r
High	1	LB	22	15	26.86	21	16	16.9	124	2.659	0.007	0.405
		UB	22	19.8	25.61	21	21	18.21	151.5	1.963	0.05	0.299
	2	FV	22	15,000,000	26.7	21	11,800,000	17.07	127.5	2.539	0.01	0.387
	3	MGFT_EST	22	35	27.27	21	80	16.48	115	2.84	0.004	0.433
	4	GC	22	67.5	24.45	21	60	19.43	177	1.332	0.187	0.203
	5	PI	22	3	16.79	21	3	16.79	121	1.819	0.07	0.277
			N	Median	Mean rank	N	Median	Mean rank	U	Z	p-value (Exact Sig. 2-tailed)	r
Low	1	LB	21	25	25.31	21	20	17.69	140.5	2.065	0.039	0.319
		UB	21	45	27.98	21	40	15.02	84.5	3.466	0	0.535
	2	FV	21	15,000,000	28.26	21	10,490,000	14.74	78.5	3.646	0	0.563
	3	MGFT_EST	21	50	26.76	21	15	16.24	110	2.821	0.004	0.435
	4	GC	21	60	24.71	21	58	18.29	153	1.725	0.086	0.266
	5	PI	21	3	24.83	21	2	18.17	150	2.733	0.006	0.417
The statistics provided in this table derive from the M-W test with a significance level of .05.												

Table 8: Test of hypothesis 4 over all experimental cases.

Knowledge	No. Case	Variable	Control Condition			Experimental Condition			Test statistics			
			N	Median	Mean rank	N	Median	Mean rank	U	Z	p-value (Exact Sig. 2-tailed)	r
yes	1	LB	14	14	16.25	12	16	10.29	45.5	2.01	0.045	0.394
		UB	14	19	15.5	12	20	11.17	56	1.467	0.148	0.288
	2	FV	14	15,000,000	16.82	12	10,000,000	9.63	37.5	2.437	0.014	0.478
	3	MGFT_EST	14	50	17.04	12	75	9.38	34.5	2.576	0.009	0.505
	4	GC	14	60	14.14	12	65	12.75	75	0.471	0.653	0.092
	5	PI	14	3	13.21	12	3	13.83	80	0.216	0.845	0.042
			N	Median	Mean rank	N	Median	Mean rank	U	Z	p-value (Exact Sig. 2-tailed)	r
no	1	LB	29	15	36.09	30	17	24.12	258.5	2.754	0.005	0.359
		UB	29	19.8	37.59	30	22	22.67	215	3.382	0.001	0.44
	2	FV	29	16,486,000	38.84	30	12,750,000	21.45	178.5	3.927	0	0.511
	3	MGFT_EST	29	30	36.59	30	70	23.63	244	2.931	0.003	0.382
	4	GC	29	60	34.66	30	58	25.5	300	2.078	0.037	0.271
	5	PI	29	3	38.33	30	2	21.95	193.5	3.75	0	0.488
The statistics provided in this table derive from the M-W test with a significance level of .05.												

The fourth experimental case exhibits equal medians for both conditions; however, the test in differences between them remains statistically significant. This is due to the rank sum of both conditions that differ enough to be statistically significant. Nevertheless, this has an impact on GC (U= 659.000, z= 2.171, p= .030, r= .235), being the only variable that does not demonstrate highly significant test results.

Moreover, Table 5 also verifies significant results for the fifth experimental case and the variable PI (U= 545.000, z= 3.238, p= .001, r= .351) providing evidence that declaring two internal controls as unsatisfactory in the hindsight is believed to have a greater misstatement risk impact on the financial statement, since the median of extent of the substantive test vary significantly from 3 for the control group to 2 for the experimental group with an medium effect size.

Overall, these statistical analyses provide sufficient evidence that anchoring and adjustment heuristics are employed in Swiss audit judgments. All variables in (Table 5) exhibit a statistically high significance, except for GC with a corresponding p= .030 that is still considered significant. Consistent with our expectations auditors in Switzerland employ the anchoring and adjustment heuristics, and thus the hypothesis 1 is maintained.

Table 6 demonstrations the statistical test of hypothesis 2, if there are differences in Swiss audit judgments with regard to the anchoring and adjustment heuristic between Big4 and non-Big4 audit firms, since bigger audit firms have more standardized audit procedures which might result in less biased audit decisions. Comparing the test

Table 9: Descriptive statistics on post experimental questions.

Variable	N	%	Mean	SD	Definition
INFL_Y/N					
Yes	34	40			participants were asked whether they have ever been influenced by information received from the client that hindered them from judging objectively (yes or no)
No	54	60			
INFL	34	n/a	1.97	0.58	Participants perception of being influenced by clients information using a 5-point scale anchored on 1= one time to 5= very often
UNCT_Y/N					
Yes	63	74.1			Participants were asked whether they have ever felt unsure about how to solve a task in audit (yes or no)
no	22	25.9			
WPPY_Y/N					
Yes	59	93.7			Participants were asked whether they have ever made use of prior year audit work or files of similar clients in order to understand their task (yes or no)
No	4	3.3			
INFL_WP	59	n/a	5.25	1.8	Participants perception of being in uenced by prior year audit work or les of similar clients per period using a 10-point scale anchored on 1= no influence to 10= highly influenced
TBCS_Y/N					
Yes	63	74.1			Participants were asked whether they have ever encountered time or budget constraints at work impending appropriate information assessment (yes or no)
No	22	25.9			
TBCS	63	n/a	2.56	1.06	Participants perception of being influenced by budget or time constrains per period using a 5-point scale anchored on 1= one time to 5= very often
INFL_TBCS	63	n/a	3.16	1.3	Participants perception of coming to a di errent conclusion under time and budget constraints using a 10-point scale anchored on 1= no difference to 10= totally different.
KNBA_Y/N					
Yes	26				Participants were asked whether they know about behavioural audit (yes or no). If yes, they were furthermore asked from where they heard about behavioural audit.
No	59				

statistics between the Big4 and the non-Big4 firm group, the findings indicate that auditors of a Big4 firm are less prone for the anchoring and adjustment heuristic compared to non-Big4 auditors, since only three of five experimental cases reveal significant differences between the control and experimental group. For the group of non-Big4 auditors four out of five experimental cases are statistically significant and the significant results have even a higher effect size. The variable FV for example has for the Big4 group a p-value of p= .047 and an effect size of r= .435, which is barely significant with a medium effect size. For the non-Big4 group the variable FV has a p-value of p= .000 and an effect size of r= .472, which can be interpreted as almost strong. Therefore, the hypothesis 2 about the differences between Big4 and non-Big4 audit firms is supported.

For the hypothesis 3 we created two groups regarding the years of experiences the participants stated in the supplemental questionnaire. Using the unweighted mean value of years of experiences we separated the participating auditors in an experienced group and in a less experienced group. The results of this analysis over all experimental cases are summarized in (Table 7). Experienced auditors show only for three of the five case exercises significant results. Less experienced auditors are more susceptible for the anchoring and adjustment heuristic. In addition, the effect sizes for the significant results in the less experienced auditor group are also higher. This supports the conclusion that experienced auditors might tend to be less prone to biases deriving from the anchoring and adjustment heuristic. Hence, there is some prove for the third hypothesis.

The fourth hypothesis presumed that here are differences in Swiss audit judgments with regard to anchoring and adjustment heuristic in respect of the auditors' knowledge of behavioral audit, since auditors with knowledge about behaviorism and anchor heuristic might tend to be less prone to biases. To examine this hypothesis we separated the participants regarding their knowledge about behaviorism and anchor heuristic, which was asked in the post experimental questionnaire, and compared the differences between the control and experimental group of auditors with knowledge of behavioral audit to the differences between the control and experimental group of auditors with no knowledge of behavioral audit. The results are presented in (Table 8) and indicate support for this hypothesis. For the auditors without any knowledge about anchor heuristic all five experimental cases are statistically significant. For auditors with appropriate knowledge only two of five experimental cases verify significant differences between the control and experimental group.

Statistics on post experimental questionnaire

After the exercises, the participants were asked questions in order to understand what influences the judgment of Swiss auditors. Thereby, the participants had to answer several 'yes or no' questions about different influential triggers. For questions that were denied, participants were redirected to the next question whereas those who answered 'yes' had to provide further information. The descriptive statistics of the post experimental questions are provided in (Table 9) and the entire post experimental questionnaire is supplied in the Appendix.

As per INFL_Y/N, only 40% of Swiss auditors have encountered situations where information provided by the client may have

hindered them from judging objectively (e.g. being influenced by sophisticated documents or by information gathered during small talking with the client, etc.). However, INFL (mean= 1.97, SD= .58) demonstrates that such situations rarely occur (i.e. not more than 5 times a year). Remarkably more auditors in Switzerland encountered situations where they were unsure how to complete a task in audit (74.1%). Out of those, approx. 90% helped themselves by making use of working papers from prior periods or from similar engagements. Furthermore, the same auditors reckon that the use of other working papers influenced their judgments moderately as stated by INFL_WP (mean= 5.25, SD= 1.80) using a 10 point scale from 1= no influence to 10= high influence. Interestingly, the same share of auditors as for UNCT_Y/N encountered situations where time or budget constraints impeded appropriate assessment of the client's information. Moreover, those 63 audit professionals indicated that such time or budget constraints occur a few times per year (mean= 2.56, SD= 1.06) using a 5 point rating scale from 1= one time to 5= very often[3]. Nevertheless, auditors believe that time and budget constraints have a low impact on their decision making as stated by INFL_TBCS (mean= 3.16, SD= 1.30) using a 10 point scale from 1= no difference to 10= totally different conclusion.

Moreover, the participants were asked about their knowledge of behavioral audit. Only 30% of all participants have knowledge about behaviorism and behavioral audit. This prevailing lack of know-how may indicate how distorted the understanding of decision making in auditing in Switzerland is. Most of the participants with knowledge about behaviorism were sensitized on the job (54%) or during their former education (46%) rather than at their CPA institution (15%).

Overall, the results suggest that the highest influence in Swiss audit judgments derives from internally tested sources such as prior year working papers or similar engagements. External sources such as client's information or time and budget constraints are believed to have a remarkable lower impact on audit judgments in Switzerland. Furthermore, less than a third of the participants were aware that they employed heuristics when solving the experimental cases.

Discussion and Conclusion

In this study, we examined the anchoring and adjustment effects on Swiss audit judgments. In particular, the results of this study offer practical and theoretical contributions by examining if the anchor heuristic biases the Swiss auditors' judgment and if audit firm size, work experience, and knowledge of behavioural audit impacts this bias.

Based on the results of the experiment, this study find evidence on the existence of the anchoring and adjustment heuristic in Swiss audit judgment as all five experimental cases yield statistically significant differences in the participant's median estimates. In addition, the extent of this finding is insofar remarkable as the effect sizes indicate solid medium effects over all variables observed. Therefore, we conclude that auditors in Switzerland employ the anchoring and adjustment heuristic to an extent that could lead to biased judgments. Consistent with our expectations, the audit firm size has an influence on the audit judgment with regard to the anchoring and adjustment heuristic. Auditors from Big4 firms are less biased in audit decisions by the impact of an anchor heuristic.

Furthermore, a relationship is been found between the years of experience in auditing and the bias driven by the anchor. Less experienced auditors are more susceptible for the anchoring and adjustment heuristic than their experienced colleges.

Finally, the results reveal that knowledge about behaviorism and anchor heuristic can prevent heuristics and biases in audit judgment. It is therefore advisable to increase the awareness and understanding for behaviorism in the Swiss audit environment. Ideally, professional judgment is the connecting factor for such endeavor since it has been shown to be the source of judgmental biases in auditing.

Beyond that, we identified anchoring and adjustment effects depending on the experience in auditing, which have not been investigated in former studies regarding behaviorism in auditing. Another interesting finding is that approximately 70% of the participants believe that the use of working papers from prior periods or similar clients has a moderate influential impact on their judgment. Furthermore, only about 30% of the participants indicated to have knowledge about behaviorism. Accordingly, this study discloses a remarkable gap of knowledge of Swiss auditors with regards to behavioral disciplines.

In summary, the prevailing debasing measure is to increase the awareness of the employment of heuristics in Swiss audit judgments. The main objective therefore is that auditors must know about behaviorism before implementing other measures. One broad approach for lessening the impact of cognitive biases on human judgments is the application of a critical-thinking strategy and professional skepticism. Critical thinking involves a conscious and iterative process of reflecting, evaluating, and challenging one's own decision and decision making process with the intent of improving each. If properly applied, this strategy can help decision makers identify cognitive biases influencing their decisions and then choose the specific measures that should be useful in controlling or eliminating them [33]. Cognitive biases can impair the decision making process of any auditor. Being aware of the many different biases that typically impact auditors' decision making is the first step in overcoming them. Professional skepticism can help auditors to guard against cognitive biases during audit engagements.

Since this survey adapts four of the five experimental cases from former studies on behavioral audit, our results can be compared. The experimental case 1 of this study find statistically highly significant differences in the medians. The original experiment conducted by Kinney and Uecker [7] find the variables to be statistically less significant for former Big8 US audit firms. A few years later, Biggs and Wild [4] also investigated on the anchoring and adjustment heuristic effects on audit judgment by applying the same experimental case. Also Biggs and Wild [4] conducted their experiment with former Big8 firms from the United States. They find, on the other side, also statistically highly significant differences in the medians. A possible explanation for the differences in medians of LB and UB between the different studies is that the trend of the book values was different for the conditions. The control condition was provided with an increasing positive trend of the gross profit margin, whereas the experimental condition has been provided with a reversal trend of the prior year's figures. This break of the apparent trend may have led the experimental group to estimate lower ranges of the values of gross

profit in percent from which the participant would further investigate in order to explain the apparent change.

The second experimental case is an own creation and is thus not comparable with other results. The third experimental case, however, is adapted from Joyce and Biddle [6]. As well as for the participants from their experiment, also Swiss auditors estimate the occurrence of significant management fraud per year statistically different depending on the condition. Whereas Joyce and Biddle [6] find the difference in the estimate to be statistically significant (p= .015), our findings reveal a highly statistical evidence (p= .000). The difference might be due to the fact that 24.7% of our participants do not work for a Big4 firm whereas the participants of the former study were all auditors from Big8 firms and might have thus been able to estimate fraud incidents more accurately. Nevertheless, our results corroborate the findings of Joyce and Biddle [6].

The fourth experimental case deals with the probability assessment of a successful product introduction that is crucial for the company to remain a going concern. This case, which is already been conducted by Joyce and Biddle [6], depends on how participants estimate probabilities. The control condition provides four incidents with the corresponding successful probability measures. The experimental group, however, is been supplied with the unsuccessful probability measures (i.e. the likelihood of failure of the incident). Regardless of the condition, both are asked to estimate the success of the client's new product line in %. Thereby, the control condition has a rather simple calculation by multiplying the given probability measures (.80* .90* .90* .90) yielding at 58%. The experimental condition, however, is provided with the probabilities of failure and has thus to calculate the inverse probability first (i.e. 20% of failure = 80% of success). In contrast, Joyce and Biddle [6] fail to proof the existence of anchoring and adjustment heuristic. Consequently, the former results seem to be inconsistent with our findings as they demonstrated a clearer absence of the anchoring and adjustment heuristic. This apparent variation of the results might be explained only by the different sample sizes (n=50 for Joyce and Biddle and n= 85 for our study).

The last experimental case deals with the extensiveness of substantive tests an auditor would perform based on the outcome of some controls from the internal control system. Therefore, the participants are asked to indicate their extensiveness of substantive test performance. Also Joyce and Biddle [6] report highly significant results. Hence, this effect seems to be consistent with the anchoring and adjustment heuristic and with the aversion towards deterioration. Overall, our findings confirm mostly the results of former studies.

This study has a number of potential limitations. First, the experimental tasks were relatively simple abstractions from the more complex analytical review situations faced by practicing auditors. Second, despite the fact that we draw a random sample and performed a non-response test we cannot ensure any representatively of the results. Third, our sample size is rather small which may limit the power of our analysis and the generalizability of our findings.

Even though, we find differences between the effect of anchoring and adjustment heuristic for different auditor groups (Big4 vs. non-Big4, experienced vs. less experienced, and with knowledge vs. without knowledge about behavioral audit) we cannot state if the underling

audit topic or the used anchor and bias heuristic is responsible for the statistical differences. Meaning, if auditors are less prone to bias and heuristics in judgment and decision making in specific audit areas or if the observed bias is responsible for the variation. Therefore, future research could investigate on the one hand the influence of different heuristics on auditors' judgment and on the other hand the impact on different audit topics.

˙1: For the purpose of analytical audit procedures, Tchebychev's inequality may assist auditors to construct an objective confidence interval for unaudited book values, especially when developing expectations in analytical audit procedures. Tchebychev's inequality states that under the assumption of no material changes in the unaudited financial statement compared with prior periods, the time series of book values is statistically likely to follow a mean reverting level over time (i.e. the auditors expectation is the average of the past values) [7,34]. Therefore, from a time series of at least two past values, an auditor can compute the expected value µ and the standard deviation σ with which the reasonableness of unaudited figures may be assessed.

˙2: The Mann-Whitney-U-test is sensitive to differences in medians between two groups.

˙3: Where 2= rarely and 3= sometimes (i.e. 2-5 times and 6-15 times of occurrence per year respectively).

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