Anchoring and adjustment effects on audit judgments: experimental evidence from Switzerland

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Abstract

Purpose – The purpose of this study is to illustrate the potentially detrimental effects on audit decision-making of certain judgmental heuristics, which can lead to systematic judgmental biases. This paper provides background on the heuristics and biases approaches to decision-making to increase auditors' awareness of the anchoring and adjustment effects affecting audit judgments adversely.

Design/methodology/approach – This study reports the results of an experimental research design analyzing the audit judgment of 85 auditors in Switzerland.

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. The authors could identify an influence of the audit company size, the auditors' experience and the auditors' knowledge about behaviorism and anchor heuristic with regard to the anchoring and adjustment effect on audit judgment.

Research limitations/implications – The experimental tasks were relatively simple abstractions from the more complex analytical review situations faced by practicing auditors. Due to the small sample size, the authors cannot ensure representativeness of the results.

Practical implications – Professional judgment is a skill that auditor acquires overtime, combined with experience and knowledge, that allows him to achieve reasonable judgments, being independent of other opinions and free from material biases in a given circumstance. Our results show that auditors who are aware of biases and heuristics are less prone to judgment biases.

Originality/value – This paper is the first to analyze the impact of auditors' explicit experience and knowledge about behaviorism and anchor heuristic on the anchoring and adjustment effect on audit judgment. Through a stronger awareness of cognitive biases, a professional skepticism can be enhanced.

Keywords Audit judgment, Heuristics and biases, Professional skepticism, Decision-making

Paper type Research paper

1. 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 the behavior of people and set up heuristically models that have 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 (Tversky and Kahneman, 1974). Based on these models, several studies investigated on behavioral impacts on audit judgments, which helped to improve decision-making in auditing (e.g. Asthon, 1984; Bedard and Wright, 1994; Briggs and Wild, 1985; Butler, 1986; Joyce and Biddle, 1981; Kinney and Uecker, 1982; Kowalczyk and Wolfe, 1998; Prawitt, 1998; Presutti, 1995; Shanteau, 1989). Recent studies with regard to heuristics and biases in audit judgments (e.g. Bhattacharjee *et al.*, 2012; Cheng, 2011; Lambert and Peytcheva, 2020; Pike *et al.*, 2013) have demonstrated an impact on an individual's ability to exercise high-quality professional judgment. Thus, initial expectations influence auditors' application and performance of certain audit practices, like analytical audit procedures. Furthermore, interpersonal effects, such as can occur in the

interaction between auditors and their clients, may affect the reliability of information. Therefore, a personality-based interpersonal influence can be an apparently irrelevant source characteristic that may inappropriately influence the auditors' assessment of source competence. These issues are important because auditors' accurate assessment of source reliability and interpretation of the outcome of audit procedures are critical to the effectiveness of the overall audit. 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 resisting cognitive heuristics and biases (Farag and Elias, 2016). While the concept of professional skepticism has been part of auditing standards for decades (e.g. IAASB, 2012; IFAC, 2012; PCAOB, 2008), there is increasing recognition of both the importance of professional skepticism and deficiencies in the application of professional skepticism (e.g. Harding and Trotman, 2017; Hurtt, 2010; Quadackers *et al.*, 2014; Westermann *et al.*, 2016). Both researchers (e.g. Hurtt *et al.*, 2013; Nelson, 2009) and regulators (e.g. IFAC and PCAOB) have emphasized the importance of exercising professional skepticism when conducting an audit. An auditor with a high degree of professional skepticism is more likely to make skeptical judgments that may, in turn, generate observable skeptical actions/outcomes that manifest as a conservative approach to the audit (Nelson, 2009). However, professional skepticism remains difficult to define and measure. Various sources have defined professional skepticism as an attitude that includes a questioning mind and a critical assessment of evidence (AICPA, 2007), the ability to detect fraud (Choo and Tan, 2000), the opposite of trust (Shaub, 1996), a conservatism bias in audit judgment (McMillan and White, 1993), the equivalent of independence (Kadous, 2000) and presumptive doubt (Nelson, 2009). Research has indicated several possible factors influencing auditors' skepticism: individual auditor characteristics, evidential characteristics, client characteristics or external environmental characteristics may affect the ability of an auditor to recognize situations where additional work or investigation is required (for a detailed listing of possible influential factors, see Hurtt *et al.*, 2013). In particular, the influence of training of skeptical judgments and critical thinking as well as experience or expertise in auditing was noted (e.g. Bucaro, 2019; Gao and Zhang, 2019; Knechel *et al.*, 2010; Olsen and Gold, 2018; Peecher *et al.*, 2007; Wedemeyer, 2010). In summary, although academic research has begun to address professional skepticism, it remains a topic where there are many more questions than answers. Only a few notable studies on anchoring and adjustment effects on audit judgments have been published ever since, investigating the interplay of several factors to shed light on the complexity of skeptical auditor behavior.

Accordingly, the main purpose of this study is to illustrate the potentially detrimental effects on audit decision-making of certain judgmental heuristics, 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' explicit experience and knowledge about behaviorism and anchor heuristic on the anchoring and adjustment effect on audit judgment. Through a stronger awareness of cognitive biases, a professional skepticism can be enhanced. Second, this analysis extends prior research by distinguishing between Big Four and non-Big Four auditors. Larger audit firms (i.e. Big Four) have a reputation of providing higher-quality audit services than smaller firms (i.e. non-Big Four) (e.g. Chen and Wang, 2018). Therefore, Big Four firms likely have more of an incentive, relatively to smaller audit firms, to ensure that adequate levels of professional skepticism are maintained in order to promote higher audit quality (e.g. Cohen *et al.*, 2017; Eshleman and Guo, 2014; Teoh and Wong, 1993). Big Four firms establish various

training and control mechanisms to maintain consistency in audit quality (Bedard *et al.*, 2008; Dowling and Leech, 2014; Jenkins *et al.*, 2008) and usually develop more effective in-house standardized audit procedures and review systems (Blokdijs *et al.*, 2006; Choi *et al.*, 2010). Analyzing the impact of knowledge about bias and heuristic and the effect of higher standardized audit procedures on audit judgment addresses the request by Hurtt *et al.* (2013) for further research on how professional skepticism can be enhanced. In addition, these two issues are also useful for auditing educators, showing that both knowledge about behaviorism and anchor heuristic and higher standardized audit procedures might lead to less biased audit judgment. Thirdly, this is the first paper to analyze the anchoring and adjustment effects on audit judgments in Europe, which contribute to reducing the lack of knowledge and awareness on this issue in Europe. In particular, the audit market in Switzerland is very much dominated by SMEs, where often only a limited audit is carried out. In the context of these audits, the audit opinion relies to a greater extent on analytical audit procedures. Against this background, an investigation of the adverse effects of cognitive heuristics on Swiss auditors seems to be very relevant.

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 a 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.

2. Background and literature review

2.1 Heuristics and biases

Simon (1957) 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 efficiently. Tversky and Kahneman (1974) see heuristics as “mental shortcuts,” which allow people to form judgments with incomplete information. Therefore, heuristics are not only restricted to laymen, but experts (e.g. partners in audit firms) are also prone to biases. Nevertheless, the authors mention that heuristics are quite useful but sometimes lead to systematic errors. Gilovich and Griffin (2013) 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 an 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 (1973) define three heuristics which occur when predicting values and assessing probabilities (representativeness, availability and anchoring and adjustment).

As the anchoring and adjustment heuristic is subject to this study, the underlying theory is discussed in more detail. 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. 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 (Slovic and Lichtenstein, 1971). Following Wilson *et al.* (1996), the anchoring and adjustment process is illustrated in Figure 1 and described as follows:

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

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). According to [Wilson et al. \(1996\)](#), 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 a plausible answer, the subject begins to consult its memory and gathers information about the feature of the target ([Wilson et al., 1996](#)). [Chapman and Johnson \(1999\)](#) 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 way of retrieving information ([Wilson et al., 1996](#)).

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 ([Wilson et al., 1996](#)). However, many studies conclude that these adjustments are often said to be insufficient (see, e.g. [Ashton, 1984](#); [Epley and Gilovich, 2006](#); [Tversky and Kahneman, 1974](#)).

One might argue that from an economic point of view, these heuristics might be seen as 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 ([Tversky and Kahneman, 1974](#)).

2.2 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 ([Kinney and Uecker, 1982](#); [Biggs and Wild, 1985](#); see also [Mactavish et al., 2018](#) for an overview). 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 a 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 ([Arens et al., 2012](#); SAS 520, Para. A15).

According to the Swiss Audit Standards (SASs), 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 often make use of analytical procedures during the execution phase ([Kartscher et al., 2013](#)). 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 ([Arens et al., 2012](#)). The main purposes of analytical audit procedures are the following:

- (1) To assess the ability of an entity to continue as a going concern
- (2) To detect material misstatements in the financial statements
- (3) To reduce test of details

The usual process of analytical audit procedures according to SAS 520 can be illustrated as exhibited in [Figure 2](#).

An auditor has to first evaluate 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 and so forth. [Biggs and Wild \(1985\)](#) exempt unaudited figures as an appropriate source since theory would violate the rule that auditors make independent evaluations. Unaudited book values are regarded as so-called “management assertions” and thus require 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 (e.g. [Biggs and Wild, 1985](#); [Treuhand-Kammer, 2013](#)). 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 ([Rodgers et al., 2017](#)). Whereas an independent expectation of depreciation 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 a sound knowledge of the client and industry, it is sometimes impossible to obtain sufficient evidence from analytical audit procedures ([Kartscher et al., 2013](#)). The expectation can be based either 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 the 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).

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	

Note(s): This table exhibits the purposes of analytical audit procedures for each phase of the audit

Table 1.
Timing and purposes
of analytical
procedures

Figure 2.
Process of analytical
audit procedure
according SAS 520

According to [Kartscher et al. \(2013\)](#), auditors often spend the 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 of auditing.

Since time and cost constraints usually arise in audit, many auditors refrain from running statistical extrapolations (see [Biggs and Wild, 1985](#); [Kinney and Uecker, 1982](#)). Therefore, professional judgment and professional skepticism are crucial for developing “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 if 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).

2.3 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 (e.g. [Biggs and Wild, 1985](#); [Butler, 1986](#); [Joyce and Biddle, 1981](#); [Kinney and Uecker, 1982](#); [Kowalczyk and Wolfe, 1998](#)).

[Joyce and Biddle \(1981\)](#) 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 \(1989\)](#) indicate anchoring effects as robust. Also, [Kinney and Uecker \(1982\)](#) reveal that the anchoring and adjustment heuristic is present in analytical reviews. 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 \(1982\)](#), where participants received two years of audited figures and biased unaudited figures, [Biggs and Wild \(1985\)](#) 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 yields significant results, [Kinney and Uecker \(1982\)](#) 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 \(1986\)](#) detects existence of anchoring effects in auditing as well; he scrutinized previous results with high significance levels (see [Joyce and Biddle, 1981](#); [Kinney and Uecker, 1982](#)). Possible reasons for [Butler’s \(1986\)](#) 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 (1998) 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, Ashton (1984) 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 on 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 (Ashton, 1984; Libby, 1981; Tversky and Kahneman, 1974). Nevertheless, the cost of the alternative assessment that eliminates the bias may outweigh the gained benefit (Joyce and Biddle, 1981; Thorngate, 1980). This might be a reason why heuristic procedures are still employed in audit judgments. Especially because heuristics are continuously applied in practice, a better understanding of heuristics would improve decision-making under uncertainty (Ashton, 1984; Epley and Gilovich, 2001; Tversky and Kahneman, 1974).

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 (Tversky and Kahneman, 1974). Ashton (1984) concludes that also auditors were not even aware of employing heuristics in their decision-making process (see also Kennedy, 1995; Smith and Kida, 1991).

Behavioral researchers have been concerned about the effect of heuristics on decision-making, especially in highly technical fields such as auditing, and have put effort into investigating significant factors influencing auditor judgment. Abdolmohammadi and Wright (1987) provide evidence that experience has a significant effect when task complexity is explicitly considered. Bonner (1999) differentiates the experience effect, specifically the role of task-specific knowledge, in the cue selection and cue weighting of components of analytical risk assessment and control risk assessment. The results show that task-specific experience aids the performance of auditors. Moreover, auditors with specialized industry knowledge have a higher skeptical judgment when working within their industry specialization, which results in less biased audit decisions (Low, 2004; Owchoso *et al.*, 2002; Solomon *et al.*, 1999).

Furthermore, Hackenbrack (1992) reveals an influence of nondiagnostic (i.e. irrelevant) and diagnostic (i.e. relevant) information on auditor judgment. Auditors given a mix of relevant and irrelevant evidence make fraud-risk assessments that are less extreme (more regressive) than those based on relevant evidence only. This behavior is consistent with the nonnormative judgment tendency known as the dilution effect (see Nisbett *et al.*, 1981). Using a different task and context than Hackenbrack, Glover (1997) extends this study in examining the influence of nondiagnostic information on auditor judgment and analyzing whether auditors exhibit the dilution effect when faced with time pressure and accountability. The imposition of time pressure significantly reduces, but does not eliminate, the dilution effect. That time pressure influences auditor judgment is consistent with previous audit research, demonstrating that contextual variables influence judgment (e.g. Ashton, 1990; McDaniel, 1990). Contrary to findings in psychology, accountability had no significant influence on the dilution exhibited by auditors. Hoffman and Patton (1997) also find that accountability did not exacerbate the dilution effect in another area of auditor judgment. Shelton (1999) finds

that experience reduces the influence of irrelevant information on auditor judgment. More experienced auditors are not influenced by the presence of irrelevant information in making a going concern judgment. However, consistent with prior research (Hackenbrack, 1992; Hoffman and Patton, 1997; Glover, 1997), less-experienced auditors are influenced by the presence of irrelevant information.

More recent studies like Amir *et al.* (2014), Gul *et al.* (2013), He *et al.* (2018) and He *et al.* (2017) have shown that the characteristics of an auditor influence professional skepticism and quality of the audit being undertaken. The individual auditor effects on audit quality can be partially explained by auditor characteristics, such as attitude toward risk, educational background, experience, rank in the audit firm and political affiliation (Amir *et al.*, 2014; Gul *et al.*, 2013). Further, the economic conditions at the time an auditor enters the labor market have a long-term impact on his or her judgment and decision-making. Specifically, engagement partners who started their career during economic downturns issue audit adjustments more frequently (He *et al.*, 2018). Besides, social ties between engagement auditors and audit committee members shape audit outcomes. Although these social ties can facilitate information transfer and help auditors mitigate management pressure to waive correction of detected misstatements, cozy interpersonal relations can undermine auditors' monitoring of the financial reporting process (He *et al.*, 2017).

There have been several studies on how to avoid contaminated judgment from a behavioral point of view. A study by Wilson *et al.* (1996), for instance, outlines 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 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 (Wilson *et al.*, 1996). In addition, Wilson *et al.* (1996) also find 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 have an effect on judgments. Auditors' intrinsic motivation for their work provides unique value for improving professional skepticism and judgment quality (Kadous and Zhou, 2019). Also, according to Epley and Gilovich (2006), 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 (Epley and Gilovich, 2006).

3. 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 multinational audit firms. Based on the presented empirical results of previous studies regarding the anchoring effects in financial audit, we hypothesize:

- H1. There are differences in Swiss audit judgment with regard to the bias deriving from the anchoring and adjustment heuristic.

We build on the extant literature on audit quality and assume that Big Four accounting firms perform higher-quality audits than non-Big Four auditors in both public (e.g. DeFond *et al.*, 2016) and private markets (e.g. Che *et al.*, 2017). A substantial body of empirical literature

suggest that Big Four firms, which potentially have more to lose from a loss of reputation, plus a higher level of expected audit quality, are more likely to demonstrate high levels of professional skepticism (e.g. [Cohen et al., 2017](#); [Eshleman and Guo, 2014](#); [Teoh and Wong, 1993](#)). Thus, large audit firms tend to place more emphasis on staff training and/or peer review within the firm, and are more likely to use standardized audit procedures and techniques (e.g. computerized audit procedures), compared with small audit firms (e.g. [Bedard et al., 2008](#); [Dowling and Leech, 2014](#); [Jenkins et al., 2008](#); [Knechel et al., 2018](#)). In addition, Big Four firms generally have more resources ([Johnson et al., 2002](#)) and a greater access to the support of a large international network ([Lenz and James, 2007](#)), which can offset idiosyncratic auditor differences in the audit process. Therefore, we suggest that Big Four firms' pervasive monitoring processes, compared to that of non-Big Four firms, are likely to dampen the effect of anchoring and adjustment heuristic on auditor decisions. Thus, we are testing the following hypothesis:

H2. There are differences in Swiss audit judgments with regard to the anchoring and adjustment heuristic between Big Four and non-Big Four auditors.

Several researchers have observed that professional skepticism enhances audit quality. For instance, findings show that auditors with a high level of professional skepticism identify more contradictions in client explanations ([Hurt et al., 2013](#)), rely less on clients' explanations ([Quadackers et al., 2014](#)), are better able to recognize unethical behavior ([Rose, 2007](#)) and are more successful in spotting fraud-related cues ([Hayes, 2016](#); [Popova, 2013](#)). Further studies reveal that auditors with more experience in conducting financial audits show more professional skepticism, presumably because of the greater audit understanding and the ability to make more skeptical judgments gained through experience (e.g. [Hurt et al., 2013](#); [Knechel et al., 2010](#); [Nugraha and Suryandari, 2018](#); [Peecher et al., 2007](#); see also [Mala and Chand, 2015](#) for an overview). Experience is meant here in terms of general audit experience (i.e. both the length of time and the number of audits that have been done). We then expect that auditors with more years of experience might tend to be less prone to biases deriving from the anchoring and adjustment heuristic, leading to our next hypothesis:

H3. There are differences in Swiss audit judgments with regard to the anchoring and adjustment heuristic with respect to the auditors' experience.

[Tversky and Kahneman \(1974\)](#) describe the availability heuristic, which indicates that people assess the probability of an event occurring based on the ease with which examples of that event can be brought to mind. Consequently, knowledge about or familiarity with behaviorism makes the awareness against cognitive biases even more available. Based on Tversky and Kahneman's findings, the likelihood or probability assessed by an individual that during a certain audit judgment a risk of an anchoring and adjustment heuristic may exist should be directly related to whether the individual can easily recall cognitive biases. As mentioned before, [Wilson et al. \(1996\)](#) emphasize people being aware of the existence of behaviorism and cognitive biases are better equipped to resist the anchoring heuristic. Thus, our last hypothesis reads as follows:

H4. There are differences in Swiss audit judgments with regard to anchoring and adjustment heuristic in respect of the auditors' knowledge of behavioral audit.

3.1 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 sent 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 a 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 were presented. Four out of these five experimental cases have been adapted from former studies in behavioral audit and one was created by the authors themselves. The five cases comprise different characterizations of anchors, which are shown in [Table 2](#).

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.

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)

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	Participants best estimate of Big Four clients per X that have significant management fraud (in CHF) <i>While X being 100 for the experimental and 1,000 for the control condition</i>
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 of substantive testing procedure

3.2 Participants

A total of 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 did not reveal essential differences between the two groups, which does not indicate a 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 participants' age ranged from 23 to 57, with corresponding years of experience of one to a maximum of 23, respectively. In all, 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.

4. Results

4.1 Analytical statistics

In order to demonstrate the anchoring and adjustment effects between the control and experimental group, we ran a Mann-Whitney U test [1] over all variables of the five experimental cases, because the collected data are 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 regard to the existence of anchoring and adjustments effects in Swiss audit judgments. The results of the analysis exhibit statistically highly significant anchoring effects on LB ($U = 532.500$, $z = 3.331$, $p = 0.001$, $r = 0.361$) and UB ($U = 463.000$, $z = 3.922$, $p = 0.000$, $r = 0.425$) 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, in the second experimental case, estimating the fair value of a building employing the discounted cash flow model results in FV ($U = 412.500$, $z = 4.372$, $p = 0.000$) being highly significant. With $r = 0.474$, 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.

	<i>N</i>	%			
<i>Category of the audit firm</i>					
Big Four	64	75.3			
Non-Big Four	21	24.7			
<i>Position</i>					
Assistant	40	47.1			
Manager/partner (CPA's)	45	52.9			
<i>Gender</i>					
Female	16	18.8			
Male	69	81.2			
	<i>N</i>	Mean	SD	Min	Max
Age	85	34.19	9.65	23	57
Years of experience	85	9.67	8.83	1	35

Table 4.
The participants' demographic data

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	532.500	3.331	0.001	0.361
		E	42	16	34.18				
	UB	C	43	19.8	53.23	463.000	3.922	0.000	0.425
		E	42	20	32.52				
2	FV	C	43	15,000,000	54.41	412.500	4.372	0.000	0.474
		E	42	11,145,000	31.32				
3	MGTF_EST	C	43	40	53.40	456.000	3.967	0.000	0.430
		E	42	90	32.36				
4	GC	C	43	60	48.66	659.500	2.171	0.030	0.235
		E	42	60	37.20				
5	PI	C	43	3	51.33	545.000	3.238	0.001	0.351
		E	42	2	34.48				

Note(s): This statistics provided in this table derive from the M-W test with a significant level of 0.05

In the third experimental case, this change of the anchor from 10 to 100 demonstrates the following statistics for MGTF_EST ($U = 456.000$, $z = 3.967$, $p = 0.000$, $r = 0.430$), with median management fraud estimation score for the control condition (40, i.e. 4%) and the experimental condition (90, i.e. 9%) being more than double 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.

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 differs enough to be statistically significant. Nevertheless, this has an impact on GC ($U = 659.000$, $z = 2.171$, $p = 0.030$, $r = 0.235$), it 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 ($U = 545.000$, $z = 3.238$, $p = 0.001$, $r = 0.351$) 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 varies significantly from 3 for the control group to 2 for the experimental group with a 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 $p = 0.030$ 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](#) demonstrates the statistical test of [Hypothesis 2](#), if there are differences in Swiss audit judgments with regard to the anchoring and adjustment heuristic between Big Four and non-Big Four audit firms since bigger audit firms have more standardized audit procedures which might result in less biased audit decisions. Comparing the test statistics between the Big Four and the non-Big Four firm groups, the findings indicate that auditors of a Big Four firm are less prone for the anchoring and adjustment heuristic compared to non-Big Four auditors, since only three of five experimental cases reveal significant differences between the control and experimental groups. For the group of non-Big Four 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 Big Four group a p -value of $p = 0.047$ and an effect size of $r = 0.435$, which is barely significant with a

Firm group	No. case	Variable	Control condition			Experimental condition			Test statistics		<i>r</i>
			<i>N</i>	Median	Mean rank	<i>N</i>	Median	Mean rank	<i>U</i>	<i>z</i>	
<i>Big Four</i>	1	LB	34	14	11.61	30	16	10.54	48.500	1.402	0.306
		UB	34	18	12.56	30	21	9.83	40.000	1.022	0.223
	2	FV	34	15,000,000	14.06	30	14,993,496	8.71	26.500	1.992	0.435
	3	MGTF_EST	34	20	12.83	30	90	9.63	37.500	1.177	0.257
	4	GC	34	60	13.50	30	59	9.13	31.500	1.641	0.358
<i>Non-Big Four</i>	5	PI	34	3	13.44	30	1.5	9.17	32.000	1.596	0.348
	1	LB	9	14	40.35	12	17	23.60	243.000	3.669	0.459
		UB	9	18	40.90	12	21	22.98	224.500	3.886	0.486
	2	FV	9	15,000,000	41.06	12	10,000,000	22.80	219.000	3.967	0.496
	3	MGTF_EST	9	50	40.63	12	80	23.28	233.500	3.775	0.472
Note(s):	4	GC	9	60	35.85	12	60	28.70	396.000	1.551	0.194
	5	PI	9	3	38.56	12	2.5	25.63	304.000	2.876	0.360

Note(s): This statistics provided in this table derive from the M-W test with a significance level of 0.05

Table 6.
Test of [hypothesis 2](#)
over all
experimental cases

medium effect size. For the non-Big Four group, the variable FV has a p -value of $p = 0.000$ and an effect size of $r = 0.472$, which can be interpreted as almost strong. Therefore, the [hypothesis 2](#) about the differences between Big Four and non-Big Four 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 experience, 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 exercise 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 proof for the third hypothesis.

The fourth hypothesis presumed that there are differences in Swiss audit judgments with regard to anchoring and adjustment heuristic with respect to 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 on the basis of their knowledge about behaviorism and anchor heuristic, which was asked in the post-experimental questionnaire, and compared the differences between the control and experimental groups of auditors with knowledge of behavioral audit to the differences between the control and experimental groups 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 groups.

4.2 Statistics on the 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). However, INFL (mean = 1.97, SD = 0.58) 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, approximately 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, ranging from 1 = no influence and 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, ranging from 1 = one time and 5 = very often [\[2\]](#). Nevertheless, auditors believe that

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	124,000	2.659	0.007	0.405
		UB	22	19.8	25.61	21	21	18.219,83	151,500	1.963	0.050	0.299
	2	FV	22	15,000,000	26.7	21	11,800,000	17.07	127,500	2.539	0.010	0.387
	3	MGTF_EST	22	35	27.27	21	80	16.48	115,000	2.840	0.004	0.433
	4	GC	22	67.5	24.45	21	60	19.43	177,000	1.332	0.187	0.203
Low	5	PI	22	3	16.79	21	3	16.79	121,000	1.819	0.070	0.277
	1	LB	21	25	25.31	21	20	17.69	140,500	2.065	0.039	0.319
		UB	21	45	27.98	21	40	15.02	84,500	3.466	0.000	0.535
	2	FV	21	15,000,000	28.26	21	10,490,000	14.74	78,500	3.646	0.000	0.563
	3	MGTF_EST	21	50	26.76	21	15	16.24	110,000	2.821	0.004	0.435
	4	GC	21	60	24.71	21	58	18.29	153,000	1.725	0.086	0.266
	5	PI	21	3	24.83	21	2	18.17	150,000	2.733	0.006	0.417
Note(s): This statistics provided in this table derive from the M-W test with a significance level of 0.05												

Table 7.
Test of [hypothesis 3](#)
over all
experimental cases

Table 8.
Test of [hypothesis 4](#)
over all
experimental cases

Knowledge	No. case	Variable	Control condition			Experimental condition			Test statistics		<i>r</i>
			<i>N</i>	Median	Mean rank	<i>N</i>	Median	Mean rank	<i>U</i>	<i>z</i> <i>p</i> -value (exact sig. 2-tailed)	
<i>Yes</i>	1	LB	14	14	16.25	12	16	10.29	45.500	2.010	0.394
		UB	14	19	15.5	12	20	11.17	56.000	1.467	0.288
	2	FV	14	15,000,000	16.82	12	10,000,000	9.63	37.500	2.437	0.478
	3	MGTF_EST	14	50	17.04	12	75	9.38	34.500	2.576	0.505
	4	GC	14	60	14.14	12	65	12.75	75.000	0.471	0.092
<i>No</i>	5	PI	14	3	13.21	12	3	13.83	80.000	0.216	0.042
	1	LB	29	15	36.09	30	17	24.12	258.500	2.754	0.359
		UB	29	19.8	37.59	30	22	22.67	215.000	3.382	0.440
	2	FV	29	16,486,000	38.84	30	12,750,000	21.45	178.500	3.927	0.511
	3	MGTF_EST	29	30	36.59	30	70	23.63	244.000	2.931	0.382
Note(s):	4	GC	29	60	34.66	30	58	25.5	300.000	2.078	0.271
	5	PI	29	3	38.33	30	2	21.95	193.500	3.75	0.488
	This statistics provided in this table derive from the M-W test with a significance level of 0.05										

Variable		N	%	Mean	SD	Definition
INFL_Y/N	Yes	34	40.0			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	51	60.0			
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	1.80	Participants' perception of being influenced by prior year audit work or less of similar clients per period using a 10-point scale anchored on 1 = no influence to 10 = highly influences
TBCS_Y/N	Yes	63	74.1			Participants were asked whether they have ever encountered time or budget constraints at work impeding 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 constraints 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 different 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 behavioral audit (yes or no). If yes, they were furthermore asked from where they had heard about behavioral audit
	No	59				

Table 9.
Descriptive statistics
on post experimental
questions

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, ranging 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.

5. 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 behavioral audit impact this bias.

Based on the results of the experiment, this study finds 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 Big Four firms are less biased in audit decisions by the impact of an anchor heuristic.

Furthermore, a relationship is 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 colleagues. Beyond that, we identified anchoring and adjustment effects depending on the experience 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 having knowledge about behaviorism. Accordingly, this study discloses a remarkable gap of knowledge in Swiss auditors with regard to behavioral disciplines.

Finally, the results reveal that knowledge about behaviorism and anchor heuristic can prevent heuristics and biases in audit judgment, which has not been investigated in former studies regarding behaviorism in auditing. It is therefore advisable to increase the awareness and understanding of behaviorism in the Swiss audit environment. Ideally, professional judgment is the connecting factor for such an endeavor, since it has been shown to be the source of judgmental biases in auditing.

In summary, the prevailing debiasing 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 (see also [Knapp and Knapp, 2012](#)). Cognitive biases can impair the decision-making process of any auditor. Being aware of the many different biases that typically affect auditors' decision-making is the first step in overcoming them. Professional skepticism can help auditors to guard against cognitive biases during audit engagements.

With respect to auditing theory and practice, our results suggest auditors should be aware of succumbing to anchoring and adjustment heuristics when processing information; thus, auditors should be especially vigilant when initial information is not proven or verifiable. This should be of particular concern to audit firms, as this is likely to correlate with risks to the audit firm (e.g. litigation risk, reputation risk). Further, the present findings have implications for both research and audit education. First, the present study contributes to the professional skepticism literature by responding to a call for more research on enhancing professional skepticism (e.g. [Hurt et al., 2013](#); [Nelson, 2009](#)). Second, the results of the present study may provide insights to educators who attempt to improve course curricula to meet multiple goals of accounting programs. Professional skepticism is an important professional responsibility that educators should highlight in accounting education ([Luan, 2013](#)). Our findings suggest the effectiveness of training and education in cognitive bias and its attenuation in promoting professional skepticism.

As with all experimental research, this study has a number of potential limitations that should be considered when evaluating the results. First, the experimental tasks were relatively simple abstractions from the more complex analytical review situations faced by practicing auditors. Traditionally, auditors who perform analytical procedures have extensive knowledge of and experience with the client, thereby having a broader base from which to create an analytical expectation. However, we hoped that auditors would view these scenarios as abstractions of situations that they typically encounter and respond as they would in practice. Second, despite the fact that we draw a random sample and perform a non-response test, we cannot ensure any representativeness of the results. Third, our sample size is rather small which may limit the power of our analysis and the generalizability of our findings. Fourth, even though we find differences between the effect of anchoring and adjustment heuristic for different auditor groups (Big Four vs non-Big Four, experienced vs less experienced, and with knowledge vs without knowledge about behavioral audit), we cannot state if the underlying audit topic or the used anchor and bias heuristic is responsible for the statistical differences, that is, 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.

Notes

1. The Mann-Whitney *U* test is sensitive to differences in medians between two groups.
2. Where 2 = rarely and 3 = sometimes (i.e. 2–5 times and 6–15 times of occurrence per year, respectively).

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