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Professional skepticism and behavioral bias in financial professionals

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ABSTRACT

Over the past few years professional skepticism has received attention from various stakeholders such as policymakers, practitioners, regulators, and the public. The interest was driven by financial professionals' failure to apply professional skepticism and the damage it has caused the reputation of the accounting profession. This study investigates the relationship between professional skepticism as a trait and decision-making biases, while also exploring how factors such as gender, age, experience, and personality traits influence financial professionals' susceptibility to decision-making biases. The study adopted an advanced statistical technique using structural equation modelling to explore the relationship between professional skepticism and decision-making biases. Online surveys were distributed and completed by professional accountants who have professional accreditation with the International Auditing and Assurance Board (IAASB). Findings revealed the presence to a significant extent among financial professionals of confirmation bias, misconceptions of regression to the mean bias, conjunctive event bias, overconfidence bias, and affect bias. Further findings reveal that specific constructs within the professional skepticism trait such as questioning mind, suspension of judgement, search for knowledge, and self-determining, show significant positive (and in some instances negative) relationships with decision-making biases. Gender, experience, and personality traits (such as extraversion and neuroticism) were found to influence susceptibility to certain biases. This research contributes to literature, offering insights into the relationship between professional skepticism and decision-making biases, underlining the importance of understanding skepticism's implications for decision-makers.

1. Introduction

In recent years, professional skepticism has received considerable attention from various stakeholders, such as policymakers, regulators, practitioners, and the public (ACCA, 2017), largely due to several negative occurrences attributed to insufficient professional skepticism among financial professionals (Glover and Prawitt, 2013). As financial professionals face increasingly complex financial and social environments, there is a need to increase professional skepticism when making judgements and decisions (Cruz et al., 2020). However, the reality is that judgements and decisions are compromised because decision-makers display bias in complex decision-making environments (Bhattacharjee and Moreno, 2002; Joyce and Biddle, 1981; Koch et al., 2016; Koch and Wüstemann, 2009; Tversky and Kahneman, 1974). Biases may arise from cognitive limitations (Maqsood et al., 2004), but research has shown that interventions such as training individuals, and by holding individuals accountable for their decisions may partially mitigate these biases (Larrick, 2004; Lerner and Tetlock, 1999).

Building on this body of research this study investigates the question of whether the trait of professional skepticism could serve as a debiasing mechanism thereby improving decision-making. While standard setters and professional regulatory bodies have emphasized the importance of professional skepticism in auditing (ACCA, 2017; IFAC, 2017), there is a growing need for all financial professionals to apply skepticism in decision-making (IFAC, 2017). Yet, research that directly links professional skepticism to bias in financial decision-making remains limited. Early studies by Koch et al. (2016) and Teye (2023) suggest that skepticism may mitigate certain biases, but the evidence remains inconclusive. This study aims to address this gap by examining the behavioural manifestation of professional skepticism as a trait and its possible relationship with decision-making biases. Furthermore, the study provides evidence of the nuanced relationship between the underlying

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sub-constructs of skepticism as a trait on decision-making biases. This study is thus exploratory in nature, contributing new insights into complex relationships that have not yet been clearly defined or researched.

The remainder of this study presents a review of key literature on decision-making biases and professional skepticism amongst financial professionals. This is followed by a description of the research design employed by the present study. Finally, the main findings are discussed in relation to the main research question, along with practical implications and recommendations for future research.

2. Literature review and hypotheses development

This section highlights several key decision-making theories that play a significant role in how individuals make decisions. This section further focuses on five decision-making biases and describes the importance of professional skepticism in a finance environment and its potential role in improving judgment and decision-making. Lastly, this section discusses other individual differences that influence bias in financial decision-making. These individual differences are included in the literature review as they play a key role in the statistical model although it is not the main focus of the study.

2.1. Decision-making theories

This study focuses on three important decision-making theories, namely Dual-Process Theory, Information Processing Theory and Cognitive Load Theory. These theories relate to human cognition and judgement which has a direct implication for how decisions are made.

Dual-Process Theory (DPT) proposes that humans make use of two types of thinking systems when making decisions. System 1 thinking is mostly unconscious and does not require too much effort for computational thinking. System 2 thinking however is a slower, more deliberate decision-making process in which more effort is made (Stanovich and West, 2000). System 1 thinking regularly comprises of using simplifying strategies, named heuristics, in the decision-making process which generally led to good decision-making (Milkman et al., 2009; Stanovich and West, 2000). However, in certain circumstances, these heuristics lead to systematic and predictable errors (Tversky and Kahneman, 1974). Although the expectation is that financial decision-makers will make use of System 2 thinking in a complex decision-making environment, System 2 thinking may cause strain on the decision-makers' cognitive processes (Maani and Maharaj, 2004).

This introduces the second decision-making theory, *Information Processing Theory (IPT),* which is built on a similar premise to DPT. This theory relates to individuals having a limited cognitive working memory to solve problems. To manage complex problems, individuals make use of mental shortcuts such as heuristics to seek an optimal solution (Simon, 1978). Due to this cognitive limitation, individuals need to identify relevant data, encode it, store results immediately and retrieve knowledge as needed to make decisions.

The third decision-making theory, *Cognitive Load Theory (CLT)*, deals with cognition processes within an individuals' memory. Individuals may encounter three different types of contributions to cognitive loads i.e., intrinsic, extraneous and or germane. Intrinsic cognitive load arises from inherent difficulty of the task itself (De Jong, 2010), while germane cognitive load refers to the mental effort devoted to understanding and learning (Ellerton, 2022). Extraneous cognitive load, by contrast, represents unnecessary mental effort caused by poorly designed information (Paas, Renkl and Sweller, 2003). When an individual's memory is overloaded, particularly by intrinsic or extraneous loads, a decision-maker' ability to engage in germane processing is reduced (Paas, Renkl and Sweller, 2003). As a result, the limited ability to make use of germane thinking may lead to decision-makers making use of System 1 thinking in complex decision-making environments. This in return may lead them to be more susceptible to bias.

2.2. Decision-making biases

Prior literature has shown that there are numerous different decision-making biases, some which are driven by heuristics and some not. This study, however, focusses on five biases that are particularly relevant to financial professionals (the population among whom this study is conducted). Consequently, these biases include anchoring, confirmation, and overconfidence biases due to their strong linkage to IAASB standards and psychology (Glover and Prawitt, 2013). It further includes regression to the mean bias and affect bias, identified as influential in financial decisions (ACCA, 2017; Bhattacharjee et al., 2012; Enslin, 2019, 2022; Fehrenbacher et al., 2020; Glover and Prawitt, 2013; Lucena et al., 2021).

Confirmation bias and *misconception of regression to the mean bias* stem from the representativeness heuristic (Tversky and Kahneman, 1974). Confirmation bias is described as people overestimating the accuracy of their judgements, by favouring their pre-existing beliefs through valuing information that confirms their beliefs, and disregarding information that contradicts their beliefs (Einhorn and Hogarth, 1978). Misconception of regression to the mean bias occurs where people believe that the outcomes of predictions should be representative of the extremity of the inputs. This is usually not the case, as outcomes tend to regress back to the mean from the previous extreme values. However, decision-makers often believe that outliers of the event will remain extreme, even in subsequent events (Bazerman and Moore, 2012).

Conjunctive events bias stem from the anchoring and adjustment heuristic and is evident when people tend to overestimate the probability of conjunctive events happening alongside the initial event, particularly when the initial event serves as a prominent reference point (Tversky and Kahneman, 1974). For *overconfidence bias* this study focuses on the overplacement aspect, which is closely related to the 'better-than-average-effect' (Merkle, 2017). The 'better-than-average-effect' describes the tendency of people to believe that their judgement and decision-making is better than that of others (they rate themselves above the median and thus overplace themselves). According to Meikle et al. (2016), people tend to overplace themselves on easy tasks as they underestimate their own abilities on easy tasks but underestimate the abilities of other people even more. For difficult tasks, this changes to underplacement as people tend to overestimate their own ability on difficult tasks but overestimates the ability of other people even more (Meikle et al., 2016). Finally, *affect bias* is defined as the overreliance on emotional stimuli when making decisions, to the extent that this overrides rational evaluation of options, resulting in biased decision-making (Finucane et al., 2000; Slovic et al., 2007).

Evidence of these five biases have been well documented by researchers within various finance fields (Cassell et al., 2022; Enslin, 2019, 2022; Fehrenbacher et al., 2020; Kang and Park, 2019; Lowies et al., 2016; Lucena et al., 2021; Meikle et al., 2016; Perera et al., 2020). Literature has identified debiasing strategies for the underlying causes of biases such as training individuals and creating accountability structures for an individual's decision-making (Larrick, 2004; Lerner and Tetlock, 1999; Trotman, 1998). Literature and several accounting bodies has supported the creation of awareness of one's own bias as a possible debiasing strategy (ACCA, 2017; Perera et al., 2020; SAICA, 2022). However, debiasing strategies like awareness and training may not always be effective (Kahneman, Lovallo and Sibony, 2011; de Klerk, 2024).

The expectation is therefore that these biases are present in decision-making, however little empirical research has been conducted into how professional skepticism influences decision-making biases (Koch et al., 2016). The present study therefore explores a new debiasing strategy, namely professional skepticism and the possibility of having this trait mitigating bias susceptibility in decision-making.

2.3. Professional skepticism

Professional skepticism is crucial for enhancing audit quality (IAASB, 2019). Academic research (Hurtt et al., 2013; Koch et al., 2016) and prominent bodies like IFAC, IAASB, ACCA, and IESBA emphasize its importance for better judgments in financial decision-making (IESBA, 2018; IFAC, 2017). Despite this interest in and call for professional skepticism, the academic literature has been inconsistent in defining professional skepticism and about whether it should be seen as a trait or a set of skills and behaviors that can be taught over time (Hurtt et al., 2013; Plumlee et al., 2012).

2.3.1. Trait and state skepticism

With reference to trait skepticism, a trait is defined as a 'relatively stable, enduring aspect of an individual' (Hurtt, 2010, p. 150). Although it can be seen as part of an individual's personality, Nelson (2009) argues that this trait only stabilises by the time a person starts studying or enters the profession. An argument can therefore be made that this trait can further develop with education and training. Prior studies have explored this reasoning to some extent. Findings from several studies have revealed that individuals who completed formal tertiary education and professional certifications showcase higher levels of trait skepticism (Charron and Lowe, 2008; Fatmawati and Fransiska, 2018). Fazekas (2019) specifically argued that an individual's level of professional skepticism is a product of the tools acquired through training, but emphasized the important role that individual's traits play. Regarding experience, however, literature has provided mixed results with studies showcasing results where experience decreases and in other cases elevates the skepticism trait (Grenier, 2017; Payne and Ramsay, 2005; Rose, 2007). Reasons behind the mixed results could be driven by different expertise levels of participants or the situational context of the task given to assess trait skepticism. This gives rise to the second aspect of skepticism namely state skepticism.

State skepticism is 'a temporary condition aroused by situational variables' (Hurtt, 2010, p. 150). Unlike trait skepticism which can be seen as relatively stable, state skepticism changes depending on the presence or absences of situational factors such as high-risk audit circumstances (Hurtt et al., 2008) or prior client experiences (Popova, 2013). Several studies supported findings that state skepticism was higher when individuals featured higher trait skepticism (Eutsler et al., 2018; Fatmawati and Fransiska, 2018; Popova, 2013). Given these findings and the causal relationship between trait and state skepticism, the present study considered professional skepticism from a trait perspective, similar to Hurtt (2010).

The present study supports Glover and Prawitt (2013) by defining professional skepticism as

> "attributes commonly associated with being a skeptic in a professional setting that requires a standard of care and due diligence in the context of professional standards, regulation, oversight, litigation, negotiation, evidence collection and evaluation, professional judgment, complex business transactions, varying incentives and motives, rationalisation, and so forth" (Glover and Prawitt, 2013, p. 2)

2.3.2. Hurtt professional skepticism scale

Hurtt (2010) developed the Hurtt Professional Skepticism Scale (HPSS) to measure professional skepticism using constructs from auditing and philosophy literature. The scale identified six distinct constructs: the way information and evidence are examined (a questioning mind, suspension of judgment, search for knowledge), the human aspect (interpersonal understanding), and an individual's ability to act on the evidence and information gathered (self-determining and self-confidence) (Hurtt, 2010).

Understanding the underlying characteristics of each construct is important, as this may provide insight into its connection with the formation of biases. Each construct is further outlined below:

- Questioning mind is the ability to critically evaluate information or a situation, having curiosity, being open-minded and having the ability to challenge assumptions (Cheng, 2023; Hurtt, 2010).
- Suspension of judgement is the ability to focus on the entire process without rushing a decision just to get to the outcome (Hurtt, 2010; Kim and Trotman, 2015). Enough time should be spent on gathering information. This attribute motivates the next construct's characteristics.
- Search for knowledge is the ability to consider information beyond what has been provided, and to display a curiosity for more knowledge (Hurtt, 2010).
- Interpersonal understanding relates to understanding the motivations of the person presenting you with information, to be able to challenge the information (Hurtt, 2010).
- Self-determining is the ability to act with autonomy and moral independence. This self-direction gives individuals the ability not to be unduly persuaded by other people (Hurtt, 2010).
- Self-confidence relates to an individual's self-esteem to value their own opinion and be able to challenge the opinion of others (Hurtt, 2010).

The HPSS is employed in this study to measure the entire professional skepticism trait and its relationship with decision-making biases, as well as to explore the relationships with the six sub-constructs.

2.4. Professional skepticism and decision-making biases

If the individual aspects of professional trait skepticism, as discussed in detail above, are considered, the question should be raised whether having this trait is more closely aligned to System 2 thinking? Hurtt et al. (2013) proposed exploring whether a lack of professional skepticism leads to unconscious bias affecting auditor's judgements. Koch et al. (2016) were among the first researchers to address the issue raised by Hurtt et al. (2013) through considering the inherent link between traits and cognition using the HPSS. Their study focused on evidence-related aspects of skepticism relating to how information is processed, finding that it reduced recency bias with sequential presentation of information, but increased cognitive effort with simultaneous information presentation. These findings showcase that professional skepticism may increase germane cognitive load as more effort is dedicated for having a questioning mind, and to search for knowledge while suspending judgement. Teye (2023) conducted his study on the influence of framing and optimism bias on professional skepticism. Findings revealed that optimism bias was associated with an increase in cognitive load, which was in turn associated with decreased professional skepticism. Therefore, a higher cognitive load may be associated with a less skeptical mindset.

The research conducted by Teye (2023) highlights the complex interplay between professional skepticism as a trait and its impact on decision-making processes. The theoretical rationale behind supporting the relationship between professional skepticism and the five biases explored in the present study is presented below.

For *confirmation bias* an argument can be made that traits such as questioning mind, search for knowledge and suspension of judgement may encourage decision-makers to look for more evidence before just accepting information that may confirm their beliefs. For *misconception of regression to the mean bias* traits such as having a questioning mind and searching for knowledge can assist the decision-maker in performing a more in-depth analysis regarding trend explorations. Furthermore, traits such as suspension of judgement could help the decision-maker postpone their belief until understanding whether or not the deviation from the mean should be expected to continue. *Conjunctive event bias* occurs when probability of events is misinterpreted by anchoring one's beliefs on the first event. Traits such as having a questioning mind and critically searching and understanding knowledge can assist decision-makers in understanding the probability of events better and suspending judgement until all relevant probabilities have been evaluated. For *overconfidence bias* having self-esteem and a sense of autonomy may encourage a decision-maker to avoid overestimating their own abilities. Suspending one's judgement can also lead to the decision-maker holding back on their confidence assessment and waiting for more evidence. Lastly, for *affect bias*, several traits such as suspension of judgement, self-esteem and self-determination can help the decision-maker make a decision based on factual evidence and not by acting with emotional reasoning.

The main hypothesis of the present study considers the complete professional skepticism trait:

> H_{1a} to H_{1e}: A relationship exists between professional skepticism as a trait and confirmation bias (H_{1a}), misconception of regression to the mean bias (H_{1b}), conjunctive events bias (H_{1c}), overconfidence bias (H_{1d}) and affect bias (H_{1e}) in the financial decision-making of financial professionals.

Hypothesis 1 is further elaborated on to consider each of the six sub-constructs within the professional skepticism trait and its relationship with the five biases. This elaboration is made as some constructs within the professional skepticism trait may be the main contributor to the relationship:

> $H_{1.1}$ to $H_{1.6}$: A relationship exists between questioning mind ($H_{1.1}$), suspension of judgement ($H_{1.2}$), search for knowledge ($H_{1.3}$), interpersonal understanding ($H_{1.4}$), self-determining ($H_{1.5}$) and self-confidence ($H_{1.6}$) and heuristic-related and other biases in the financial decision-making of financial professionals.

2.5. Individual differences

The literature has identified several determinants that influence bias in decision-making. This study includes and treat these variables (specifically gender, experience and personality traits) as independent variables. These determinants are not the main focus of the study and is only briefly elaborated on to support its inclusion in the statistical model.

Several studies have highlighted *gender's* influential role in decision-making biases. Research has established a relationship between gender and biases such as conjunctive events bias and affect bias with women being more susceptible to these respective biases (Bacha and Azouzi, 2019; Enslin, 2019). Conversely, men were found to exhibit higher levels of overconfidence bias (Baker et al., 2019; Mishra and Metilda, 2015).

For the relationship between *age* and various decision-making biases literature has yielded mix results. For the five decision-making biases explored in this study the following literature has supported a relationship with age: Baker et al. (2019), Enslin (2019), Kudryavtsev and Cohen (2011), Ossareh et al. (2021), Prosad et al. (2015), Eberhardt et al. (2019) and You et al. (2019).

The present study considers both *general experience* and *key decision-making experience* within a finance environment. This distinction was driven by the study performed by Hogarth and Einhorn (1992) which provided evidence that experience only mitigates bias if experience reduces task difficulty. It is therefore argued that key decision-making experience may play a differentiating role in bias mitigation, compared to general experience. Experience within a specific finance field has been supported in the literature to influence biases (Baker et al., 2019; Bhattacharjee and Moreno, 2002; Chalissery et al., 2023; Henrizi et al., 2021; Ossareh et al., 2021; Tekçe et al., 2016).

Personality traits have also been found to play a key role in people's subjective perception when making financial decisions (Nga and Yien, 2013, p. 230). The literature has found support for people exhibiting the extraversion or neuroticism trait to be more susceptible to decision-making biases (Ahmad and Shah, 2020; Baker et al., 2021; Chalissery et al., 2023; Furnham et al., 2012). For personality traits, the present study focuses only on extraversion and neuroticism[1].

While not the primary focus of the present study, several individual difference variables were included to strengthen the explanatory power of the model. The supporting hypotheses related to these variables, along with their corresponding results, are provided in Appendix 4.

3. Data and methodology

3.1. Questionnaire design

This study uses a questionnaire to gather primary data about professional skepticism, behavioral biases and individual differences. The questionnaire has three sections. Section 1 measured individual differences such as gender, qualification, experience, and personality traits. Two aspects of experience were confirmed namely the number of years of general experience and the number of years of key decision-making experience a participant has. For this study key decision-making was defined as 'decisions which can relate to strategic, financial, or operational decisions that may have a noticeable financial impact on business operations'. This study did not differentiate between the various financial professions (e.g., internal auditors, external auditors, financial analysts or investment managers etc.) or job roles the participants had, as professional skepticism is expected to make a difference within all of the finance profession's roles. The personality traits were derived from the Big Five theory, specifically the Ten-Item Personality Inventory (TIPI) scale developed by Gosling et al. (2003).

Section 2 of the questionnaire focused on the professional skepticism trait measured by the HPSS using a 6-point Likert scale answer, ranging from 1 (strongly disagree) to 6 (strongly agree). The HPSS has been validated in multiple finance studies (Eutsler et al., 2018; Harding and Trotman, 2017; Khan and Harding, 2020; Koch et al., 2016; Teye, 2023).

Section 3 of the questionnaire related to measuring the five decision-making biases tested in this study and relied on existing questions adapted and adopted from literature. For confirmation bias, misconception of regression to the mean bias, conjunctive events bias and affect bias, questions were adopted from Enslin (2019) who derived his questions from Einhorn and Hogarth (1978), De Bondt and Thaler (1985), Joyce and Biddle (1981) and Kida et al. (2001). For overconfidence bias this study used several measures adapted from Gort (2009) and Benoît et al. (2015). Refer to Appendix 1 for further detail on how biases were measured from the literature stated.

3.2. Sample and data collection

The target population consists of financial professionals who are members of an accredited professional body, signified by their accreditation with either the IAASB or the ACCA or both. This include individuals who had completed their post-graduate qualification and were gaining work experience to complete the professional examinations of either the IAASB and/or the ACCA to receive a professional certification. Financial professionals that form part of these international bodies are expected to apply professional skepticism in their judgement and financial decision-making. A total of 460 responses were returned and after missing data was removed, the final sample consisted of 298 respondents. The sample size is large enough to meet the requirements of the statistical models used in this study (Newsom, 2018). This is discussed further in Section 3.4.2.

Of the 298 respondents 52 % were male and 48 % were female. The age groups 22–30 (48 %) and 31–40 (40 %) account for the largest portion in the sample. From a qualification perspective, 216 (73 %) of the respondents were qualified with the South African Institute of Chartered Accountants (SAICA) with 72 (24 %) of respondents doing their three-year training experience within a SAICA accredited office. A limitation of this study may be the generalisability of the results as it was done among financial professionals in a single country namely South Africa and primarily accredited by SAICA.

An application for ethical clearance for the study, including the contents of the questionnaire, was submitted and approved by the Research and Ethics Committee of the Faculty of Economic and Management Sciences at the University of Pretoria, protocol number: EMS079/22.

3.3. Data processing

To ensure quality and validity of data collected, data was cleaned to address any omissions and errors, with particular attention given to numerical responses given by respondents. The time taken by each respondent to complete the questionnaire was also considered and no irregularities were noted. To further mitigate the possibility of non-response bias, a wave analysis was performed comparing the responses of the early and late respondents. No significant differences were noted. These steps collectively contribute to the reliability and integrity of the dataset.

3.4. Research method

A multivariate statistical data analysis is required given several separate relationships that is tested for the set of bias-dependent variables. There is a wide range of multivariate techniques to choose from when the main dependent variable is binary in nature. These include binary logistic regressions, probit regressions or structural equation modelling (SEM). SEM has been chosen for this study due to this statistical technique having many advantages over similar techniques such as regressions. Collier (2020) highlights the following three advantages to use SEM over regression techniques. Firstly, SEM simultaneously estimates the influence of multiple independent variables on one, or more than one, dependent variables. Secondly, SEM explicitly models and corrects for measurement error in latent constructs by incorporating multiple observed indicators per latent variable, while regression assumes variables are measured without error, which can bias parameter estimates in this case (Bollen, 1989). Lastly, SEM tests an entire model which may consist of multiple paths instead of testing individual relationships at a time.

3.4.1. Measurement model

A confirmatory factor analysis (CFA) was adopted as the measurement model in this study to measure the latent constructs of the professional skepticism trait and personality traits[2]. The professional skepticism (PS) trait latent variable is made up of a further six latent variables namely: questioning mind (QM), suspension of judgement (SOJ), search for knowledge (SFK), interpersonal understanding (IU), self-determining (SD) and self-confidence (SC). The measurement model's validity is first assessed through assessing model fit. Thereafter, construct validity is assessed using both convergent and discriminant validity. Amos version 28 software is used for measurement model testing. Model fit was confirmed, and the detailed results are reported in Appendix 2.

3.4.2. Structural model

From the various existing SEM techniques, this study adopted a structural path model, using a diagonally weighted least squares (DWLS) estimation approach using the Mplus statistical modelling program, version 8.10. A DWLS approach was chosen over the more familiar maximum likelihood (ML) estimation approach due to the dependent variable being binary in nature ((Muthén and Muthén, 2017; Newsom, 2010, 2018). The SEM is used to test the relationship between the dependent variable and various independent variables. The dependent variable is the decision-making biases, and the independent variables consist of professional skepticism as a trait, gender, age, experience and personality traits. Different sample size guidance is given by literature when using SEM ranging from 200 (Garver and Mentzer, 1999) to 300 (Bacon, 2001; Newsom, 2018; Tabachnick et al., 2007; Worthington and Whittaker, 2006). The sample in the present study of 298 is deemed appropriate for the use of SEM.

Based on the theoretical foundation and the measurement structure of professional skepticism as a latent variable, this study included six sub-constructs: QM, SOJ, SFK, IU, SD and SC. Both a first order model and second order model representation of the skepticism trait were tested. The required threshold for the target coefficient ratio of 0.9 was met to use a second order model representation (Hong and Thong, 2013). Fig. 1 displays the first order representation where the six constructs of skepticism is measured against the bias-dependent variable.

Table 1 reports the findings of the final set of fit indices (i.e., values established after model respecification[3] was considered) of the SEM which are satisfactory, except for CFI, IFI and SRMR. For CFI and IFI values between 0.8 and 0.9 still confirms marginal fit for the use in a statistical model (Halim et al.,2018). For SRMR, values between 0.08 and 0.1 is still deemed acceptable (Kock, 2020). However, for the SRMR of confirmation bias which exceeds 0.1, Hu and Bentler (1999) argue that if all other goodness-of-fit thresholds are met, model fit can be accepted. Lai and Green (2016) support this view as their study argues that one need not disregard a model if only one fit index does not meet the required threshold. Maydeu-Olivares et al. (2018) has also concluded that with estimation models other than Maximum Likelihood, SRMR may be too sensitive measure to use to confirm model fit.

Due to scaling issues among continuous independent variables, Mplus encountered convergence problems when analyzing overconfidence bias (OB). Instead of converting these variables to categorical ones, a multinomial logistic regression was employed for this bias in SPSS to analyze the professional skepticism trait and personality traits in a similar manner to SEM (Muthén and Muthén, 2017). The multinomial logistic regression was conducted using SPSS on the composite, factor-based variables for the professional skepticism trait and personality traits.

4. Results

4.1. Descriptive statistics

This section displays the descriptive statistics for both the decision-making biases as well as professional skepticism and its related constructs.

Table 2 below displays the sample's susceptibility to the five

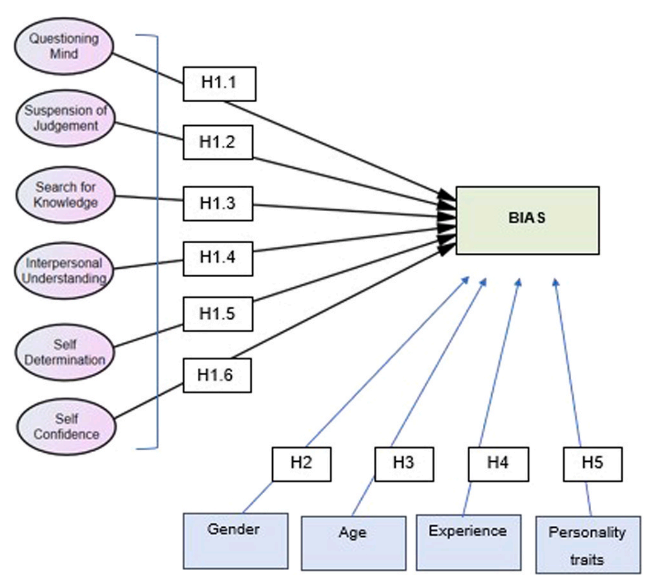

Fig. 1. First order structural model. The oval shapes represent the six latent variables used to measure the main independent variable of this study, professional skepticism. The four rectangle shapes represent the other independent variables.

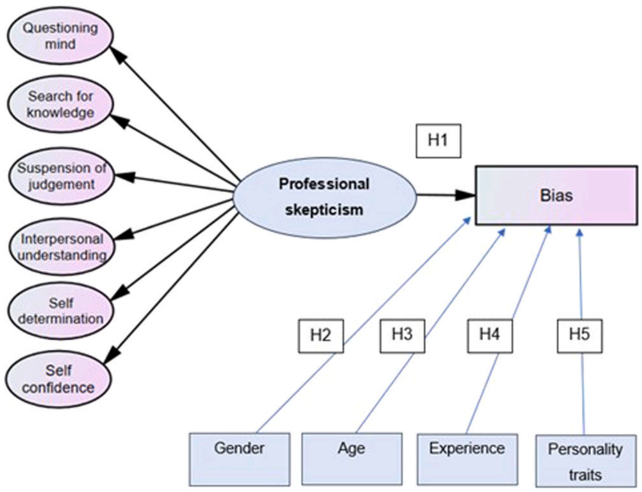

Fig. 2. Second order structural model. The oval represents a single latent variable used to measure professional skepticism. In this model, the six latent constructs are used to measure the single latent variable for professional skepticism.

Table 1
Fit indices for structural model.

Bias	CMIN/DF	RMSEA	CFI	IFI	SRMR
Second order structural model					
CB	1.310	0.037	0.897	0.887	**0.117**
MRB	1.441	0.039	0.888	0.878	0.099
CEB	1.401	0.037	0.894	0.894	0.100
AB	1.426	0.038	0.892	0.883	0.099
First order structural model					
CB	1.325	0.037	0.893	0.877	**0.112**
MRB	1.367	0.035	0.911	0.899	0.095
CEB	1.337	0.034	0.914	0.902	0.100
AB	1.362	0.035	0.913	0.900	0.095
Good fit	< 3	≤ 0.05	> 0.95	> 0.95	≤0.08
Acceptable fit		Between 0.05 and 0.08	Between 0.95 and 0.9	Between 0.95 and 0.9	Between 0.08 and 0.1
Marginal fit		Between 0.08 and 0.1	Between 0.9 and 0.8	Between 0.9 and 0.8	

CB = Confirmation bias; MRB = Misconception of regression to the mean bias; CEB = Conjunctive events bias; AB = Affect bias
Source: Own compilation

decision-making biases assessed in this study. For all biases, except affect bias, more than half of the sample showcased a prevalence for these biases.

Table 3 provides a total overview of the sample's skepticism levels and additionally provides a breakdown between the fully certified participants and trainees studying for certification. An additional student

Table 2
Decision-making biases descriptive statistics.

Decision-making bias	Rational	Bias
Confirmation bias	21 %	79 %
Misconception of regression to the mean bias	37 %	63 %
Conjunctive events bias (anchoring)	26 %	74 %
Overconfidence bias	28 %	24 %*
		48 %**
Affect bias	55 %	45 %

Source: Own compilation
* Portion of participants who underplaced themselves.
** Portion of participants who overplaced themselves.

Table 3
Professional skepticism descriptive statistics.

	Total	SAICA	Trainee	Student
n	***288***	***216***	***72***	***125***
PS	**140.65**	**141.45**	**138.10**	**137.20**
QM	22.70	22.80	22.37	21.94
SOJ	23.39	23.39	22.97	**24.45**
SFK	25.14	25.42	24.23	24.23
IU	23.57	23.63	23.38	23.04
SD	21.62	21.53	**21.90**	20.96
SC	24.34	24.67	23.35	22.58

Source: Own compilation

sample was included, only for descriptive purposes, to showcase the change in skepticism across education and experience. The student sample consisted of third year students and was collected in the same period in which the sample for this study was collected. This cohort of students still needs to complete a post-graduate diploma in Accounting Sciences before they can commence with a three-year training experience within a SAICA accredited office.

A total score of 180 could be achieved from completing the professional skepticism scale and each construct contributed 30 to the total. The descriptive results indicate that total professional skepticism increases after education and with experience gained as the mean PS score increases from 137.20 to 141.45. These descriptive statistics support the argument of Nelson (2009) that this trait may only stabilise by the time a person starts studying or enters the provision. All constructs increased from the student to the SAICA certified sample except for suspension of judgement and self-determining. The difference between each sample was not statistically tested as this was not the main scope of the present study. The descriptive statistics in this study showcase that education and experience may play a role in elevating skepticism levels.

4.2. *Results regarding the relationship between professional skepticism and biases*

Table 4 and Table 5 show the results for Hypothesis 1 and reveal support for 5 out of the 35 hypotheses. These findings can be understood through analyzing the characteristics of the constructs in more detail as well as through combined lenses of dual processing, cognitive load, and information processing theories.

For the overall professional skepticism trait construct no statistically significant relationship was found. Professional skepticism is made up of several distinct constructs, however, these results reveal that when the characteristics of these constructs are analyzed, they do not impact decision-making in the same way. When considering the decision-making theories discussed in the literature review, new insights emerge into some constructs requiring deeper processing and analytical thinking, engaging in System 2 thinking. In contrast, other constructs may increase the cognitive load of the decision-maker resulting in less rational thinking. Through combining these constructs and assessing professional skepticism in its entirety, the important differences of the constructs are not exposed (Koch et al., 2016).

For the evidence related construct of the professional skepticism trait (***questioning mind, suspension of judgement and search for knowledge***), the findings firstly reveal that questioning mind has a statistically significant negative relationship with conjunctive events bias ($H_{1.1c}$, $\beta = -0.40$, $p = .050$). For suspension of judgement and search for knowledge a statistically significant positive relationship with underplacement ($H_{1.2d}$, $\beta = 0.131$, $p = .006$ and $Exp(\beta) = 1.140$) and misconception of regression to the mean bias ($H_{1.3b}$, $\beta = 0.28$, $p = .010$) was revealed, respectively.

Results reveal having a *questioning mindset* makes an individual less susceptible to conjunctive events bias. To interpret the negative relationship between questioning mind and conjunctive events bias, it is noted that the trait of possessing a questioning mind is characterised as

Table 4
Results of Hypothesis 1 testing.

Latent variable	Hypothesis	CB (H_{1a})		MRB (H_{1b})		CEB (H_{1c})		AB (H_{1e})		Hypothesis supported
		Path Coeff	Std error	Path Coeff	Std error	Path Coeff	Std error	Path Coeff	Std error	
	Second order model									
PS	H_1	−0.03	0.11	−0.05	0.09	−0.11	0.10	−0.12	0.09	
	First order model									
QM	$H_{1.1}$	0.30	0.39	−0.15	0.18	**−0.40***[a]	0.20	0.17	0.31	$H_{1.1c}$
SOJ	$H_{1.2}$	0.14	0.15	0.14	0.10	−0.15	0.10	0.10	0.31	
SFK	$H_{1.3}$	−0.10	0.12	**0.28****[a]	0.11	0.06	0.12	0.10	0.23	$H_{1.3b}$
IU	$H_{1.4}$	0.19	0.16	−0.00	0.12	0.12	0.11	0.11	0.71	
SD	$H_{1.5}$	−0.25	0.27	−0.04	0.13	**0.40****[a]	0.16	0.13	0.23	$H_{1.5c}$
SC	$H_{1.6}$	0.20	0.16	0.17	0.13	0.12	0.14	0.13	0.30	

"A" Significant at a 10 % level of significance ($p < 0.1$);
*Significant at a 5 % level of significance ($p < 0.05$);
**Significant at a 1 % level of significance ($p < 0.01$);
***Significance at a 0.1 % level of significance ($p < 0.001$);
[a]Two-tailed test;
[b]One-tailed test
Source: Own compilation

Table 5
Results of Hypothesis 1 testing (overconfidence bias).

Category	Variable	Hypothesis	β	Std error	Significance	Exp(β)	Hypothesis supported
Overconfidence – professional skepticism composite							
0 (underplace)	PS	H_{1d}	0.007	0.012	0.544	1.007	
1(rational)	PS	H_{1d}	0.001	0.010	0.942	1.001	
Overconfidence – individual professional skepticism trait composites							
0 (underplace)	QM	$H_{1.1d}$	−0.028	0.058	0.635	0.973	
	SOJ	$H_{1.2d}$	0.131	0.048	**0.006****[a]	1.140	$H_{1.2d}$
	SFK	$H_{1.3d}$	0.022	0.049	0.650	1.022	
	IU	$H_{1.4d}$	−0.026	0.046	0.578	0.974	
	SD	$H_{1.5d}$	0.006	0.045	0.891	1.006	
	SC	$H_{1.6d}$	−0.039	0.048	0.417	0.962	
1	QM	$H_{1.1d}$	0.071	0.056	0.203	1.073	
(rational)	SOJ	$H_{1.2d}$	−0.017	0.041	0.669	0.983	
	SFK	$H_{1.3d}$	−0.057	0.043	0.192	0.945	
	IU	$H_{1.4d}$	−0.060	0.042	0.159	0.942	
	SD	$H_{1.5d}$	0.073	0.043	**0.090**[Aa]	1.076	$H_{1.5d}$
	SC	$H_{1.6d}$	−0.029	0.045	0.528	0.972	

'A' Significant at a 10 % level of significance ($p < 0.1$);
*Significant at a 5 % level of significance ($p < 0.05$);
**Significant at a 1 % level of significance ($p < 0.01$);
***Significant at a 0.1 % level of significance ($p < 0.001$);
[a]Two-tailed test;
[b]One-tailed test
Source: Own compilation

the ability to interrogate information and evidence while maintaining an element of suspicion (Hurtt, 2010), as well as being willing to challenge and critically evaluate assumptions (Cheng, 2023). This may suggest that having a questioning mind leads to the decision-maker making use of System 2 thinking which reduces bias (Koch et al., 2016). Having a questioning mindset could therefore lead one to regard initial anchors with some suspicion, and to more carefully evaluate the effect of new or additional information (e.g. the effect of additional conjunctive events on overall outcome probability).

For *suspension of judgement*, these results indicated that financial professionals were more likely to underplace themselves rather than to overplace themselves when having the suspension of judgment trait. When examining the positive relationship between suspension of judgement and underplacement bias, a person exhibiting suspension of judgement tends to withhold judgement until more information is gathered and sufficient evidence is obtained (Hurtt, 2010). Financial professionals may suspend their judgement more when they perceive a decision to be more difficult and this, in turn, affects their evaluation of their ability to make the correct decision. This aligns with the argument of Moore and Schatz (2017) that people tend to underplace themselves on tasks that they perceive to be difficult when they are uncertain about their own performance, and underplace their abilities more than they underplace the abilities of others. This suggestion is further supported in that the student sample, who would be expected to have less confidence in their professional abilities than more experienced professionals in the field, tend to exhibit more of the suspension of judgement sub-trait.

The opposite results were found for *search for knowledge* where having this trait showcased an increased susceptibility towards misconception of regression to the mean bias. While this initially seems counter intuitive, the literature associates this trait with having a curious mind to gather more knowledge *in general*, but not with the specific purpose to *verify a statement* (Hurtt, 2010). Decision-making theories help explain this finding: for IPT decision-makers seek more information, however in their search they fail to gain a deeper understanding of the information gathered. Similarly, under DPT the search for knowledge trait may invoke curiosity to gather information but not necessarily activate System 2 thinking to critically assess the information gathered. Additionally, CLT suggests that collecting too much information, without distinguishing the relevance of the information, increases cognitive load, increasing the likelihood of bias susceptibility. As a result, individuals displaying the search for knowledge trait may accept the knowledge of past performance as relevant knowledge, and do not necessarily verify it with the statistical phenomenon that past performance tend to regress back to the mean (Tversky and Kahneman, 1974).

Koch et al. (2016) were one of the first researchers that examined the relationship between the evidence related construct (which encompasses questioning mind, suspension of judgement and search for knowledge) of the professional skepticism trait and decision-making biases and found that this aspect of the professional skepticism trait mitigated recency bias (which stems from the availability heuristic). The present study partly supports their findings: questioning mind and suspension of judgement reduced specific biases, but search for knowledge was associated with a higher susceptibility to misconception of regression to the mean bias. A plausible explanation for these differences is that the respective constructs within trait skepticism may influence biases stemming from different heuristics in different ways. However, the results also suggest that different sub-constructs of professional skepticism as a trait, specifically regarding the evidence-related sub-constructs, may have opposing effects on biases. This finding confirms the need to drill down into the composing sub-constructs of the evidence-related aspects of the skepticism trait to fully understand its relationship with biases.

For the remaining sub-constructs, namely ***interpersonal understanding, self-esteem, and self-determining***, only self-determining revealed significant relationships. A statistically significant positive relationship was revealed for conjunctive event bias ($H_{1.5c}$, $\beta = 0.401$, $p = .010$) and rationally placing your abilities compared to that of others ($H_{1.5d}$, $\beta = 0.073$, $p = .090$ and $\mathrm{Exp}(\beta) = 1.076$).

Regarding the positive relationship between self-determination and conjunctive events bias, a plausible explanation may be that the self-determining construct fosters attributes such as autonomy and independence in decision-making by not being easily influenced by others' opinions and attempts to persuade (Hurtt, 2010). In respect to biases related to the anchoring and adjustment heuristic, people tend to place too high a value on the initial anchor that they accept, which leads them then to undervalue any new information (Tversky and Kahneman, 1974). When a self-determined decision-maker anchors on an initial value, they may be overly cautious to being persuaded to adjust this initial position, based on additional information received. Consequently, additional information received which may require the initial value anchored on, may be perceived as less valuable than it in actual fact is. These individuals may then not be receptive to being persuaded to sufficiently adjust their initial anchored estimate for the new information presented.

The findings reveal a negative relationship between self-determination and overconfidence bias. Hurtt (2010) defines self-determination from the literature as being autonomous or independent of the influence of others with the specific goal of remaining objective when making a judgement. The definition therefor suggests that self-determination is not related to overconfidence in one's own ability or under confidence in the ability of others, but rather an attempt to remain free of endeavours by others to influence one's objectivity. Based on the results, self-determination can be argued to be more related to the desire to remain rational (i.e. not being influenced by others) than with overconfidence in one's abilities. An interesting avenue for future research may be to examine the possible relationship between self-determining and herding bias, as a self-determent individual, may be less inclined to be influenced to follow the actions of others (i.e., herding bias).

Overall, these results contribute significantly to the literature, given that only a limited number of studies have considered professional skepticism as a trait and its individual constructs in relation to bias in financial decision-making. The questioning mind, suspension of judgement and self-determining traits support the concept that increased skepticism leads to a reduction of certain biases and improved decision-making (Koch et al., 2016; Teye, 2023). However, contrary to expectation, the results for the search of knowledge and self-determining traits provided insights suggesting that some skepticism traits may elevate certain biases. This finding highlights the importance of considering not only the entire construct of the professional skepticism trait, but also the underlying sub-constructs that comprise it, as these can exert both positive and negative influences on decision-making biases.

The results were re-run using a probit regression technique to determine if SEM and other regression techniques yields similar results. The results yielded by the probit regression were significantly different to that of SEM which justifies a methodological contribution made by this study's use of the more robust SEM technique. Refer to Appendix 3 for the results of the probit regression.

4.3. *Results regarding the influence of other individual differences*

Each of the other individual demographic differences included in the statistical model exhibited significant relationships with some of the main variables tested. Consequently, their inclusion in the model is justified to strengthen the model. Yet, as these variables are not the main focus of the present study, their relationships are displayed and summarized in Appendix 4.

5. Conclusion

This study is exploratory in nature and the first to investigate whether professional skepticism trait, its underlying constructs, may act as a debiasing mechanism for decision-making biases. It presents critical insights into influences affecting the decision-making behavior of financial professionals. Professional skepticism is traditionally argued to be essential for countering biases, yet this study reveals nuanced findings. While higher levels of skepticism in terms of some if its sub-constructs are found to reduce susceptibility to biases like, conjunctive events and overconfidence bias, other sub-constructs, such as search for knowledge and self-determining, unexpectedly heighten susceptibility to biases such as misconception of regression to the mean and conjunctive events.

These findings highlight that different sub-constructs of skepticism may affect cognitive engagement differently. Depending on the task and type of bias, different cognitive mechanisms are at work which can either reduce or elevate bias susceptibility. Biases such as overconfidence stem from more intuitive heuristics which requires more deliberate traits such as self-determination to mitigate the bias. The self-determining trait however poses a threat to other biases such as conjunctive event bias where decision-makers may not be easily persuaded to change their judgement when they consider their initial judgement to be sound. However, having a questioning mind in this instance overcomes the susceptibility to conjunctive event bias as this trait requires the decision-maker to critical evaluate the additional information gained.

Findings of the present study further highlight that evidence-based constructs such as search for knowledge and suspension of judgement, elevates cognitive demand through the ongoing search for information and suspension of concluding on information received. Overloading the decision-maker with information and uncertainty may reduce rational thinking in some instances. Professional skepticism continues to be beneficial for decision-making, but these results challenge conventional assumptions and highlights the complexity of the role that skepticism plays in decision-making.

Despite the emphasis that the ACCA, the IAASB, the IFAC and the IESBA place on professional skepticism, the skepticism trait had no relationship with any of the five biases investigated in this study. However, specific sub-constructs of the skepticism trait had several significant relationships with some of the biases investigated. Yet, this was not observed for all biases, further highlighting the need for deeper exploration into how these constructs influence decision-making. These findings underscore the importance of understanding the relationship between professional skepticism and decision-making biases to enhance the quality of judgements in the accounting environment.

5.1. Practical implications

These findings carry important practical implications for regulatory bodies such as SAICA and IRBA. Regulatory bodies can implement training and development programs to enhance different professional skepticism constructs and emphasize its impact on bias susceptibility. Regulatory standards and competency frameworks can be enhanced to acknowledge and expose decision-makers to the impact of cognitive demands and bias on different aspects of skepticism.

5.2. Future research recommendations

This study recommends several possibilities for future research. *Firstly*, future studies should expand research into other decision-making biases across other finance population to further validate the relationships found in this study. *Secondly,* from this study's findings combining skepticism traits such as critical thinking and self-determination with behavioral interventions, may suggest ways to improve decision-making outcomes. Literature in enhancing professional skepticism has proposed developing skills such as questioning mindset, curiosity, and critical thinking through both classroom education and on-the-job training, where universities and professional bodies play a key role in this development (Agrawal et al., 2021; IAESB, 2018). Based on the descriptive results for professional skepticism, there is potential to enhance skepticism levels through targeted interventions such as education and training, which should be explored further. *Lastly*, future studies should distinguish between different financial professions to examine professional skepticism across different professionals and job functions. Data from different work environments could be explored to further determine how context could shape decision-making.

5.2.1. Notes

As part of the measurement model testing conducted on the five personality traits, the findings revealed that only extraversion and neuroticism met the required criteria for validity and reliability to be included for SEM testing.

A CFA for the personality trait constructs were performed but one of the items of the conscientiousness personality trait displayed large deviations from normality, so it was decided to run the CFA using the asymptotic free distribution free (ADF) estimation method rather than the maximum likelihood estimation (Newsom, 2018). The results displayed an inadmissible solution, due to a negative error variance. Based on these results, a CFA was not considered an appropriate instrument for the present study's sample context. Hence, an exploratory factor analysis (EFA) was performed, using principal axis. Based on the results of the EFA, only two traits met the required standard factor loadings, reliability and discriminant validity thresholds.

The first set of fit indices for the SEM did not meet all the required thresholds for an acceptable model fit. The model output was therefore inspected with reference to standardized model results, and residual error variances with a high modification index. Two areas for respecification were identified. Firstly, variables with factor loadings below 0.5 identified in the standardized model results were deleted (Chin, 1998). Secondly, a review of the model modification indices was performed to identify residual covariances with a high modification index. Two residual covariances with the highest modification indices were identified between extraversion and self-confidence and neuroticism and self-confidence, exceeding a modification index of 75 for the second order model only. These covariances were added in each of the second order models.

In the multinomial regression performed for overconfidence, the trait of professional skepticism together with the six sub-constructs are treated as a composite variable.

CRediT authorship contribution statement

We confirm that this manuscript is original, has not been published previously, and is not currently under consideration by any other journal. All authors have contributed significantly to the work, have reviewed the final manuscript, and agree with its submission. No conflicts of interest are declared.

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CRediT authorship contribution statement

Enslin Zack: Supervision, Writing – review & editing. **De Klerk Charisa:** Validation, Project administration, Formal analysis, Conceptualization, Writing – original draft, Resources, Methodology, Data curation. **Hall John:** Supervision, Writing – review & editing.

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Appendix 1

Table 6 below reveals the measurement of each of the five decision-making biases considered in this study.

Table 6
Summary measurement of decision-making biases

Decision-making bias	Literature	Measure of bias
Confirmation bias	Einhorn and Hogarth (1978); Enslin (2019)	The question adopted from literature requests participants to choose the minimum information they would require to accept or reject a statement. Only if participants selected the correct pieces of information were they considered rational.
Misconception of regression to the mean bias	De Bondt (2020); De Bondt and Thaler (1985); Enslin (2019)	The question adopted from literature required participants to choose between two investment scenarios. The first investment outperformed the other investment in recent past and were correctly priced higher whereas the second investment performed worst that other investments in recent past and was correctly priced lower than other investments. If participants selected the higher priced investment, they were prone to regression back to the mean bias.

(continued on next page)

Table 6 (*continued*)

Decision-making bias	Literature	Measure of bias
Conjunctive event bias	Joyce and Biddle (1981); Enslin (2019)	Participants were required to decide on whether, or not, to acquire a business. Based on additional information given the participants were assessed on whether they made overly conservative adjustments on the probability of the investment taking place. Only if a participant selected a range between 50 % and 60 % were they considered rational.
Overconfidence bias	Gort (2009); Benoît et al. (2015)	Over confidence was measured as a combined measure using three questions. If participants were biased for two of the three measures questions, they were considered biased. Question 1 was a general measure of bias in which a participant compared themselves against other financial professionals. Question 2 and 3 provided participants with easy, unfamiliar quizzes. Participants were asked to provide their confidence level, before and after taking the quiz, in how well they will perform against other financial professionals taking the quiz. The participants' actual placement based on their performance in the quiz is then compared to where they placed themselves before and after the quiz to determine whether they are rational regarding their placement or whether they overplaced or underplaced themselves.
Affect bias	Kida et al. (2001); Enslin (2019)	Participants were given a choice between two investments where an affective response was embedded in one of the two investments. The investments with the higher return embedded the affective information. Therefore, if the participant chose the investment which did not embed the affective information, they were considered prone to affect bias.

Appendix 2. Measurement model testing

Model fit statistic results indicated good fit indices, with the CMIN/DF (1.709) below 3 (Kline, 2016), the RMSEA (0.049) below 0.05, and the SRMR (0.062) less than 0.08 (Hu and Bentler, 1999). The results for the CFI (0.931) and the IFI (0.932) were within an acceptable fit range (Hu and Bentler, 1999). Convergent validity is measured by considering standardised factor loadings, reliability measures such as Cronbach's alpha (CA) and composite reliability (CR), and the average variance extracted (AVE) (Hair et al., 2009). All factor loadings exceeded the 0.4 threshold in line with the research studies performed by Hurtt (2010) and Koch et al. (2016). Table 1 displays the values for CA, CR and AVE for each respective sub-construct.

Table 7
Convergent validity for measurement model

Constructs and statements	CA	CR	AVE
Questioning mind	0.71	0.73	0.37
Suspension of judgement	0.78	0.81	0.46
Search for knowledge	0.90	0.90	0.65
Interpersonal understanding	0.80	0.82	0.50
Self-determining	0.88	0.89	0.61
Self-confidence	0.79	0.79	0.45

Source: Own compilation

All CA and CR values are above the recommended level of 0.7 (Bagozzi and Yi, 2012; DeVellis, 1991); and 0.6 (Hair et al., 2009; Psailla and Wagner, 2007), respectively. A minimum AVE value of 0.5 is required to show that the indicators converge to measure a single concept (Collier, 2020) and only SFK, IU, and SD met the required 0.5 threshold. However, studies have supported an AVE value lower than 0.5, if a minimum CR of 0.6 is achieved (Hair et al., 2009; Psailla and Wagner, 2007). The constructs for QM, SOJ and SC all met the CR threshold of 0.6 and therefore convergent validity was confirmed. Discriminant validity was assessed using two methods: first, by ensuring correlations are lower than the square root of the AVE for each construct (Fornell and Larcker, 1981); second, by applying the Heterotrait-monotrait ratio of correlations (HTMT). While the first method showed good results except between QM and SD, the HTMT method confirmed discriminant validity between all construct pairs (Henseler et al., 2015).

Appendix 3. Probit regression results

The probit regression was performed to determine whether this statistical technique yields the same results as SEM. For the probit regression the latent variables such as professional skepticism and the six related constructs are measured as composite variables. Overconfidence bias was not included in this statistical analysis as this bias-dependent variable in this study was not performed in SEM as a multinomial logistic regression was employed.

Table 8
Probit regression results of Hypothesis 1 testing

Composite variable	Hypothesis	CB (H_{1a})		MRB (H_{1b})		CEB (H_{1c})		AB (H_{1e})		Hypothesis supported
		Estimate	Std error	Estimate	Std error	Estimate	Std error	Estimate	Std error	
Professional skepticism trait composite										
PS	H_1									
Individual professional skepticism trait composites										
QM	$H_{1.1}$	**−0.076****	0.033	−0.040	0.028	−0.040	0.031	−0.028	0.028	$H_{1.1a}$
SOJ	$H_{1.2}$	0.001	0.024	−0.015	0.021	0.029	0.024	−0.035	0.022	
SFK	$H_{1.3}$	0.042	0.029	0.019	0.023	−0.007	0.025	**0.047****	0.023	$H_{1.3e}$
IU	$H_{1.4}$	0.005	0.025	0.013	0.022	0.013	0.023	0.000	0.022	

(*continued on next page*)

Table 8 (*continued*)

Composite variable	Hypothesis	CB (H_{1a})		MRB (H_{1b})		CEB (H_{1c})		AB (H_{1e})		Hypothesis supported
		Estimate	Std error	Estimate	Std error	Estimate	Std error	Estimate	Std error	
SD	$H_{1.5}$	**0.068****	0.027	0.011	0.022	**0.046***	0.024	0.032	0.022	$H_{1.5a}$ $H_{1.5c}$
SC	$H_{1.6}$	−0.015	0.027	−0.026	0.024	−0.018	0.025	0.022	0.024	

"A" Significant at a 10 % level of significance ($p < 0.1$);
*Significant at a 5 % level of significance ($p < 0.05$);
**Significant at a 1 % level of significance ($p < 0.01$);
***Significance at a 0.1 % level of significance ($p < 0.001$);
[a]Two-tailed test;
[b]One-tailed test
Source: Own compilation

From Table 8 the results revealed using the probit regression indicated different significant relationships between the constructs and decision-making biases compared to SEM. Only one overlapping relationship is found between self-determination and conjunctive event bias. These results further confirm the methodological contribution of this study using a more advanced statistical technique which takes measurement error into account. Results obtained using SEM are a more accurate reflection of the relationships found.

From Table 9 the results for the relationship between the individual differences and decision-making biases again yielded different results. However, for these observed variables some overlaps were noted especially for key decision-making experience and confirmation bias as well as neuroticism and affect bias.

Table 9
Probit regression results of hypothesis 2–5 testing

	Hypothesis	CB (H_{1a})		MRB (H_{1b})		CEB (H_{1c})		AB (H_{1e})		Hypothesis supported
		Estimate	Std error	Estimate	Std error	Estimate	Std error	Estimate	Std error	
Professional skepticism trait composite										
Age	$H_{3a, b, c, e}$	0.015	0.030	−0.024	0.020	−0.015	0.029	−0.016	0.021	
Experience	$H_{4.1\ a, b, c, e}$	0.009	0.029	−0.002	0.020	−0.033	0.032	−0.001	0.021	
Decision-making experience	$H_{4.2\ a, b, c, e}$	**−0.082***[a]	0.035	**0.047**[Aa]	0.026	0.033	0.031	0.023	0.025	$H_{4.2\ a, b}$
Extraversion	$H_{5.1\ a, b, c, e}$	−0.042	0.064	0.021	0.057	−0.052	0.060	−0.069	0.056	
Neuroticism	$H_{5.2\ a, b, c, e}$	0.081	0.084	0.082	0.075	0.125	0.083	**0.169***[a]	0.074	$H_{5.2\ e}$
Individual professional skepticism trait composites										
Age	$H_{3a, b, c, e}$	0.017	0.030	−0.021	0.020	−0.019	0.028	−0.012	0.020	
Experience	$H_{4.1\ a, b, c, e}$	0.008	0.029	−0.004	0.020	−0.035	0.031	0.002	0.021	
Decision-making experience	$H_{4.2\ a, b, c, e}$	**−0.085***[a]	0.033	**0.044**[Aa]	0.026	0.040	0.031	0.014	0.025	$H_{4.2\ a, b,}$
Extraversion	$H_{5.1\ a, b, c, e}$	−0.033	0.056	0.020	0.050	−0.071	0.053	−0.023	0.049	
Neuroticism	$H_{5.2\ a, b, c, e}$	0.095	0.078	0.068	0.069	0.110	0.078	**0.216****[a]	0.069	$H_{5.2e}$

'A' Significant at a 10 % level of significance ($p < .1$);
*Significant at a 5 % level of significance ($p < .05$);
**Significant at a 1 % level of significance ($p < .01$);
***Significant at a 0.1 % level of significance ($p < .001$);
[a]Two-tailed test;
[b]One-tailed test
Source: Own compilation

Appendix 4. Results of hypothesis 2–5 testing

The supporting hypotheses are summarized below, and the related results presented in Table 10.

Table 10
Hypotheses 2–5

Individual difference	Hypothesis number	Hypothesis developed
Gender	Hypothesis 2	A relationship exists between gender and confirmation bias (H_{2a}), misconception of regression to the mean bias (H_{2b}), conjunctive events bias (H_{2c}), overconfidence bias (H_{2d}) and affect bias (H_{2e}) in the financial decision-making of financial professionals.
Age	Hypothesis 3	A relationship exists between age and confirmation bias (H_{3a}), misconception of regression to the mean bias (H_{3b}), conjunctive events bias (H_{3c}), overconfidence bias (H_{3d}) and affect bias (H_{3e}) in the financial decision-making of financial professionals.
General experience	Hypothesis 4.1	A relationship exists between the level of general experience and confirmation bias ($H_{4.1a}$), misconception of regression to the mean bias ($H_{4.1b}$), conjunctive events bias ($H_{4.1c}$), overconfidence bias ($H_{4.1d}$) and affect bias ($H_{4.1e}$) in the financial decision-making of financial professionals.
Key decision-making experience	Hypothesis 4.2	A relationship exists between the level of key decision-making experience and confirmation bias ($H_{4.2a}$), misconception of regression to the mean bias ($H_{4.2b}$), conjunctive events bias ($H_{4.2c}$), overconfidence bias ($H_{4.2d}$) and affect bias ($H_{4.2e}$) in the financial decision-making of financial professionals.
Extraversion	Hypothesis 5.1	A relationship exists between extraversion and confirmation bias ($H_{5.1a}$), misconception of regression to the mean bias ($H_{5.1b}$), conjunctive events bias ($H_{5.1c}$), overconfidence bias ($H_{5.1d}$) and affect bias ($H_{5.1e}$) in the financial decision-making of financial professionals.
Neuroticism	Hypothesis 5.2	A relationship exists between neuroticism and confirmation bias ($H_{5.2a}$), misconception of regression to the mean bias ($H_{5.2b}$), conjunctive events bias ($H_{5.2c}$), overconfidence bias ($H_{5.2d}$) and affect bias ($H_{5.2e}$) in the financial decision-making of financial professionals.

Source: Own compilation

Table 11
Results of hypotheses 2–5 testing

	Hypothesis	CB (H_{1a})		MRB (H_{1b})		CEB (H_{1c})		AB (H_{1e})		Hypothesis supported
		Path Coeff	Std error	Path Coeff	Std error	Path Coeff	Std error	Path Coeff	Std error	
Second order structural model										
Gender	$H_{2a, b, c, e}$	0.066	0.087	**0.224**^{**a}	0.071	**0.234**^{**b}	0.077	0.271	0.149	H_{2b} and H_{2c}
Age	$H_{3a, b, c, e}$	−0.080	0.301	0.156	0.141	0.074	0.295	0.002	0.020	
Experience	$H_{4.1\ a, b, c, e}$	−0.064	0.304	0.001	0.152	0.242	0.323	−0.004	0.021	
Decision-making experience	$H_{4.2\ a, b, c, e}$	**0.400**^{*a}	0.177	−0.229	0.147	−0.135	0.167	−0.004	0.021	$H_{4.2a}$
Extraversion	$H_{5.1\ a, b, c, e}$	0.053	0.109	−0.002	0.100	0.119	0.137	−0.001	0.096	
Neuroticism	$H_{5.2\ a, b, c, e}$	−0.028	0.114	0.023	0.101	0.075	0.122	**−0.298**^{**b}	0.097	$H_{5.2e}$
First order structural model										
Gender	$H_{2a, b, c, e}$	0.138	0.183	**0.224**^{**a}	0.071	**0.234**^{**b}	0.077	0.134	0.073	H_{2b} and H_{2c}
Age	$H_{3a, b, c, e}$	−0.010	0.038	0.156	0.141	0.074	0.295	0.019	0.167	
Experience	$H_{4.1\ a, b, c, e}$	−0.008	0.038	0.001	0.152	0.242	0.323	−0.036	0.175	
Decision-making experience	$H_{4.2\ a, b, c, e}$	**0.070**^{*a}	0.033	−0.229	0.147	−0.135	0.167	−0.022	0.130	$H_{4.2a}$
Extraversion	$H_{5.1\ a, b, c, e}$	0.029	0.152	0.081	0.128	**0.194**^{Ab}	0.095	0.137	0.131	$H_{5.1c}$
Neuroticism	$H_{5.2\ a, b, c, e}$	0.154	0.141	−0.076	0.108	−0.081	0.108	0.212	0.114	

'A' Significant at a 10 % level of significance ($p < .1$);
*Significant at a 5 % level of significance ($p < .05$);
**Significant at a 1 % level of significance ($p < .01$);
***Significant at a 0.1 % level of significance ($p < .001$);
[a]Two-tailed test;
[b] One-tailed test
Source: Own compilation

For *gender,* a statistically significant relationship was found between women and misconception of regression to the mean bias (H_{2b}, $\beta = 0.224$, $p = .002$), as well as conjunctive events bias (H_{2c}, $\beta = 0.234$, $p = .002$). These results do support the studies performed by Enslin (2019), Kudryavtsev and Cohen (2011) and Rajdev and Raninga (2016) regarding biases stemming from the anchoring and adjustment heuristic. Based on the corroboration of the findings of previous studies by that of the finding of this study, there are strong indications that women are more prone to biases stemming from the anchoring and adjustment heuristic compared to men. Mixed results have been reported in the literature between *age* and decision-making biases. This study found no statistically significant relationship between age and the biases tested, and therefore only aligns with the studies of Enslin (2019) (except for confirmation bias) and Sinha and Shunmugasundaram (2023) who found similar results.

Experience was measured in two ways, namely general experience and key decision-making experience. Overall, for general experience, no significant results were found. This is contrary to the literature reviewed which provided support where general experience within a specific finance domain had an influence on decision-makers susceptibility (Ateş et al., 2016; Bhattacharjee and Moreno, 2002; Chalissery et al., 2023; Henrizi et al., 2021; Ossareh et al., 2021; Tekçe et al., 2016). For key decision-making experience, two statistically significant relationships were found for confirmation bias and overconfidence bias. For confirmation bias a statistically positive relationship was found ($H_{4.2a}$, $\beta = 0.070$, $p = .034$). These findings imply that financial professionals in this study who reported higher (lower) levels of decision-making experience, showcased higher (lower) predicted probability of displaying proneness to confirmation bias in financial decision-making.

For overconfidence bias a statistically positive relationship was found for both the model using the professional skepticism trait composite ($H_{4.2d}$, $\beta = 0.136$, $p = .033$ and $\mathrm{Exp}(\beta) = 1.146$) and the model using the skepticism trait sub-construct composites ($H_{4.2d}$, $\beta = 0.149$, $p = .019$ and $\mathrm{Exp}(\beta) = 1.160$). For overconfidence bias results reveal that an increase in decision-making experience resulted in participants' being more likely to underplace themselves than to overplace themselves. In both models more decision-making experience led to lower susceptibility towards the respective bias which is contrary to prior literature findings (Ateş et al., 2016; Beatrice et al., 2021; Chalissery et al., 2023; Deaves et al., 2010; Mishra and Metilda, 2015; Prosad et al., 2015).

Finally for the personality traits, a positive relationship was identified between extraversion and conjunctive events bias (H5.1c, $\beta = 0.194$, $p = .041$) and a negative relationship was found between neuroticism and affect bias (H5.2e, $\beta = -0.298$, $p = .017$). For conjunctive events bias these findings reveal that being more extroverted is associated with being more prone to this bias, contrary to the findings of Furnham et al. (2012). Extraversion incorporates aspects such as being energetic, optimistic, sociable, and talkative (Baker et al., 2021). The findings of neuroticism being associated with lower affect bias seem to be anomalous as most studies find that being neurotic leads to people being more susceptible to affect bias (Baker et al., 2021; Khan and Abid Usman, 2021).

References

ACCA, 2017. Banishing bias? Audit, objectivity and the value of professional scepticism. ACCA Global⟨https://www.accaglobal.com/gb/en/professional-insights/global-profession/banishing-bias.html?⟩.

Agrawal, Prerana, Birt, Jacqueline, Holub, Mark, van Zyl, Warrick, 2021. Professional scepticism and the accounting classroom. Account. Educ. 30 (3), 213–233.

Ahmad, Maqsood, Shah, Syed Zulfiqar Ali, 2020. Overconfidence heuristic-driven bias in investment decision-making and performance: mediating effects of risk perception and moderating effects of financial literacy. J. Econ. Adm. Sci. 38 (1), 60–90.

Ateş, Sinem, Coşkun, Ali, Şahin, M.Abdullah, Levent Demircan, M., 2016. Impact of financial literacy on the behavioral biases of individual stock investors: evidence from borsa istanbul. Bus. Econ. Res. J. 7 (3).

Bacha, Sami, Azouzi, Mohamed Ali, 2019. How gender and emotions bias the credit Decision-Making in banking firms. J. Behav. Exp. Financ. 22, 183–191.

Bacon, L.D., 2001. Using AMOS for structural equation modeling in market research. Lynd Bacon & Associates Limited and SPSS Incorporated, Chicago, IL.

Bagozzi, Richard P., Yi, Youjae, 2012. Specification, evaluation, and interpretation of structural equation models. J. Acad. Mark. Sci. 40, 8–34.

Baker, H.Kent, Kumar, Satish, Goyal, Nisha, Gaur, Vidhu, 2019. How financial literacy and demographic variables relate to behavioral biases. Manag. Financ. 45 (1), 124–146.

Baker, H.Kent, Kumar, Satish, Goyal, Nisha, 2021. Personality traits and investor sentiment. Rev. Behav. Financ. 13 (4), 354–369.

Bazerman, Max, Moore, Don A., 2012. Judgment in Managerial Decision Making, 8 ed. John Wiley and Sons, Hoboken, NJ.

Beatrice, Vania, Murhadi, Werner Ria, Herlambang, Arif, 2021. The effect of demographic factors on behavioral biases. J. Siasat Bisnis 25 (1), 17–29.

Benoît, Jean-Pierre, Dubra, Juan, Moore, Don A., 2015. Does the Better-Than-Average effect show that people are overconfident?: two experiments. J. Eur. Econ. Assoc. 13 (2), 293–329.

Bhattacharjee, Sudip, Moreno, Kimberly, 2002. The impact of affective information on the professional judgments of more experienced and less experienced auditors. J. Behav. Decis. Mak. 15 (4), 361–377.
Bhattacharjee, Sudip, Moreno, Kimberly K., Riley, Tracey, 2012. The interplay of interpersonal affect and source reliability on Auditors' inventory judgments. Contemp. Account. Res. 29 (4), 1087–1108.
Bollen, K.A., 1989. Structural equations with latent variables. John Wiley & Sons.
Cassell, Cory A., Dearden, Stuart M., Rosser, David M., Shipman, Jonathan E., 2022. Confirmation bias and auditor risk assessments: archival evidence. Audit. A J. Pract. Theory 41 (3), 67–93.
Chalissery, Neenu, Tabash, Mosab I., Nishad, T.Mohamed, Aburezeq, Ibtehal M., Daniel, Linda Nalini, 2023. Does the Investor's trading experience reduce susceptibility to Heuristic-Driven biases? The moderating role of personality traits. J. Risk Financ. Manag. 16 (7), 325.
Charron, K.F., Lowe, D.J., 2008. Skepticism and the management accountant: insights for fraud detection. Manag. Account. Q. 9 (2), 9–15.
Cheng, Kin Chung. "Audit: Questioning Mind Vs. Asking the Right Question: A Guide for Auditors (Part 1)." (2023). ⟨https://www.linkedin.com/pulse/audit-questioning-mind-vs-asking-right-question-guide-kin-chung-cheng/?trackingId=lWwm7D3ERNSdLSiA1SckcQ%3D%3D⟩.
Chin, Wynne W., 1998. The partial least squares approach to structural equation modeling. Mod. Methods Bus. Res. 295 (2), 295–336.
Collier, Joel E., 2020. Applied structural equation modeling using amos: basic to advanced techniques. Routledge.
Cruz, Aeson Luiz Dela, Patel, Chris, Ying, Sammy, Pan, Peipei, 2020. The relevance of professional skepticism to finance Professionals' socially responsible investing decisions. J. Behav. Exp. Financ. 26, 100299.
De Bondt, W., 2020. Investor and market overreaction: a retrospective. Rev. Behav. Financ. 12 (1), 11–20. https://doi.org/10.1108/RBF-12-2019-0175.
De Bondt, Werner F.M., Thaler, Richard, 1985. Does the stock market overreact? J. Financ. 40 (3), 793–805.
De Jong, T., 2010. Cognitive load theory, educational research, and instructional design: Some food for thought. Instr. Sci. 38 (2), 105–134.
de Klerk, C., 2024. Prof. Trait Scept. Behav. Bias Decis. Mak. Financ. Prof. (Dr. Diss. Univ. Pretoria (South Afr.
Deaves, Richard, Lüders, Erik, Schröder, Michael, 2010. The dynamics of overconfidence: evidence from stock market forecasters. J. Econ. Behav. Organ. 75 (3), 402–412.
DeVellis, R.F., 1991. Scale development: theory and applications. Soc. Indic. Res. 112 (3), 497–527.
Eberhardt, Wiebke, Bruine de Bruin, Wändi, Strough, Jo.Nell, 2019. Age differences in financial decision making: the benefits of more experience and less negative emotions. J. Behav. Decis. Mak. 32 (1), 79–93.
Einhorn, Hillel J., Hogarth, Robin M., 1978. Confidence in judgment: persistence of the illusion of validity. Psychol. Rev. 85 (5), 395–416.
Ellerton, P., 2022. On critical thinking and content knowledge: a critique of the assumptions of cognitive load theory. Think. Skills Creat. 43, 100975.
Enslin, Zacharias, 2019. Behavioural aspects that influence business Decision-Making by management accounting professionals. University of Pretoria. ⟨https://www.proquest.com/dissertations-theses/behavioural-aspects-that-influence-business/docview/2901486582/se-2?accountid=14717⟩.
Enslin, Zack, 2022. Management accountants' susceptibility to overconfidence: the overplacement perspective. Rev. Behav. Financ. 15 (6), 827–845.
Eutsler, Jared, Norris, Anne E., Trompeter, Gregory M., 2018. A live simulation-based investigation: interactions with clients and their effect on audit judgment and professional skepticism. Audit. A J. Pract. Theory 37 (3), 145–162.
Fatmawati, D., Fransiska, I.P., 2018. Does accounting education affect professional skepticism and audit judgment? UKM J. Manag. 52, 221–233.
Fazekas, M., 2019. Professional scepticism and fraud. Account. South Afr. ⟨https://www.saica.co.za/Technical/Assurance/LatestdevelopmentsintheauditingprofessionAccountancySAarticles/tabid/4048/language/en-US/Default.aspx⟩.
Fehrenbacher, Dennis D., Kaplan, Steven E., Moulang, Carly, 2020. The role of accountability in reducing the impact of affective reactions on capital budgeting decisions. Manag. Account. Res. 47, 100650.
Finucane, Melissa L., Alhakami, Ali, Slovic, Paul, Johnson, Stephen M., 2000. The affect heuristic in judgments of risks and benefits. J. Behav. Decis. Mak. 13 (1), 1–17.
Fornell, Claes, Larcker, David F., 1981. Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res. 18 (1), 39–50.
Furnham, A., Boo, H.C., McClelland, A., 2012. Individual differences and the susceptibility to the influence of anchoring cues. J. Individ. Differ.
Garver, M.S., Mentzer, J.T., 1999. Logistics research methods: employing structural equation modeling to test for construct validity. J. Bus. Logist. 20 (1), 33–57.
Glover, S.M., and Prawitt, D.F. "Enhancing Auditor Rofessional Skepticism." (2013). ⟨https://www.iaasb.org/meetings/iaasb-quarterly-board-meeting-june-15-19-2015-new-york-usa⟩.
Gort, C., 2009. Overconfidence and active management: An empirical study across Swiss pension plans. J. Behav. Finance 10 (2), 69–80.
Gosling, Samuel D., Rentfrow, Peter J., Swann Jr., William B., 2003. A very brief measure of the Big-Five personality domains. J. Res. Personal. 37 (6), 504–528.
Grenier, J.H., 2017. Encouraging professional skepticism in the industry specialization era. J. Bus. Ethics 142 (2), 241–256.
Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E., 2009. Multivariate Data Analysis, 7 ed. Prentice Hall, New York.
Halim, J.K., Margaretha, S., Rahardja, C., 2018. Consumer's response to e-mail advertisement from tour and travel agency in Indonesia. Adv. Soc. Sci. Educ. Humanit. Res. 186 (15), 162–165.
Harding, Noel, Trotman, Ken T., 2017. The effect of partner communications of fraud likelihood and skeptical orientation on auditors' professional skepticism. Audit. A J. Pract. Theory 36 (2), 111–131.
Henrizi, Philipp, Himmelsbach, Dario, Hunziker, Stefan, 2021. Anchoring and adjustment effects on audit judgments: experimental evidence from Switzerland. J. Appl. Account. Res. 22 (4), 598–621.
Henseler, J., Ringle, C.M., Sarstedt, M., 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. J. Acad. Mark. Sci. 43 (1), 115–135.
Hogarth, Robin M., Einhorn, Hillel J., 1992. Order effects in belief updating: the Belief-Adjustment model. Cogn. Psychol. 24 (1), 1–55.
Hong, Weiyin, Thong, James Y.L., 2013. Internet privacy concerns: an integrated conceptualization and four empirical studies. MIS Q. 275–298.
Hu, Li-tze, Bentler, Peter M., 1999. Cut off criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct. Equ. Model. A Multidiscip. J. 6 (1), 1–55.
Hurtt, R.Kathy, 2010. Development of a scale to measure professional skepticism. Audit. A J. Pract. Theory 29 (1), 149–171.
Hurtt, R.K., Eining, M.M., Plumlee, D., 2008. An experimental examination of professional skepticism. SSRN Electron. J. https://ssrn.com/abstract=1140267.
Hurtt, R.Kathy, Brown-Liburd, Helen, Earley, Christine E., Krishnamoorthy, Ganesh, 2013. Research on auditor professional skepticism: literature synthesis and opportunities for future research. Audit. A J. Pract. Theory 32 (ement 1), 45–97.
IAASB. "IAASB Professional Skepticism Focus Feb 2019." (2019). ⟨http://www.ifac.org/publications-resources/focus-professional-skepticism⟩.
IAESB. "Exposure Draft: Proposed revisions to IESs 2, 3, 4 and 8 – Information and communcations technologies and professional skepticism." (2018).
IESBA. "Professional Skepticism - Meeting Public Expectations." (2018). ⟨https://www.saica.org.za/resources/62017⟩.
IFAC. "Towards Enhanced Professional Skepticism." (2017). ⟨https://www.iaasb.org/publications/toward-enhanced-professional-skepticism-0⟩.
Joyce, Edward J., Biddle, Gary C., 1981. Anchoring and adjustment in probabilistic inference in auditing. J. Account. Res. 19 (1), 120–145.
Kahneman, Daniel, Dan Lovallo, and Olivier Sibony. "Before you make that big decision." (2011).
Kang, Mijung, Park, Min Jae, 2019. Employees' judgment and decision making in the banking industry: the perspective of heuristics and biases. Int. J. Bank Mark. 37 (1), 382–400.
Khan, Jahanzeb, Harding, Noel, 2020. Facilitating the application of auditors' underlying skeptical disposition: the relationship between trait skepticism and basic human values. Account. Res. J. 33 (1), 34–56.
Khan, Nisar, Abid Usman, Muhammad Farooq Jan, 2021. The impact of Investor's personality traits over their investment decisions with the mediating role of financial self efficacy and emotional biases and the moderating role of need for cognition and the individual mood in Pakistan stock exchange. Multicult. Educ. 7 (8), 766–775.
Kida, Thomas E., Moreno, Kimberly K., Smith, James F., 2001. The influence of affect on managers' Capital-Budgeting decisions. Contemp. Account. Res. 18 (3), 477–494.
Kim, S., Trotman, K.T., 2015. The comparative effect of process and outcome accountability in enhancing professional scepticism. Account. Finance 55 (4), 1015–1040.
Kline, Rex B., 2016. Principles and Practice of Structural Equation Modeling, Fifth edition ed. Guilford publications, New York.
Koch, Christopher, and Jens Wüstemann. "A Review of Bias Research in Auditing: Opportunities for Integrating Experimental Psychology and Experimental Economics." *Available at SSRN 1032961* (2009).
Koch, Christopher, Annette Koehler, and Kristina Yankova. "Professional Skepticism and Auditor Judgment: Does Trait Skepticism Mitigate the Tecency Bias?" *Available at SSRN 2880653* (2016).
Kock, N., 2020. Using indicator correlation fit indices in PLS-SEM: selecting the algorithm with the best fit. Data Anal. Perspect. J. 1 (4), 1–4.
Kudryavtsev, Andrey, Cohen, Gil, 2011. Behavioral biases in economic and financial knowledge: are they the same for men and women? Adv. Manag. Appl. Econ. 1 (1), 15–52.
Lai, K., Green, S.B., 2016. The problem with having two watches: assessment of fit when RMSEA and CFI disagree. Multivar. Behav. Res. 51 (2-3), 220–239.
Larrick, R.P., 2004. Blackwell handbook of judgment and decision making. Blackwell.
Lerner, Jennifer S., Tetlock, Philip E., 1999. Accounting for the effects of accountability. Psychol. Bull. 125 (2), 255–275.
Lowies, Gert Abraham, Hall, John Henry, Cloete, Christiaan Ernst, 2016. Heuristic-driven bias in property investment decision-making in South Africa. J. Prop. Invest. Financ. 34 (1), 51–67.
Lucena, Edzana R.F. da C., Tibúrcio Silva, César Augusto, Azevedo, Yuri Gomes Paiva, 2021. The influence of cognitive ability on cognitive biases generated by the representativeness heuristic. Rev. Bus. Manag. 23 no. 1 180–205.
Maani, Kambiz E., Maharaj, Vandana, 2004. Links between systems thinking and complex decision making. Syst. Dyn. Rev. J. Syst. Dyn. Soc. 20 (1), 21–48.
Maqsood, Tayyab, Finegan, Andrew, Walker, Derek, 2004. Biases and heuristics in judgment and decision making: the dark side of tacit knowledge. Issues Inf. Sci. Inf. Technol. 1, 295–301.
Maydeu-Olivares, A., Shi, D., Rosseel, Y., 2018. Assessing fit in structural equation models: a Monte-Carlo evaluation of RMSEA versus SRMR confidence intervals and tests of close fit. Struct. Equ. Model. A Multidiscip. J. 25 (3), 389–402.
Meikle, Nathan L., Tenney, Elizabeth R., Moore, Don A., 2016. Overconfidence at work: does overconfidence survive the checks and balances of organizational life?. Res. Organ. Behav. 36, 121–134.

Merkle, Christoph, 2017. Financial overconfidence over time: foresight, hindsight, and insight of investors. J. Bank. Financ. 84, 68–87.
Milkman, Katherine L., Chugh, Dolly, Bazerman, Max H., 2009. How can decision making be improved? Perspect. Psychol. Sci. 4 (4), 379–383.
Mishra, K.C., Metilda, Mary J., 2015. A study on the impact of investment experience, gender, and level of education on overconfidence and self-attribution bias. IIMB Manag. Rev. 27 (4), 228–239.
Moore, Don A., Schatz, Derek, 2017. The three faces of overconfidence. Soc. Personal. Psychol. Compass 11 (8), e12331.
Muthén, L.K., Muthén, B.O., 2017. Mplus HTML user's guide [User Guide]. Mplus. ⟨https://www.statmodel.com/html_ug.shtml⟩.
Nelson, M.W., 2009. A model and literature review of professional skepticism in auditing. Audit.: J. Pract. Theory 28 (2), 1–34.
Newsom, J.T., 2010. Some clarifications Recomm. Fit. Indices. ⟨https://web.pdx.edu/~newsomj/semclass/⟩.
Newsom, J.T., 2018. Altern. Estim. Methods. ⟨https://web.pdx.edu/~newsomj/semclass/⟩.
Nga, Joyce K.H., Yien, Leong Ken, 2013. The influence of personality trait and demographics on financial decision making among generation Y. Young.. Consum. 14 (3), 230–243.
Ossareh, Adele, Pourjafar, Mohammad Saeed, Kopczewski, Tomasz, 2021. Cognitive biases on the Iran stock exchange: unsupervised learning approach to examining feature bundles in Investors' portfolios. Appl. Sci. 11 (22), 1–21.
Paas, F., Renkl, A., Sweller, J., 2003. Cognitive load theory and instructional design: recent developments. Educ. Psychol. 38 (1), 1–4.
Payne, E.A., Ramsay, R.J., 2005. Fraud risk assessments and auditors' professional skepticism. Manag. Audit. J. 20 (3), 321–330.
Perera, Dinuja, Chand, Parmod, Mala, Rajni, 2020. Confirmation bias in accounting judgments: the case for international financial reporting standards for small and medium-sized enterprises. Account. Financ. 60 (4), 4093–4119.
Plumlee, David, Rixom, Brett A., Rosman, Andrew J., 2012. Training auditors to think skeptically. University of Utah.
Popova, V., 2013. Exploration of skepticism, client-specific experiences, and audit judgments. Manag. Audit. J. 28 (2), 140–160.
Prosad, Jaya Mamta, Kapoor, Sujata, Sengupta, Jhumur, 2015. Behavioral biases of Indian investors: a survey of Delhi-NCR region. Qual. Res. Financ. Mark. 7 (3), 230–263.
Psailla, Giuseppe, Wagner, Roland, 2007. E-Commerce and web technologies. In: 8th International Conference, Ec-Web 2007, Regensburg, Germany, 4655. Springer.
Rajdev, Amit A., Raninga, A.M., 2016. Gender and heuristic driven biases: a review of literature. Int. J. Commer. Bus. Manag. 5 (3), 35–38.
Rose, J.M., 2007. Attention to evidence of aggressive financial reporting and intentional misstatement judgments: Effects of experience and trust. Behav. Res. Account. 19 (1), 215–229.
SAICA (South African Institute of Chartered Accountants). (2022). *SAICA Code of Professional Conduct 2022*. ⟨https://www.saica.org.za/resources⟩.
Simon, H.A., 1978. Information-processing theory of human problem solving. Erlbaum, Hillsdale, NJ, pp. 271–295.
Sinha, Aashna, Shunmugasundaram, V., 2023. Relationship between demographic factors and behavioral biases. Glob. Jounral Account. Financ. 7 1, 199–225.
Slovic, Paul, Finucane, Melissa L., Peters, Ellen, MacGregor, Donald G., 2007. The affect heuristic. Eur. J. Oper. Res. 177 (3), 1333–1352.
Stanovich, Keith E., West, Richard F., 2000. Individual differences in reasoning: implications for the rationality debate? Behav. Brain Sci. 23 (5), 645–665.
Tabachnick, B.G., Fidell, L.S., Ullman, J.B., 2007. Using multivariate statistics. Pearson Boston.
Tekçe, Bülent, Yılmaz, Neslihan, Bildik, Recep, 2016. What factors affect behavioral biases? Evidence from turkish individual stock investors. Res. Int. Bus. Financ. 37, 515–526.
Teye, P., 2023. Behavioral Biases and Nudges in Auditing (Doctoral dissertation), 3. Jean Moulin University Lyon.
Trotman, Ken T., 1998. Audit judgment Research—Issues addressed, research methods and future directions. Account. Financ. 38 (2), 115–156.
Tversky, Amos, Kahneman, Daniel, 1974. Judgment under uncertainty: heuristics and biases. science 185 (4157), 1124–1131.
Worthington, R.L., Whittaker, T.A., 2006. Scale development research: a content analysis and recommendations for best practices. Couns. Psychol. 34 (6), 806–838.
You, Xuqun, Ju, Chengting, Wang, Mo, Zhang, Baoshan, Liu, Pei, 2019. Age differences in the influence of induced negative emotion on Decision-Making: the role of emotion regulation. J. Gerontol. Ser. B 74 (5), 796–805.