PROFESSIONAL TRAIT SCEPTICISM AND BEHAVIOURAL BIAS IN DECISION-MAKING BY FINANCIAL PROFESSIONALS

by

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DECLARATION

I, Charisa de Klerk, declare that the research work reported in this thesis is my own, except where otherwise indicated and acknowledged. It is submitted for a PhD (Financial Management Sciences) at the University of Pretoria, Gauteng. This thesis has not, either in whole or in part, been submitted for a degree or diploma to any other academic institution. I further declare that all sources cited or quoted are indicated and acknowledged by means of a comprehensive list of references at the end of this document.

Signature

15 April 2024

Date

Pretoria

Signed at

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ABSTRACT

Professional scepticism has received attention from various stakeholders, such as policy-makers, regulators, practitioners, and the public, in the last few years. This interest was driven by various negative events which have been attributed to financial professionals' failure to apply professional scepticism. Such incidents have damaged the reputation of the finance profession. This study investigates the relationship between the trait of professional scepticism and decision-making biases. It further examines how possible determinants, such as gender, age, experience, and personality traits, could play a role in financial professionals' susceptibility to decision-making biases.

The study adopted an empirical research design, using a quantitative data analysis approach. Data were collected primarily through questionnaires distributed to financial professionals accredited by the International Auditing and Assurance Board (IAASB) or the Association of Chartered Certified Accountants (ACCA). Advanced statistical techniques, including structural equation modelling (SEM), were used to explore the relationship between the trait of professional scepticism and decision-making biases.

The findings show 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. There was no significant relationship between the trait of professional scepticism and these biases. However, specific constructs within the trait of professional scepticism (such as a questioning mind, suspension of judgement, the search for knowledge, and self-determining) displayed significant positive (and in some instances negative) relationships with these biases. The results reveal that determinants such as gender, experience, and personality traits (such as extraversion and neuroticism) lead to both higher and lower susceptibility to certain decision-making biases among financial professionals.

The present study contributes to the literature by providing evidence of the behavioural manifestation of the relationship between the trait of professional scepticism constructs and decision-making biases. These findings shed light on the effectiveness of some constructs of the trait of professional scepticism in making financial professionals less susceptible to decision-making biases. Conversely, instances were

also identified where certain constructs could potentially aggravate decision-making biases. The findings offer valuable insights for policy-makers, regulators, and professional bodies such as the IAASB and the ACCA, emphasising the need for a comprehensive understanding of professional scepticism and its possible implications for decision-makers in the finance profession.

Key words:

Decision-making biases; financial professionals; heuristics; professional scepticism; trait of professional scepticism

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LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Meaning
A	Agreeableness
ACCA	Association of Chartered Certified Accountants
ADF	Asymptotic distribution free
AMOS	Analysis of moment structures
AVE	Average Variance Extracted
C	Conscientiousness
CA(SA)	Chartered Accountant (South Africa)
CFA	confirmatory factor analysis
CFI	Comparative Fit Index
CMIN/DF	Chi-square statistic to the Degrees of Freedom
DWLS	Diagonally weighted least squares
E	Extraversion
EFA	Exploratory factor analysis
EUT	Expected Utility Theory
HPSS	Hurtt professional scepticism scale
HTMT	Heterotrait-monotrait ratio of the correlations
IAASB	International Auditing and Assurance Standards Board
IESBA	International Ethics Standards Board for Accountants
IIASA	Institute of Internal Auditors South Africa
IFAC	International Federation of Accountants
IFI	Incremental Fit Index
IFRS	International Financial Reporting Standards
ISA	International Standards of Auditing
IU	Interpersonal understanding
IRBA	Independent Regulatory Board for Auditors

KMO	Kaiser-Meyer Olkin
MLS	Maximum likelihood estimation
N	Neuroticism
QM	Questioning mind
O	Open to new experience
PAF	Principle axis factoring
PS	Professional scepticism
RMSEA	Root Mean Square Error of Approximation Index
SAICA	South African Institute of Chartered Accountants
SAIPA	South African Institute of Professional Accountants
SC	Self-confidence
SD	Self-determining
SEM	Structural Equation Modelling
SFK	Search for knowledge
SME	Small and Medium Enterprises
SOJ	Suspension of judgement
SPSS	Statistical Package for Social Sciences
SRMR	Standardised Root Square Mean Residual
TIPI	Ten-item personality inventory

LIST OF DEFINITIONS

Bias	A subjective and/or predisposed opinion that influences the decision process (Busenitz & Barney, 1994, p. 85) or relates to predictable tendencies caused by cognitive errors.
Decision	To take a course of action by making up one's mind about the issue at hand (Bonner, 1999, p. 385). Decisions typically follow judgements, and decision-makers are faced with a choice among various alternatives based on judgements about those alternatives.
Financial professional	Financial professional for the purposes of this study is defined as an individual involved in making key judgement and decisions, either internal or external to a business environment. This includes managers preparing financial statements, auditors providing professional judgement as part of the audit process, financial analysts making judgement about future cash flows, and accountants who use judgements when faced with measurement issues. For the purposes of this study, financial professionals need to be accredited by international bodies belonging to either the IAASB or the ACCA or both. Financial professionals that form part of these international bodies are expected to apply professional scepticism in their judgement and decision-making. This includes individuals who have completed post-graduate qualification(s) and are currently gaining work experience to complete the professional examinations of either the IAASB and/or the ACCA to receive a professional designation.
Heuristic	A rule-of-thumb or simplification strategy used by decision-makers in complex decision-making environments where there are time pressure and information constraints (Bazerman & Moore, 1994, p. 6).
Judgement	Formation of an opinion or idea about an object, event, or state (Bonner, 1999, p. 385).
Key decision-making	Decisions which can relate to strategic, financial, or operational decisions that may have a noticeable financial impact on business operations.

Professional scepticism	Professional scepticism incorporates the attributes commonly associated with being a sceptic in a professional setting that requires a particular standard of care and due diligence in the context of professional standards, regulation, oversight, litigation, negotiation, evidence collection and evaluation, professional judgement, complex business transactions, varying incentives and motives, rationalisation, and so forth (Glover & Prawitt, 2013, p. 2).
Professional trait scepticism	Multi-dimensional characteristics of scepticism which combine to determine one's level of trait scepticism, which, in turn, influences one to behave in certain ways (Hurtt, 2010, p. 165). Throughout the present study this is referred to as the trait of professional scepticism or professional scepticism as a trait.

CHAPTER 1:
INTRODUCTION

1.1 BACKGROUND

In the last few years, professional scepticism has received considerable attention from various stakeholders, such as policy-makers, regulators, practitioners and the public (Association of Chartered Certified Accountants [ACCA], 2017, p. 5). This interest is driven by several negative occurrences that have been attributed to financial professionals' failure to apply sufficient professional scepticism over the last few decades, both globally and in the South African audit and commercial industries environment, damaging the reputation of the finance profession. A recurring global concern is that auditors have struggled to apply professional scepticism appropriately in their judgements and decision-making (Glover & Prawitt, 2013, p. 2). Hence, Cruz et al. (2020, p. 1) argues that financial professionals face an increasingly complex financial and social environment, which requires them to sharpen their professional scepticism when they need to make judgements and decisions. The reality is that judgements of and the decisions made with regard to financial information are not always of high quality, because decision-makers display bias in complex decision-making environments (Bhattacharjee & Moreno, 2002; Joyce & Biddle, 1981; Koch et al., 2016; Koch & Wüstemann, 2009; Tversky & Kahneman, 1974). The aim of the present study is to investigate whether professional scepticism has a relationship with bias in financial decision-making.

Professional scepticism has been identified as the single most important aspect needed to enhance audit quality (International Auditing and Assurance Standards Board [IAASB], 2019, p. 1). Glover and Prawitt (2013, p. 2) argue that professional scepticism is an important aspect in making high-quality judgements, but they point out that it is only one component to exercising sound professional judgement. The importance of professional scepticism in the financial decision-making environment is also emphasised by Hurtt et al. (2013, p. 46), Koch et al. (2016, p. 2) and prominent professional accounting bodies such as the International Federation of Accountants (IFAC, 2017, p. 3). Even though professional scepticism is seen as an important aspect within decision-making, the present study acknowledges that professional scepticism can be influenced by knowledge, traits,

incentives and environmental factors (Hurtt et al., 2013; Nelson, 2009). However, this aspect is not being investigated in the present study.

When defining professional scepticism, the academic literature has been inconsistent about whether it should be seen as a trait or a set of skills and behaviours that can be taught over time (Hurtt et al., 2013; Plumlee et al., 2012). In the present study, professional scepticism is defined as those "attributes commonly associated with being a sceptic 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 judgement, complex business transactions, varying incentives and motives, rationalisation, and so forth". A trait is defined as "a relatively stable, enduring aspect of an individual" and a state as "a temporary condition aroused by situational variables" (Hurtt, 2010, p. 150). The present study therefore chooses to define professional scepticism as a trait, in line with Hurtt (2010), and to focus on the trait of scepticism as a stable characteristic of an individual.

Judgement and decision-making have been researched for decades, resulting in multiple studies on the topic (Ashton & Ashton, 1995; Joyce & Biddle, 1981; Nelson & Tan, 2005; Parker et al., 2008; Simon, 1957; Solomon & Trotman, 2003; Tversky & Kahneman, 1974; Von Neumann & Morgenstern, 1947). In the finance environment, the judgement and decision-making continues to be one of the most relevant areas of research, because of the ongoing requirements of producers, users, auditors and regulators of financial information (ACCA, 2017, p. 9; Bonner, 1999, p. 385; Glover & Prawitt, 2013, p. 2). Tversky and Kahneman (1974, pp. 1124-1131) were some of the first to conduct research on the identification of individuals who use heuristic principles to reduce complex tasks by using simplified judgements in their decision-making process (Schwenk, 1984, p. 112). These simplification strategies can lead to good decisions, but can also lead to severe and even systematic errors (Tversky & Kahneman, 1974, p. 1124). Availability, representativeness, and anchoring and adjustment are the three foundational heuristics that their study identified. Since their seminal study, in the last few decades, more heuristics have been identified. The cognitive biases which stem from reliance on such judgemental heuristics have become a cause of concern. Chapter 2 of the present study elaborates on the biases that can arise from the use of availability, representativeness, and anchoring and adjustment heuristics.

For the purposes of this study, *judgement* refers to the formation of an opinion or idea about an object, event, or state, and a *decision* refers to taking a course of action by making up one's mind about the issue at hand (Bonner, 1999, p. 385). Decisions typically follow judgements. Then, decision-makers are faced with a choice among various alternatives, based on judgements about those alternatives. Throughout this study, the terms "heuristic" and "bias" are also used. These two terms have not been applied consistently in the academic literature. In this study, the term *heuristic* is defined as a rule of thumb or simplification strategy used by decision-makers in complex decision-making environments with time pressure and information constraints (Bazerman & Moore, 1994, p. 6). In simplified terms it refers to an efficient rule or method that people use to make quick decisions or solve problems. It is a mental shortcut that helps a person come to a decision without having to think too hard or analyse every detail. *Bias* can be defined as a subjective and/or predisposed opinion that influences the decision-making process (Busenitz & Barney, 1994, p. 85) or relates to predictable tendencies caused by cognitive errors. Heuristics is therefore seen as a simplification strategy that can lead to and induce bias in decision-makers under certain circumstances.

The susceptibility of decision-makers' judgement to biases can be attributed to cognitive limitations (Maqsood et al., 2004, p. 297). These limitations in judgement and decision-making can be corrected through changing the person, changing the task, or changing the environment (Bonner, 1999, p. 390). When the underlying causes for biases are known, it is possible to create strategies and remedies for "debiasing" (Trotman, 1998, p. 118) individuals. Biases and judgemental heuristics have been successfully partially debiased by prior researchers by training individuals, and by holding individuals accountable for their decisions (Larrick, 2004, p. 270; Lerner & Tetlock, 1999). The present research study aims to expand on the research conducted by Larrick (2004), Lerner & Tetlock (199) and Trotman (1998) by investigating other factors that can debias decision-makers. The present study specifically explores professional scepticism, and more specifically whether *trait* scepticism displays any relationship with bias in financial decision-making.

Koch et al. (2016, p. 26) have investigated specifically whether the trait of professional scepticism can mitigate bias. They found that trait scepticism, particularly its evidence-related construct, reduced *recency bias* and judgement problems. Their study considered only recency bias, and it was one of only a limited number of studies investigating this

relationship. Based on their results, it is expected that this trait may lead to less bias and improved decision-making.

The present study acknowledges that bias in financial decision-making continues to be a significant problem, often resulting from cognitive limitations and heuristic simplifications that lead to systematic errors. While previous research indicates that training and accountability may mitigate these biases, there is limited exploration of whether professional scepticism as a trait can effectively reduce such biases. The present study therefore aims to extend the research by Koch et al. (2016) to address this gap by examining the relationship between trait scepticism and bias susceptibility in financial decision-making.

1.2 PROBLEM STATEMENT

The problem that this study investigates is driven by the fact that financial professionals use heuristics, but are subject to biases, which may lead to suboptimal decision-making in certain circumstances. Decisions made by financial professionals in a business environment may have an impact on the interests of key stakeholders, such as users of financial statements, investors, policy-makers and the general public. Hence, it is important to ensure that the judgements and decisions made by financial professionals are of superior quality. Professional scepticism has been suggested to be an aspect that could improve decision-making, but thus far, there is limited empirical evidence as to whether it may also limit behavioural bias.

1.3 RESEARCH QUESTIONS

Based on the problem statement, the research objectives of the study are the following:

- to determine the most prevalent heuristics-related and other biases present in the financial decision-making behaviour of financial professionals; and
- to determine the relationship between the trait of professional scepticism and the identified heuristic-related and other biases in the financial decision-making behaviour of financial professionals.

The preceding objectives are rephrased into two main research questions, which are investigated by means of supporting hypotheses.

1.3.1 Research Question 1

Which of the most prevalent heuristic-related and other biases are present in the financial decision-making behaviour of financial professionals?

The literature acknowledges the presence of bias in the judgements and decisions made by financial decision-makers. The finance discipline is broad, covering fields such as accounting, auditing, and taxation, to name but a few. In this study, financial professionals are defined as individuals involved in making key judgements and decisions in a business environment for which professional scepticism is required. This includes managers who need to make judgements when they prepare financial statements; auditors who provide professional judgements as part of the audit process; financial analysts who make judgements about future cash flows, and accountants who use judgements when they are faced with measurement issues. The description is further defined, for the purposes of this study, to include financial professionals with a professional designation accredited by the International Auditing and Assurance Standards Board (IAASB), the Association of Chartered Certified Accountants (ACCA), or both. This includes individuals who have completed their post-graduate diplomas and who are currently gaining work experience to complete the professional examinations of either the IAASB and/or the ACCA to receive their professional designation.

In recent years, the finance profession has come under increasing scrutiny as a result of a significant number of audit failures and corporate scandals. Regulators and others in the finance profession point to audit failures and audit deficiencies as evidence that auditors are not exercising a sufficient level of scepticism (Hurtt et al., 2013, p. 46). The International Ethics Standards Board for Accountants (IESBA) has also emphasised that all accounting professionals, not only auditors, must be constantly aware of the public interest aspect of their work, and that applying professional scepticism is the first step in preserving the public interest (IESBA, 2018, p. 4).

The IAASB has identified four judgement tendencies in the auditing environment as having the most direct linkage (so far) between the IAASB's standards, and concepts from psychology (Glover & Prawitt, 2013, p. 11). These judgement tendencies are *availability and anchoring heuristics*, as well as *confirmation bias,* and *overconfidence bias*. Three of the four tendencies are rooted in the foundational heuristics outlined by Tversky and Kahneman (1974): availability, anchoring and adjustment, and confirmation bias, which stems from the

representativeness heuristic. The ACCA and other local professional accounting bodies, such as the South African Institute of Chartered Accountants (SAICA) agree that most of the heuristic-related and other biases reported above are some of the most relevant biases in the audit process (ACCA, 2017, p. 9; 2022; SAICA, 2022, p. 37). *Affect bias* has also been identified as a judgement tendency that influences financial decisions, especially in relation to auditor and management accountant judgements (Bhattacharjee & Moreno, 2002, p. 364; Bhattacharjee et al., 2012, p. 1090; Enslin, 2022; Fehrenbacher et al., 2020). The above heuristics and biases are some of the most prevalent ones in financial decision-making. Hence, the focus of the present study is on the representativeness heuristic, the anchoring and adjustments heuristic, as well as the overconfidence bias and affect bias. The heuristic-related and other biases form the basis on which Hypothesis 1 is developed:

> *Hypothesis 1*: Financial professionals are susceptible to a number of heuristic-related and other biases when they make financial decisions.

The objective of Research Question 1 is to confirm whether the financial professionals surveyed in the study are subject to bias related to using the representativeness heuristic, bias related to using the anchoring and adjustment heuristic, as well as overconfidence bias and affect bias. Prior studies have established financial professionals' susceptibility to decision-making biases, so this relationship is anticipated. Research Question 1 in this study therefore has to precede Research Question 2, as one can only measure a variable's relationship with bias susceptibility if the sample or population does indeed exhibit bias to some extent. This research question is therefore included to assist in addressing Research Question 2, the answer to the main contribution of the study.

1.3.2 Research Question 2

What is the relationship between the trait of professional scepticism and the identified heuristic-related and other biases in the financial decision-making behaviour of financial professionals?

Standard setters, regulators and academic researchers have emphasised the importance of professional scepticism in auditing (IFAC, 2017, p. 3). They regard it as fundamental to a quality audit (ACCA, 2017, p. 4; IFAC, 2017, p. 3). Moreover, the IFAC (2017, p. 5) has argued that professional scepticism is not just an important aspect in an audit environment: it should be applied by all financial professionals in making judgements and decisions. Koch

et al. (2016, p. 26) found that higher levels of the trait of professional scepticism are associated with lower levels of recency bias, but their study is one of very few to explore the relationship between professional scepticism and bias in financial decision-making. So far, too little evidence has been gathered to confirm a clear relationship between professional scepticism and bias in financial decision-making. The present study aims to expand research in this area and is thus exploratory in nature, as it investigates a relationship that has not yet been clearly defined or researched.

Research Question 2 builds on Research Question 1 by considering the same heuristic-related and other biases in the finance profession, namely *representativeness heuristics, anchoring and adjustments heuristics* as well as *overconfidence bias* and *affect bias.* This led to the development of the second hypothesis:

> *Hypothesis 2:* A relationship exists between professional scepticism as a trait and heuristic-related and other biases in the financial decision-making of financial professionals.

The next section includes a judgement and decision-making framework, adapted from Bonner (1999), which discusses the key questions every judgement and decision-making researcher should ask before a judgement and decision-making study can be completed successfully. The section identifies and supports the key research objectives, and identifies why the present study is a successful judgement and decision-making research study.

1.4 JUDGEMENT AND DECISION-MAKING FRAMEWORK

To perform successful research on judgement and decision-making in finance, close consideration must be given to identifying a true issue in judgement and decision-making that requires improvement. Bonner (1999, p. 389) developed a framework in the late 1990s to provide guidance on how to successfully conduct a study on judgement and decision-making issues in the field of finance. The key questions in the framework need to be addressed to ensure that the study is viable and can be successfully conducted.

Figure 1.1 (overleaf) displays an adapted version of the decision framework developed by Bonner (1999, p. 389). Each of the questions in the framework is then addressed with further reference to the chapters in the present study to justify why the study is a valid judgement and decision-making research study.

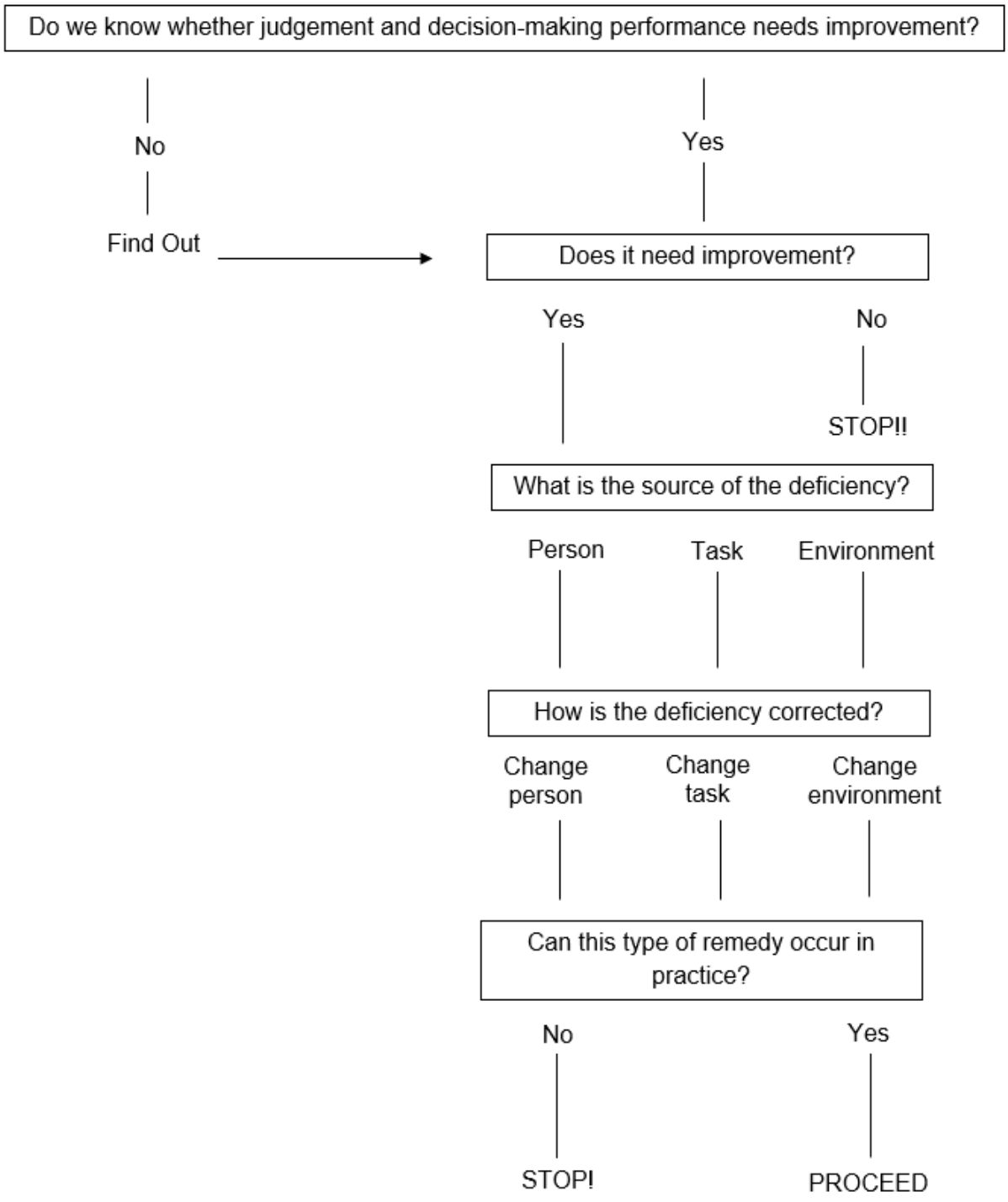


Figure 1.1: Framework for judgement and decision-making research

Source: Own compilation, adapted from Bonner (1999, p. 389)

1.4.1 Do we know whether judgement and decision-making performance needs improvement?

The first question in the framework aims to establish whether there is an existing issue that may affect judgement and decision-making. There is no point to conduct a judgement and decision-making study if the potential for some enhancement of the practice from the research is limited – a judgement and decision-making study is not worthwhile if there is little room for improvement.

In the finance environment, decision-makers use simplifying strategies during complex decision-making. Research in psychology refers to these simplification strategies used during the performance of complex tasks as heuristics (Schwenk, 1984, p. 123). Decision-makers can use either System 1 thinking, which is automatic and largely unconscious and demands little if any computational capacity, or System 2 thinking, which is considered slow, conscious, and logical, and where effort is applied (Stanovich & West, 2000, p. 659). System 1 thinking frequently leads to good decision-making, but is more susceptible to heuristics and biases (Milkman et al., 2009; Stanovich & West, 2000).

In the financial decision-making context, it is anticipated that decision-makers will not use System 1 thinking in performing complex tasks, but would rather tend to use System 2 thinking. However, research has suggested that it is difficult to maintain System 2 thinking, because of the strain it places on cognitive processes (Maani & Maharaj, 2004). Therefore, financial decision-makers also use simplified strategies (heuristics) as part of their decision-making strategy (Joyce & Biddle, 1981, p. 122; Koch & Wüstemann, 2009, p. 3).

Therefore, a judgement and decision-making issue has been identified in which improvement is required.

1.4.2 What is the source of the deficiency that requires improvement?

The next step in the framework is to identify variables that affect judgement and decision-making performance. As is shown in Figure 1.1, these variables can be classified into three categories, namely person, task, and environment variables. In this study, the focus is on a personal variable, namely heuristic-related biases which individuals (the person) use in decision-making. Even though heuristics may lead to efficient decision-making, it can be a source of deficiencies in judgement and decision-making, as it may lead to bias in

judgements and decisions when performing complex tasks. The literature supports the claims that financial decision-makers display bias in complex decision-making environments and that judgemental heuristics are the underlying cause of such bias. Both the IAASB (2019, p. 2) and the ACCA (2017, p. 9) have acknowledged the presence of multiple heuristics from which certain biases are derived, as well as of other biases that do not stem from specific heuristics. The heuristic-related and other biases considered in the present study are discussed in more detail in Chapter 2.

In this study, the focus of the main research questions is therefore one specific *person variable*, namely the use of heuristic-related and other biases in decision-making, which links to the first research question of the study (as set out in Section 1.3), namely: *Which of the most prevalent heuristics and biases are present in the financial decision-making behaviour of financial professionals?*

1.4.3 How is the deficiency corrected?

According to the framework (see Figure 1.1), the deficiency can be corrected by changing aspects of the person or individual, the task or the environment. When the underlying causes for biases are known, it is possible to create strategies and remedies for "debiasing" (Kahneman et al., 2011; Trotman, 1998, p. 118). The main research questions centre on a personal variable, specifically addressing a personal aspect of the individual known as the trait of professional scepticism. This study defines professional scepticism as a trait and not as a state. This point is elaborated in Chapter 3.

In this study the aim is to assess whether changing a characteristic or trait of a person corrects the deficiency. The person variable that the study assesses is the trait of professional scepticism and whether this individual characteristic or trait is related to different levels of the deficiency, namely the presence of heuristic-related and other biases. This links mainly with the **second research question** of the study (as set out in Section 1.3), namely: *What is the relationship between the trait of professional scepticism and the identified heuristic-related and other biases in the financial decision-making behaviour of financial professionals?*

The inclusion of professional scepticism in the study responds to the call in the studies by Koch et al. (2016) and Hurtt et al. (2013) to explore professional scepticism in the decision-making environment further. Koch et al. (2016, p. 26) investigated whether professional

scepticism can serve to mitigate bias. As already indicated in Section 1.3.2., they found that the trait of professional scepticism was associated with lower levels of recency bias and acted as a remedy to judgement problems. Given the importance attached to being professionally sceptical by regulatory bodies such as the IAASB, the ACCA and the IESBA (IESBA, 2018, p. 4), it is to be expected that possessing this trait should lead to better quality judgements, and in the context of the present study, to lower levels of bias. The study therefore explores this topic to establish whether there is a relationship between the trait of professional scepticism and bias susceptibility levels.

The study acknowledges that prior studies have identified other person variables that also influence decision-makers' susceptibility to bias in decision-making. These individual personal variables include gender, age, experience, and personality traits. These other personal variables are discussed further in Chapter 3, but are not the main focus of the study or its contribution to the literature.

Understanding which biases financial professionals are most susceptible to is an important first step in this study. Once these biases have been established, it is possible to explore how the trait of professional scepticism influences decision-makers' susceptibility to these biases. Findings on this relationship may help to determine whether there is a need to change the individual or person, or to look further into changing the task or environment.

1.4.4 Can this type of remedy occur in practice?

The last question in the framework asks whether the type of remedy that is proposed can occur in practice. If the findings confirm that there is a relationship between professional scepticism and being less susceptible to bias, attention should be paid to developing or encouraging this trait. If professional scepticism is related to decision-makers' being more susceptible to bias, the question should be raised with the regulatory bodies why they place such significance on this trait in the new auditing standards and code of ethics. If no relationship is found, it should then be considered whether other controls should not rather be emphasised to decrease bias, in an attempt to improve judgement and decision-making among financial professionals.

Additionally, awareness can be created regarding the existence of the bias(es) that a financial professional holds. The ACCA (2017, 2022) has identified creating awareness of biases as a key outcome of any bias-based research. The IFAC (2017, p. 4) has also

emphasised the importance of reinforcing and monitoring the application of professional scepticism amongst accounting professionals.

The above information has briefly addressed each of the questions identified in the adaptation of Bonner's (1999, p. 389) framework in Figure 1.1. The answers to the questions raised in the framework indicate why the present study is a valid, successful judgement and decision-making research study. The components of the framework are addressed in the following chapters:

- Chapter 2 focuses on the judgement and decision-making deficiency that has been identified, namely the heuristic-related and other biases explored in the study.
- Chapter 3 considers how the judgement and decision-making deficiency could be corrected by looking into the trait of professional scepticism and whether the presence of this trait can change, correct or influence decision-makers' bias(es). It also introduces other determinants that prior research has found to influence susceptibility to bias in decision-making.
- Chapter 4 and 5 explain in detail the research design of the study, the statistical analyses that are conducted in this research and the descriptive statistics used.
- Chapter 6 reports the results relating to whether the judgement and decision-making deficiency, heuristic-related and other biases are present in the sample of financial professionals used in the study.
- Chapter 7 reports the results regarding whether there is a relationship between the trait of professional scepticism and heuristic-related and other biases in financial decision-making by financial professionals. These findings reveal whether the personal variable, the trait of professional scepticism, displays a relationship with decision-makers' bias(es), together with other determinants such as gender, age, experience and personality traits.
- Chapter 8 presents the conclusions based on the results of the study.

1.5 IMPORTANCE AND BENEFITS OF THE STUDY

The study contributes to the literature in three main ways:

- The main contribution of the study is the identification of the presence of professional scepticism, and its detailed investigation of whether the trait of professional scepticism displays a relationship with bias in decision-making. Thus, the study provides evidence regarding the behavioural manifestation of professional scepticism. Furthermore, the

study extends this line of research by looking at the individual constructs of the trait of professional scepticism and whether these respective constructs display a relationship with bias in financial decision-making. There have only been a limited number of studies exploring this area so far.

- The results from the study may be valuable for professional accounting bodies as well as for the practice. In the last few years, professional accounting bodies such as the IAASB and the ACCA have regarded professional scepticism as a topical subject area, placing considerable emphasis on audit quality and on improving the judgement of financial professionals. This study explores whether professional scepticism is an important characteristic or trait which may have a relationship with heuristic-related and other biases when making financial decisions. The outcomes of the study can provide guidance to the IAASB and the ACCA on whether increased levels of the trait of professional scepticism can influence bias in decision-making. Furthermore, the results may suggest possible mitigating strategies for the practice, which may include either developing or encouraging professional scepticism or disregarding it as a possible debiasing strategy.
- The study also makes a substantial contribution to an understanding of the research methods to measure relationships between behavioural-related variables, compared to those used in the past. The study employs an advanced statistical technique, namely structural equation modelling (SEM), to measure the relationship(s) between professional scepticism and heuristic-related and other biases. The advantages of employing this statistical technique compared to the other techniques used in prior research are explained in detail in Chapter 4.

Given the importance that the IAASB currently attaches to auditors' exercising appropriate levels of professionally scepticism, it is expected that this trait should lead to better quality judgements. It is therefore important to understand whether professional scepticism displays a relationship with cognitive behavioural aspects such as biases in financial decision-making.

1.6 DELINEATIONS AND LIMITATIONS

1.6.1 Delineations

The study does not attempt to determine all the specific heuristics and biases that influence financial professionals' decisions. It focuses only on selected biases, some which stem from heuristics, and attempts to identify the possible relationship of these biases with professional scepticism. Therefore, the study does not aim to determine the degree to which a respondent demonstrates a specific bias, but rather to which degree a relationship exists between the trait of professional scepticism and bias.

The focus is on a sample of the population of financial professionals who use judgement in key decision-making environments. To qualify for inclusion in the study, financial professionals needed to be accredited by international bodies belonging to either the IAASB or the ACCA or both. Financial professionals that form part of these international bodies are expected to use professional scepticism in their judgement and decision-making.

The duties and responsibilities of financial professionals have been further defined in Section 1.3. The study aims to establish whether there is a relationship between the trait of professional scepticism and bias in financial professionals' decision-making. The study also includes other determinants which may increase the susceptibility of groups in this sample to bias. The results are therefore not representative of each individual financial professional, but offer an indication of the average behaviour of financial professionals as a group.

Finally, this research has been conducted on a sample of financial professionals which was limited by the number of financial professionals prepared to answer the questionnaire online, given the logistical difficulty of distributing such a questionnaire. Therefore, the results may not be generalisable to all financial professionals.

1.6.2 Limitations

The study acknowledges that it has some limitations. For the sake of transparency and to provide context to the findings reported, the following limitations should be noted:

- An online survey instrument was used, which limits a researcher's control over the circumstances in which the responses are framed. This method of data collection does, however, usually lead to larger sample sizes where the target populations for the sample are widely dispersed and difficult to reach. The bigger sample size received in return

assisted in increasing the statistical power of the statistical techniques used and the ability to detect significant effects.

- The way bias was measured was limited to the context that could be provided in an online survey instrument. The richness of the finance environment, for the defined financial professionals who participated in the study, can therefore not be captured fully, which reduces external validity.
- The online survey instrument was distributed by means of two non-probability sample methods, namely convenience sampling and snowball sampling, which may have limited diversity in data collected from the sample. The study used numerous channels to distribute the online survey to increase external validity where possible.

1.7 OUTLINE OF THIS STUDY

Chapter 1 has provided the background and rationale for the study and the research questions investigated by the study. It has explained how to successfully study judgement and decision-making issues within the financial field.

Chapter 2 describes the psychological theories relating to behavioural influences in decision-making. It therefore reviews the literature on judgement and decision-making. It also outlines the literature on heuristics and biases in the decision-making of financial professionals in the context of the study. Chapter 3 reviews the literature on professional scepticism, specifically focusing on defining professional scepticism, differentiating between scepticism as a trait versus a state. It also introduces a scale that measures the trait of professional scepticism. Furthermore, Chapter 3 discusses the four other determinants identified in the literature as having an influence on heuristic-related and other biases in decision-making.

Chapter 4 presents the research design adopted in this research study as well as details on the statistical techniques adopted to generate the results.

The results are presented in Chapters 5 to 7. Chapter 5 focuses on the results of the descriptive statistics and factor analyses. Chapter 6 presents the findings regarding bias in financial decision-making, and Chapter 7 sets out the results regarding the trait of professional scepticism and bias in financial decision-making.

Chapter 8 summarises the results of the study and presents the conclusions on the main points, reflecting on the limitations of the study and the contribution and implications of the findings. It also presents suggestions for future research.

CHAPTER 2:
BEHAVIOURAL ASPECTS
IN JUDGEMENT AND DECISION-MAKING

The decision-making theories are outline in Chapter 2 together with heuristic and bias research. Figure 2.1 illustrates a graphical representation of the information presented in this chapter.

CHAPTER 2: BEHAVIOURAL ASPECTS IN JUDGEMENT AND DECISION-MAKING
2.2 DECISION-MAKING THEORIES
2.2.1 Normative theory 2.2.2 Descriptive theories 2.2.3 Prescriptive theories
2.3 HEURISTIC AND BIAS RESEARCH
2.3.1 The representativeness heuristic 2.3.2 The availability heuristic 2.3.3 The anchoring and adjustment heuristic 2.3.4 Overconfidence bias 2.3.5 Affect bias
2.4 HEURISTICS AND THE BIAS OF FINANCE PROFESSIONALS
2.4.1 The representativeness heuristic 2.4.2 The anchoring and adjustment heuristic 2.4.3 Overconfidence bias 2.4.4 Affect bias

Figure 2.1: Outline of Chapter 2

Source: Own compilation

2.1 INTRODUCTION

This chapter discusses the psychological aspects that influence individual behaviour in judgement and decision-making. Three decision-making theories in the study of judgement and decision-making are addressed, namely normative theory, prescriptive theory, and descriptive theory. The focus then moves to the general judgement and decision-making literature, which deals with the main judgement and decision-making research studies completed in the recent decades. This chapter also identifies a list of the behavioural heuristic-related and other biases that are most prevalent in the decision-making behaviour of financial professionals. For this purpose, in the context of the present study, a definition of financial professionals is given, together with an in-depth review of the heuristic-related and other biases that are specifically considered in this study.

2.2 DECISION-MAKING THEORIES

The literature has identified various decision-making theories, among which normative theory, prescriptive theory, and descriptive theory are some of the main ones. Some authors use prescriptive and normative theory interchangeably (Bell et al., 1988) and therefore only focus on two main theories. Bazerman and Moore (2012) are some of the decision-making experts who distinguish only between two decision-making theory approaches, namely prescriptive and descriptive research. Prescriptive research mainly investigates individual decision-making models for optimal decision-making. By contrast, descriptive research investigates and describes how individual decision-makers actually make decisions. The present study briefly discusses each of the three decision-making theories.

2.2.1 Normative theory

Normative theory describes how decisions are made, based on rational approaches to solving a problem (Kahneman & Riepe, 1998). The theory assumes that decisions are made on the basis of how rational, “super” rational people should think and act (Bell et al., 1988). Bazerman and Moore (2012) have identified six steps in the rational individual decision-making process:

- Step 1: Defining the decision problem;
- Step 2: Identifying the relevant criteria upon which to base the decision;
- Step 3: Weighing the relevant criteria in terms of order of importance;
- Step 4: Generating alternative decision options with which to solve the decision problem;
- Step 5: Rating each alternative decision option on each of the relevant criteria identified in Step 2; and
- Step 6: Computing and selecting the optimal decision option.

An earlier researcher, Simon (1955) also uses traditional economic theory to state his definition of what a rational person is in the context of normative theory. In terms of this theory, Simon (1955, p. 99) argues the existence of an economic man that is both economic and rational. The economic man also has several attributes, according to which he is

assumed to have knowledge of relevant aspects surrounding his environment; he is well-organised, has a stable system of preferences and has the ability to perform calculations in respect of the alternative courses available to him to choose the course that will have the highest attainable point on his preference scale.

Based on normative theory principles, in line with which decision-makers are expected to act rationally, the Expected Utility Theory (EUT) was formulated in the early 1940s, and was made axiomatic by Von Neumann and Morgenstern (1947). Transitivity and choice maximisation are considered the key assumptions that underlie the normative and prescriptive theories (Edwards, 1954, p. 381) as they relate to logic and rationality. *Transitivity* refers to preferences that come from observing choices and summarising those choices as a ratio, proportion, or probability. For example, the statement that someone prefers A to B and B to C then implies that the same person also prefers A to C. The assumption is therefore that preferences are not exclusive (Sumpter et al., 1999, p. 237). *Choice maximisation* is applied by the economic man, who will always choose the alternative that will give him the best possible outcome (Edwards, 1954, p. 382). The study by Edwards (1954, p. 391) explains that the EUT refers to the maximum expected utility that can be achieved by maximising the expected value of the decision. The expected value for each decision option is attained by multiplying the utility from each possible outcome from the specific decision option by the probability of that outcome occurring. The option with the highest expected value should then be selected by the rational decision-maker.

The EUT has been widely used in the field of economics as a descriptive theory, but under normative theory principles, the EUT has also been used in decision-making analysis to determine optimal decisions and policies (Tversky, 1975). Multiple studies have, however, proved that under some circumstances, the assumptions of EUT are violated and people do not act as rationally as expected under the normative theory principles (Baumol, 1951; Tversky, 1969). Based on these findings, *prescriptive theories* followed which started to research what practical advice individuals can be given to make more rational decisions (Kahneman & Riepe, 1998) as well as *descriptive theories* that observe why people do not act rationally, and why they act the way that they do (Bell et al., 1988).

2.2.2 Descriptive theories

A *descriptive theory*, in contrast to a normative theory, deals with how real people actually behave and make decisions (Kahneman & Riepe, 1998) – in other words, how and why people think and act the way that they do (Bell et al., 1988). The EUT models have been firmly established by the 1950s (Von Neumann et al., 1947), but other subsequent axiomatic developments, such as the subjective expected utility ((S)EU) theories, which are descriptive models, have always been more controversial (Weber & Coskunoglu, 1990). Descriptive decision-making research dates back to the 1950s. It has shown that sub-optimal decision-making occurs in a complex decision-making environment characterised by uncertainty, where a decision-maker uses a simplified model in an attempt to make a reasonable decision (Simon, 1957). Such a simplified model can lead to acceptable decisions in some circumstances, but it can also lead to sub-optimal decision-making in other circumstances.

There is a large body of literature on why decision-makers make sub-optimal decisions. This body of research can be divided into (1) the cognitive limitations of individual information processing; (2) a restructuring of the problem representation by the decision-maker; (3) the use of heuristics or simplifying processing algorithms; and (4) the instability of preference structures (Weber & Coskunoglu, 1990). A brief description of each of these four areas of research is given below.

Simon (1955) identified constraints to the *individual's ability to process information* rationally. These constraints include a set of alternatives that are open to choice, the relationships that determine the pay-offs of the choice as a function of the alternative that is chosen, and how the preferences among pay-offs are ordered. Hogarth (1987) built on this work by Simon (1955) by distinguishing other limitations, such as selective perception of information, a sequential manner of processing, and memory capacity. Over time, decision-makers deal with such cognitive limitations by restructuring the problem representation and by using heuristics. These processing styles become automatic and are even present in situations where the decision-maker wants to implement more formal procedures, which causes these heuristics to lead to serious biases (Weber & Coskunoglu, 1990).

Restructuring the problem representation is also known as framing effects, which takes place in any natural environment (Tversky & Kahneman, 1981). Different descriptions of the same problem may result in different decisions being made by a particular decision-maker (Tversky & Kahneman, 1981).

Tversky and Kahneman (1974, p. 1124) identify the *use of heuristics* as the application of simplified processing strategies used in decision-making environments where events are uncertain. This suggests that over time decision-makers with some experience learn to recognise certain regularities in their environment, which they then use in making decisions (Weber & Coskunoglu, 1990). The foundational heuristics that were identified by Tversky and Kahneman (1974) are the representativeness, availability, and anchoring and adjustment heuristics.

The last limitation is the *instability of preference structures*. The rational preference order for a set of outcomes or alternatives should not depend on the particular method by which that set is assessed, however, this is not the case in reality. Tversky and Kahneman (1981) found that different elicitation procedures highlight different aspects of decision alternatives and may suggest different heuristics or different decision frames. These different aspects give rise to inconsistent responses when decisions are made.

About two decades later, Stanovich and West (2000) identified two systems in decision-making, which they named System 1 and System 2 thinking. System 1 thinking is considered automated, largely unconscious and undemanding of computational capacity. System 2 thinking refers to conscious analytical processing, which decision-makers employ to reach a decision, applying reasoning that is slow, conscious, effortful, explicit and logical (Milkman et al., 2009; Stanovich & West, 2000). System 1 thinking frequently leads to good decision-making, but is more susceptible to the limitations mentioned above, such as framing, heuristics and biases (Milkman et al., 2009; Stanovich & West, 2000).

Each of the elements discussed above provides background to and reasons for how rational people behave and act the way they do, as well as why they do not always follow the full rational process to solve a problem. In the present study, descriptive theories are explored in more depth in Section 2.4, looking into the cognitive limitations that heuristic-related and other biases impose on decision-makers in the finance field.

2.2.3 Prescriptive theories

Prescriptive theories build on and exploit some of the logical consequences of normative theory, by dealing with practical advice and ways to help people to make decisions more rationally (Bell et al., 1988; Kahneman & Riepe, 1998). Prescriptive decision-making research is based on the assumption that decision-makers are rational, self-interested and

focused on maximising the expected utility, as discussed under normative theory (Edwards, 1954). Descriptive theories acknowledge that even rational people do not always act rationally, because of cognitive limitations. Therefore, prescriptive theories give practical advice, which is underpinned by techniques and decision aids such as decision trees or linear programming, based on a number of normative assumptions about decision-making (Weber & Coskunoglu, 1990). As mentioned in the discussion of normative theory (Section 2.2.1), the EUT has widely been used in the field of economics as a descriptive theory (for example, to explain the relation between spending and saving, as well as the purchase of insurance). The EUT is accepted as setting out adequate principles of rational behaviour when faced with uncertainty. However, observation shows that when decision-makers have to make decisions in risky situations, their behaviour can still contradict the decision aids that are in place, and the practical advice given, because of the possibility of non-normative behaviour (Weber & Coskunoglu, 1990).

In view of the prescriptive theories, the use of the EUT has been criticised because non-normative behaviour is often noted even in the presence of decision aids. One study to express such criticism was that by Tversky (1969), who found that the transitivity assumption was violated in an experiment which found that people were not consistent in their choices when faced with repeated choices. Nevertheless, other studies have supported the EUT model and have countered Tversky's (1969) findings regarding the violation of the transitivity assumption (Regenwetter et al., 2011).

It remains unclear whether utility theory provides a reasonable approximation to the behaviour of individuals under conditions of uncertainty, and whether prescriptive theories can provide useful decision aids to make people act more rationally. In the present study, decision aids are explored in more depth in Chapter 3 to determine whether the cognitive limitations that arise from biases and the use of heuristics can be overcome.

2.3 HEURISTIC AND BIAS RESEARCH

One objective of the present study is to investigate the effects of behavioural aspects of heuristics and biases on decision-making by financial professionals. This section discusses the various heuristic-related and other biases that have been recognised in prior research, most of which was not specifically related to the finance environment. For the purposes of the present study, a *heuristic* is defined as a rule of thumb or simplification strategy used by

decision-makers in complex decision-making environments where they are under time pressure and there are information constraints (Bazerman & Moore, 1994, p. 6). These simplified processing strategies can lead to efficient and effective decision-making, especially when the decisions need to be made quickly (Payne et al., 1988, p. 20). A *bias* can be defined as a subjective and/or predisposed opinion that influences the decision process (Busenitz & Barney, 1994, p. 85), or relates to predictable tendencies caused by cognitive errors. Biases can lead to errors (Kahneman et al., 1982) when decisions are made in uncertain decision-making environments, because strain is placed on a person's information processing capabilities (Gilbert et al., 1992, p. 20).

Heuristics often lead to the occurrence of biases. Hence, the terms *heuristic* and *bias* are sometimes used interchangeably in the literature. The present study identifies three heuristics from the study by Tversky and Kahneman (1974, p. 1131), as well as two additional biases that arise when decision-makers need to make judgements in uncertain circumstances. These three heuristics are the representativeness, availability, and anchoring and adjustment heuristics. The study also considers two additional biases, namely *overconfidence bias* and *affect bias*. These biases have frequently been discussed together with biases stemming from heuristics (ACCA, 2017).

The next few paragraphs elaborate on each of these three heuristics and discuss the related biases, which may stem from using these heuristics in certain decision-making scenarios. Overconfidence bias and affect bias are also discussed in more detail.

2.3.1 The representativeness heuristic

The *representativeness heuristic* suggests that when a person has to assess the probability that A comes from Population B, the assessment is often based on the extent to which A is similar to B. A higher probability of occurrence is associated with events that are more representative (Trotman, 1998, p. 123). This heuristic tends to ignore relevant data including base rates, source reliability and sample sizes, which in turn leads to various other biases, as explained below (Tversky & Kahneman, 1974).

Insensitivity to the prior probability of outcomes or *base rate frequency* refers to the tendency of decision-makers to ignore the probability of outcomes when they apply the representativeness heuristic (Tversky & Kahneman, 1974, p. 1124). *Base rate bias* occurs when prior knowledge and information are ignored, and people focus only on the meaning

of an individual piece of information (Koch & Wüstemann, 2009, p. 13). Tversky and Kahneman (1974, p. 1124) provided the following results from an experiment they conducted to showcase insensitivity to the prior probability of outcomes. Those who participated in the experiment were given a personality description of several people randomly sampled from a group of 100 professional engineers and lawyers. Everyone was told to assess to which professional the description belonged. Two conditions were used in the experiment. One group of participants was given the information that the group of professionals from which the sample had been drawn consisted of 70 engineers and 30 lawyers, whereas the other group was told that the group of professionals consisted of 30 engineers and 70 lawyers. It was expected that the first group would associate the personality descriptions more strongly with engineers, given that the group consisted of 70 engineers versus 30 lawyers. However, Tversky and Kahneman (1974, p. 1124) found that under both conditions, both groups came to the same probability judgements, which demonstrated that the participants ignored the prior probabilities and instead used stereotypes to determine which description was more representative of the professionals under consideration.

Insensitivity to sample size refers to a second factor that tends to be ignored when applying the representativeness heuristic. People assume that a sample drawn from a given population will loosely represent the population of that sample; however, statistically, a smaller sample will diverge more from the population (would be less representative) than a larger sample would diverge from the population (Rapoport & Budescu, 1997, p. 603; Tversky & Kahneman, 1974, p. 1125).

Misconceptions of chance refers to the tendency to ignore chance in applying the representativeness heuristic. People expect the sequence of a random event to be representative of the characteristics of a given process, irrespective of whether the sequence is short or long (Tversky & Kahneman, 1974, p. 1125). Tversky and Kahneman (1974, p. 1125) used the example of flipping a coin and the probability of getting either heads or tails. People expect there to be a relatively even distribution between the number of times the coin will fall on either heads or tails. The expectation of a higher probability of a heads outcome develops after a series of tail outcomes, as people expect heads to become more probable after a run of tails. People therefore ignore the possibility that the outcome may be purely random, even though in terms of probability, there is only a 50% chance every time the coin is flipped that heads will be the outcome.

Insensitivity to predictability should also be considered. This bias leads to reliance on data which is irrelevant to future predictions (Ackert & Deaves, 2010, p. 95). Tversky and Kahneman (1974, p. 1126) give the example that when a person is given a description of a company and asked to predict its future profit, the type of description given of that company may be seen as the most representative of the company. If a favourable description is given, a very high profit will appear to be the most representative, even if the description is irrelevant in terms of the predictability of profit. The same is true for when a mediocre description is given of the company. If people use only the description to make their prediction, their prediction will remain unaffected by the reliability of the evidence and the anticipated accuracy of the prediction (Tversky & Kahneman, 1974, p. 1126).

Tversky and Kahneman (1974, p. 1126) have identified an *illusion of validity* as another area which relates to the representativeness heuristic. Illusion of validity bias occurs where there is confidence in the accuracy of predictions when the anticipated results of a process seem to align closely with the inputs into that process. This confidence is based on how representative the outcome appears to be of the input. Stated more simply, people tend to overestimate the accuracy of their judgements based on how effectively they analyse information.

Confirmation bias is related to the illusion of validity bias. With confirmation bias, people also overestimate the accuracy of their judgements, by favouring their pre-existing beliefs through valuing information that confirm their beliefs, and disregarding information that contradicts their beliefs. Einhorn and Hogarth (1978, p. 395) conducted research on confirmation bias, noting that people tend to look for information to confirm a statement, and neglect to search for information that disconfirms a statement. Pompian (2011, p. 188) provided the following example to showcase confirmation bias. A participant is given four cards, each with a number on the one side and a letter on the other side. The person is then informed that every card that has a vowel on the one side will automatically have an even number on the other side. The person is then shown four cards with the following numbers and letters: “A”, “2”, “9” and “X”. The participant is requested to choose two cards to test the rule. Most participants choose “A” and “2”, which are not the correct cards to choose to check the rule. The participants are trying to prove the rule correct, rather than trying to disprove the rule by choosing cards “A” and “9”.

It is important to acknowledge that recent research studies have begun to consider confirmation bias as an independent bias, as distinct from merely arising from the representativeness heuristic. Nevertheless, there is still disagreement in the literature about whether confirmation bias should be seen as originating from the representativeness heuristic, or as an independent bias. The present study acknowledges this debate, but for the purposes of the present study, confirmation bias is treated as stemming from the representativeness heuristic.

The last bias identified is *misconceptions of regression to the mean* (Tversky & Kahneman, 1974, p. 1126). Where this bias is present, 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 still believe that outliers of the event will remain extreme, even in subsequent events (Bazerman & Moore, 2012, p. 58).

2.3.2 The availability heuristic

The *availability* heuristic is the second heuristic mentioned by Tversky and Kahneman (1974, p. 1127). This heuristic refers to how easily decision-makers retrieve events or occurrences from their memory to make the decision they are faced with (Trotman et al., 2011, p. 313). Although in many instances, the availability heuristic leads to the correct probability and outcome, other factors in a decision-maker's memory can influence the outcome judgements, which leads to bias (Tversky & Kahneman, 1974, p. 1127). The availability heuristic tends to induce the following biases: retrievability bias, recall bias, illusionary correlations bias and recency bias.

Retrievability bias relates to how retrievable events are from memory, based on a person's familiarity with the event (Tversky & Kahneman, 1974, p. 1127). Bazerman and Moore (2012, p. 58) explain that people retrieve those events that are easier to search for in memory and judge those events as happening more frequently. Tversky and Kahneman (1974, p. 1127) provide the following example: a group was given a list of well-known personalities of both sexes. The group's task was to judge how many people on that list were male or female. Different lists were given to different groups – on some lists there were male personalities that were more famous, while other lists contained female personalities

that were more famous. In each of the groups, the subjects mistakenly believed that there were more people on the list of the sex that had the more famous personalities.

Recall bias is the tendency to assess events of a vivid nature to have occurred more frequently, which means that these events are more vivid in the person's memory than events that occurred, with a similar frequency, but were less vivid (Bazerman & Moore, 2012, p. 58). Tversky and Kahneman (1974, p. 1127) state that recall bias relates to the imaginability of the event. The imaginability of the event relates to the ease with which the person can (re)construct a similar event in their memory, which then creates a higher subjective probability that such an event could have occurred.

The third bias identified that forms part of the availability heuristic is *illusionary correlations bias*, which relates to how people judge the frequency with which two events co-occur, based on whether the two events have an associative bond (Tversky & Kahneman, 1974, p. 1128). The following example by Chapman and Chapman (1967, p. 198) illustrates illusionary correlations bias: inexperienced undergraduate students were asked to make psychological diagnoses based on hypothetical drawings of patients suffering from mental illnesses. The students based their associations on drawings of peculiar eyes and a diagnosis of suspiciousness to make their diagnoses, ignoring other information that was provided that contradicted such a diagnosis.

The last bias related to the availability heuristic is *recency bias.* Einhorn and Hogarth (1985) developed the belief-adjustment model, which built on the principles of the availability heuristic. The model was a theoretical framework that looked at the nature of sequential information and whether an order effect of information was present. The model of Hogarth and Einhorn (1992, p. 2) assumes that belief adjustment follows the anchoring and adjustment process, and thereafter predicts an order effect when both confirming (positive) and disconfirming (negative) information is received. More recent studies have elaborated on recency bias, and have defined it as "a cognitive predisposition that causes people to more prominently recall and emphasize recent events and observations than those that occurred in the near or distant past" (Pompian, 2011, p. 216).

2.3.3 The anchoring and adjustment heuristic

The *anchoring and adjustment* heuristic functions on the basis that when people make an estimate starting from an initial value, the adjustment to the final answer is typically

insufficient, because the initial value is used as the anchor for the adjustment (Tversky & Kahneman, 1974, p. 1128). People estimate a starting point from an initial value (anchor) which is thereafter adjusted to yield the final answer. The anchor that the person uses biases the estimates of the decision, as individuals have different starting points. When additional information is made available, different final estimates are made, as insufficient adjustments are made to the original anchors (Tversky & Kahneman, 1974, p. 1128). The fact that insufficient adjustments are made to the initial anchors has been labelled *conservatism* (Slovic & Lichtenstein, 1971, p. 693), but the present study refers to this heuristic as the anchoring and adjustment heuristic.

Tversky and Kahneman (1974, p. 1128) give the following example where insufficient adjustments are made because of the anchoring effect: a group was tasked to estimate various quantities, stated in percentages, of how many African countries are in the United Nations. For each quantity, a number between 0 and 100 was provided, and the number was determined by a spinning wheel. The group members were then requested to state whether the number generated by the wheel was higher or lower than the actual quantity, and to adjust the quantity upward or downward from the given number. Two groups provided two different median estimates, based on the different starting points allocated to each group. The respective group's starting points were 10 and 65, which led to median estimates of 25 and 45.

Conjunctive and disjunctive events bias was also identified as part of the anchoring and adjustment heuristic. Tversky and Kahneman (1974, p. 1129) explains that the probability of an event occurring provides a natural anchor, which leads to an insufficient downward adjustment for the probability that other events will occur conjunctively with the initial event. In this context, an event refers to an incident or occurrence that takes place. Similarly, where an event provides a natural anchor, it tends to be insufficiently adjusted upwards for the probability that the events will occur disjunctively (in other words, that one of the events will occur). Conjunctive events are insufficiently adjusted downward, whereas disjunctive events are insufficiently adjusted upwards.

Bar-Hillel (1973, pp. 403-405) initially identified the existence of this bias, which occurs when a person overestimates the probability of outcomes that are dependent on multiple events occurring in conjunction with each other, and underestimates the probability of outcomes dependent on a single event. Bar-Hillel (1973, p. 396) undertook an experiment in which the

participants were required to select marbles from a bag containing 90% red and 10% white marbles. The results indicated that the participants overestimated the probability of drawing red marbles seven times in succession, but underestimated the probability of drawing a white marble only once in seven successive attempts.

2.3.4 Overconfidence bias

Overconfidence bias is based on the assumption that people tend to believe that their abilities and judgements are better than they actually are (ACCA, 2017, p. 13). Overconfidence can create a mismatch between one's confidence in one's own judgements and the accuracy of these judgements (Hardies et al., 2012, p. 105). Tversky and Kahneman (1974, p. 1129) note that decision-makers make overly narrow probability distribution judgements, which demonstrate that they exhibit too much confidence in the knowledge they possess on a specific topic.

Moore and Healy (2008, p. 502) differentiate between three aspects of overconfidence, namely overestimation, overplacement and overprecision. *Overestimation* occurs when people believe that their judgement and decision-making is better than it actually is. *Overplacement* implies that people believe their judgement and decision-making is better than that of others (they rate themselves above the median). *Overprecision* applies when people are overly confident and are certain that their answer is the right one. The present study focuses on the overplacement aspect of overconfidence bias, which is closely related to the "better-than-average-effect" (Merkle, 2017, p. 69).

Moore and Healy (2008, p. 508) investigated the reactions of a random group of participants in a study where trivia quizzes covering six general topics were given to participants to complete. Participants were asked to predict their own score before taking the quiz, and to predict the score of another random participant. Thereafter the participants took the test. Before the results were released, they had an opportunity to again predict their own score and that of another random participant. During the first round of predicting scores, participants did not overplace themselves, because they did not have any information on what the quizzes were about. However, after they had taken the quiz, in the second round of predictions, participants overplaced themselves on easy quizzes, but underplaced themselves on the more difficult quizzes, compared to the other random participant.

2.3.5 Affect bias

The *affect heuristic* is based on the assumption that people are influenced by emotional stimuli when making decisions, and that this can lead people to become biased in their decision-making (Finucane et al., 2000, p. 3; Slovic et al., 2007, p. 1347). Affect can also be described as intuition retrieving sentiments from memory that are related to decision stimuli (De Bondt et al., 2013).

In an investment research study, Seo and Barrett (2007, p. 923) had investors rate their feelings on a daily basis over a period of 20 days whilst they made investment decisions. The results indicated that the decision-making performance of investors who experienced more intense feelings was better. Moreover, the investors who were able to distinguish how they were feeling achieved even better decision-making performance, as they were able to control the possible biases that stem from those feelings.

Lerner and Keltner (2001, pp. 154-155) found that emotions such as optimism, fear and anger have a significant effect on risk perceptions in decision-making. Their study was conducted on a group of students. It found that participants who were more fearful made more pessimistic judgements, whereas those who were happy made more optimistic judgements involving risk. Overall, positive (negative) affect tends to be associated with optimistic (pessimistic) judgements in decision-making.

Based on the literature review, the present study acknowledges the role of heuristic-related and other biases in decision-making. The next section elaborates on each of the previously mentioned heuristic-related and other biases in the context of research on financial decision-making.

2.4 HEURISTICS AND THE BIASES OF FINANCE PROFESSIONALS

Section 2.3 introduced heuristic-related decision-making and biases outside of a finance context. Mala and Chand (2015, p. 1) emphasised the importance of the judgement and decision-making attributes that professionals in the field of finance need to have, given their key role in the financial decision-making process. The present study wants to build on the existing literature by identifying factors that have an impact on the quality of the decisions made, and by identifying ways in which such decisions can be improved. Research on the influences of heuristic-related and other biases on financial decision-making are presented

and reviewed in the remainder of this chapter. The discussion in this section forms part of the focus of Research Question 1 of the present study.

In this study, when reference is made to judgements and decisions, *judgement* typically refers to forming an idea, opinion, or estimate about an object, an event, a state, or another type of phenomenon, and *decision* refers to making up one's mind about the issue at hand and taking a course of action (Bonner, 1999, p. 385). Professional judgement plays a key role for individuals such as managers, auditors, financial analysts, accountants, and standard setters, as previously noted. However, in practice, accountants, managers and auditors who produce and audit financial information sometimes choose methods and make judgements that suit their own best interests above that of the company, and therefore do not always act with professional judgement (Bhattacharjee & Moreno, 2002; Joyce & Biddle, 1981; Koch et al., 2016; Koch & Wüstemann, 2009; Tversky & Kahneman, 1974).

Financial professionals are considered key role players, each carrying their own responsibility regarding day-to-day judgement and decision-making duties. Research has shown that judgements and decisions made by professionals in different fields within the broader context of finance differ slightly (Ashton & Ashton, 1995). This implies that professionals in different fields are subject to different heuristics, which in turn lead to different biases, based on the types of decision made in the respective fields (Mala & Chand, 2015, p. 5). Therefore, in the present study, the term financial professionals is limited to professionals who need to use professional scepticism as part of making judgements and decisions. This includes managers who use judgement in preparing financial statements, auditors who provide professional judgements as part of the audit process, financial analysts who have to make judgements about future cash flows, and accountants who use judgement when faced with measurement issues. The population of financial professionals targeted in the present study has already been defined in Sections 1.3 and 1.6.

The remainder of this section focuses on the heuristic-related literature and on the literature on other biases that is specifically applicable to financial professionals, and from which the main hypothesis and sub-hypotheses are developed to address Research Question 1. The objective of Research Question 1 is to confirm whether financial professionals in the present study use, or are subject to, heuristic-related and other biases. As previously noted in Chapter 1, the literature has already established that financial professionals are prone to bias in decision-making, and therefore such a relationship is expected. The hypotheses

supporting Research Question 1 are included in Sections 2.4.1 to 2.4.4 to help address Research Question 2, the answer to which is the main contribution of the study.

The study focuses mainly on biases stemming from the representativeness heuristic and the anchoring and adjustment heuristic, as well as overconfidence bias and affect bias. The availability heuristic is not considered further in the present study, although it has been identified as one of the three key heuristics that induce certain biases in decision-making. Any biases related to the availability heuristic are not included, because it is not practical or feasible to test these biases in a survey design study. A few prior studies have tested this heuristic in the context of a finance environment, but those studies could accommodate experimental (Anderson et al., 1997; Libby, 1985; Moser, 1989) and other more appropriate research designs (Kliger & Kudryavtsev, 2010; Kudryavtsev, 2018). The study also limits itself to a selection of the biases originating from these heuristics to determine their relevance to financial professionals in the context of the study.

2.4.1 The representativeness heuristic

The representativeness heuristic may lead to various biases. The present study focuses only on *confirmation bias* and *misconceptions of regression to the mean bias* that originate from this heuristic. Although Section 2.3.1 identified more biases that stem from this heuristic, these biases have not been tested extensively in the literature, given the difficulty in developing appropriate methods to test them.

Confirmation bias is related to illusion validity bias. Based on literature reviews performed in behavioural finance, there are relatively few studies related to this bias (Costa et al., 2017). Einhorn and Hogarth (1978) performed one of the first studies on confirmation bias. Their study provided a scenario to a group of statisticians, and asked them to check a claim made by a share market consultant which related to a specific rise in the share market (Einhorn & Hogarth, 1978, pp. 399-400). The group was specifically informed that when this particular share market consultant made a claim which predicted that the market would rise, the outcome was consistently correct. The statisticians had to check the consultant's claim. They could choose from one or a combination of items of evidence, but were tasked to select the minimum amount of evidence required. The results indicated that the statisticians displayed confirmation bias, as half of them chose to observe confirmatory evidence, as opposed to selecting both confirming and disconfirming evidence. As a minimum

requirement, the group was expected to look for disconfirming evidence. Enslin (2019) used the question developed by Einhorn and Hogarth (1978), and adapted it in his sample on management accountants. Enslin's (2019) results revealed that a significant portion of management accountants considered only confirming evidence to support the share market consultant's claim.

An audit research experiment was designed by Peterson and Wong-On-Wing (2000) to examine confirmation bias by means of a positive testing approach. Participating auditors were tasked with determining why profits had increased unexpectedly in the given scenario. That study found that auditors used a positive testing strategy when they made an initial and intermediate hypothesis as to why profits had increased (Peterson & Wong-On-Wing, 2000, p. 267). This meant that the auditors selected only those transactions that they thought would be the cause of the increase; thus they confirmed their beliefs by investigating whether these transactions contained an error or not (Peterson & Wong-On-Wing, 2000, p. 258).

A study by Wheeler and Arunachalam (2008) also confirmed confirmation bias amongst tax practitioners when they conducted tax research for their clients. Their study attempted to determine whether tax professionals tended to select and overweight information that confirmed their research for their clients and underweighted information that was contradictory. The participants were asked to make a judgement as to whether a pay bonus could be used as a tax deduction for employee income tax purposes. The experiment required these tax professionals to express their assessment based on the background information provided. Thereafter, several cases, both confirming and disconfirming the eligibility of a pay bonus as a deduction were provided to the participants. Confirmation bias was noted, because the participants chose only cases that confirmed the initial tax position they had chosen for their client(s) and ignored any information that contradicted their decision (Wheeler & Arunachalam, 2008, p. 141).

Perera et al. (2020, p. 4096) performed a study on accountants to determine whether they tended to confirm prior knowledge of the full set of International Financial Reporting Standards (IFRS) when making a judgement whilst applying IFRS for Small and Medium Enterprises (SMEs). A revenue recognition scenario on construction contracts was given to participants to make a reporting judgement on, as there is a difference regarding this section between IFRS and IFRS for SME's. Participants were given revenue recognition criteria supporting either full IFRS or IFRS for SMEs, from which they could choose to support their

revenue recognition decision. The findings revealed that participants did not choose the correct accounting treatment for the revenue transaction in accordance with the IFRS for SMEs guidelines. Rather than drawing from their knowledge of IFRS for SEMs, participants tended to confirm their decision by relying on their pre-existing understanding of the full IFRS (Perera et al., 2020, p. 4115).

Cassell et al. (2022) conducted a more recent study amongst a group of professional auditors to establish whether the introduction of quality control processes could reduce confirmation bias. Their results showed that confirmation bias was still strongly present. This specifically related to situations where auditors with previous experience of auditing a client with a historically low risk did not respond adequately by raising their evaluation of risk where an increase in risk was noted. The only instance where quality control processes mitigated confirmation bias was when the risk increase established for the client whilst performing the audit violated the auditor's reasonableness constraint (Cassell et al., 2022, p. 89).

Misconceptions of regression to the mean bias was confirmed in a finance context by De Bondt and Thaler (1985, p. 797). Their study considered stocks on the New York Stock exchange, which the stock market labelled "winners" or "losers" based on the previous three years' performance. Investors made judgement errors, as they relied on the stocks' most recent performance, but did not consider future implications. The stocks labelled "losers" ultimately outperformed the stocks that were labelled "winners", based on the historical results.

These results were supported by a study conducted in a South African context by a similar survey scenario designed on the basis of the work performed by De Bondt and Thaler (1985, p. 797) among property fund investment managers (Lowies, 2012, p. 124). Participants were given two investment scenarios to choose from. The first investment had performed well in the past and participants deemed it likely that the investment would continue to perform well in the future. The second investment had performed poorly in the past, but the participants' perception was that the investment would perform well in the future. The second investment was the rational choice, as the second investment on average would outperform the first investment for at least a period of three years after the investment was made (De Bondt & Thaler, 1985, p. 797). Results in this South African study indicated that many of the participants chose the first investment, which had had good recent results, to have the most likely positive outcome, and only a few investors chose the investment that had bad recent

results, but for which there were good future forecasts. These results indicate that participants were biased and tended to rely on recent successes rather than future outcomes (Lowies, 2012, p. 124).

The results of Lowies (2012) were expanded in a study by Enslin (2019), which included a professional management accountant population. The aforementioned study used a similar question to that of Lowies (2012) and results indicated that 50% of those who participated in the study were influenced by misconceptions of regression to the mean bias.

Since 2019 two more studies have been conducted in a finance context. Lucena et al.'s (2021) results for a group of accounting students and accounting professionals demonstrated susceptibility to biases stemming from the representativeness heuristic, specifically the misconception of regression to the mean bias. Their results also established that higher cognitive ability lowered incidences of misconception of regression to the mean bias. Baker et al. (2019) sampled a group of individual Indian investors to examine ten biases, one of which was extrapolation bias, also known as the misconception of regression to the mean bias. Their study revealed that individual investors tended to favour recent past return investments they had purchased as the expectation is that this favourable trend will continue, by thus reinforcing the misconception of regression to the mean bias.

From the literature, it is clear that there are various biases that stem from the representativeness heuristic, such as confirmation bias and misconception of regression to the mean bias, and that these biases affect the decision-making of financial professionals. Therefore, the first two hypotheses are developed as follows:

Hypothesis H_{1a}: Financial professionals are susceptible to *confirmation bias* related to the representativeness heuristic when they make financial decisions.

Hypotheses H_{1b}: Financial professionals are susceptible to *misconception of regression to the mean bias* related to the representativeness heuristic when they make financial decisions.

2.4.2 The anchoring and adjustment heuristic

The anchoring and adjustment heuristic may also lead to various biases. The present study focuses on conjunctive events bias, which originates from this heuristic. Although Section

2.3.3 identified more biases that stem from this heuristic, only the biases selected for testing in the present study are feasible for testing in a survey research design.

An early study confirming *conjunctive events bias* was performed by Joyce and Biddle (1981, p. 133). In their study, experienced auditors were presented with a product development scenario in which they had to make a judgement about whether the product line would be successful or not. The first part of the experiment related to testing conjunctive events bias, and Joyce & Biddle (1981, p. 135) found that auditors judged the probability of the conjunctive events higher than is statistically probable. This was evident from the fact that more than half of the sample of respondents anchored on the initial probability provided, and made insufficient downward adjustments for the subsequent probabilities of additional requirements for successful product introduction (Joyce & Biddle, 1981, p. 135). The expectation is that participants should update their probability based on the new events. However, the researchers warned that these results should be interpreted cautiously, as they had concerns about reliance on the independence of the underlying events (Joyce & Biddle, 1981, p. 138). The second part of the experiment used a case study identical to that of the first experiment to test disjunctive event bias.

Enslin (2019) made use of the product development scenario created by Joyce and Biddle (1981). His findings supported their results in respect of the existence of conjunctive events bias. Enslin (2019) conducted his study on a group of management accountants who had to make a choice regarding whether a company should be acquired, based on the introduction of a new product line. The information given to the participants regarding the probabilities for success mirrored that given in Joyce and Biddle's (1981) study. Similar results were obtained to those of Joyce and Biddle (1981), as more than half of the management accountants showcased conjunctive events bias (Enslin, 2019, p. 227).

Kang and Park (2019) also considered conjunctive event bias in a group of banking employees in the banking industry, but used a different scenario. Their study used a scenario concerned with judging the accuracy of the Korean Composite Stock Price Index prediction. Three pieces of information were given to participants upon which to base their judgement. Each piece of information contained a probability percentage for how accurate the information was. The results revealed that approximately 64% of the participants overestimated the probability of the conjunctive event, in other words, they did not adjust appropriately for the probabilities of each additional piece of information. These results are

similar to both those of Joyce and Biddle (1981) and Enslin (2019), demonstrating that their research also indicated a susceptibility to conjunctive events bias.

The literature review highlights the existence of conjunctive events bias in the decision-making of financial professionals. The present study focuses only on conjunctive events bias and not disjunctive event bias. Therefore, the next hypothesis is developed as follows:

Hypothesis H_{1c}: Financial professionals are susceptible to *conjunctive events bias* related to the anchoring and adjustment heuristic when they make financial decisions.

2.4.3 Overconfidence bias

The present study considers only one aspect of overconfidence bias, namely overplacement, which is also known as the "better-than-average-effect". This specific construct of overconfidence is built on the premise that decision-makers neglect to reflect and compare themselves against the reference group, in other words, a decision-maker with similar skills to themselves (Bazerman & Moore, 2012). The literature review in the next paragraphs showcase the existence of overplacement in a financial environment.

Gort (2009, p. 73) conducted a study in an investment environment which included asset managers. These managers were tasked with answering questions to determine whether their pension plans would achieve above average risk-adjusted future returns and whether their pension plans would outperform those of other asset managers. The results indicated that the most common answers selected by managers were "average" or "slightly above average", which indicated that they believed that their pension plans were better than those of others. This suggested that the participants were prone to the "better-than-average-effect". The findings of Menkhoff and Nikiforow (2009, p. 325) confirmed the aforementioned results. They posed a similar question to that used by Gort (2009) to asset managers in Germany, namely "How do you evaluate your own performance compared to that of other asset managers". Their results showed that the sample rated themselves better than the mean. Moreover, these results were supported by a more recent study conducted amongst a group of individual investors, where the presence of all three facets of overconfidence (overestimation, overplacement and overprecision) were shown to cause decreased quality in investment decision-making (Ahmad & Shah, 2020).

In an accounting environment, Ben-David et al. (2007, p. 29) find that corporate financial decision-makers exhibited overconfidence bias, particularly tending towards overestimation, in a wide range of decisions they made on various corporate policies. These included making overoptimistic earnings forecasts, participating more in investments and acquisitions, and using lower discount rates when evaluating project cash flows. Arend et al. (2016, p. 1161) reported similar results, as their study confirmed that overconfidence among chief financial officers were accompanied by higher risk-taking behaviour, which in turn led to poorer financial results. This problem was also highlighted in a study by Huang et al. (2016, p. 93), where overconfident executive management took on higher liquidity risk through increasing the use of short-term debt. A study by Meikle et al. (2016, p. 129) found that overconfident financial executives pursued more risky investment projects, which can put companies under pressure in the long term, and even lead to fraudulent reporting to enable risky projects to match the expected returns. However, Phua et al. (2018, p. 519) also found that overconfidence among chief executive officers, when demonstrated verbally, helps to attract good supplier and labour commitments, which could be beneficial for the company. This shows the advantage of being overconfident. Nevertheless, when confidence is expressed verbally, it may lead to a lack of trust from stakeholders, as the expectations set by executive management might not be realised, which in turn causes reputational risk (Tenney et al., 2019, p. 396).

Although various prior research studies have tested overconfidence bias, the results of these studies on the “better-than-average-effect” have been called into question. Firstly, the fact that people regard themselves as better than the average person on simple tasks is a common result that is to be expected, as it is human nature to expect to be better than the average person (Benoît & Dubra, 2011, p. 1591). However, this is a biased reaction, because clearly it is not possible for everyone to be better than average. Secondly, the “better-than-average-effect” is most commonly noted when a person has to complete an easy task, and the effect may disappear with increased task difficulty or unfamiliar tasks (Moore & Healy, 2008, p. 504). In Moore and Healy’s (2008, p. 512) study, although participants’ confidence still increased when the problem difficulty increased, the participants’ confidence in their own ability to outperform others decreased.

Benoît et al. (2015) extended initial research by Benoît and Dubra (2011) to address the concerns raised. In an experiment performed on a group of undergraduate students, an easy quiz was given to participants. The quiz offered a monetary incentive to participants who

could demonstrate that when they rated themselves as higher than others and backed it up with their actual performance, they would receive a reward. This monetary reward was to ensure that participants provided a more accurate rating. The results suggest that the sample still overplaced themselves with unfamiliar easy tasks.

The use of unfamiliar easy quizzes was also adopted by other studies, such as those by Merkle and Weber (2011) and Burks et al. (2013). In a more recent study, Enslin (2022) conducted a study on a group of management accountants and tested for general overplacement, as well as whether overplacement changed when participants were faced with a difficult decision problem. Significant results were found for general overplacement, corroborating prior research studies' finding that management accountants exhibit overplacement bias. However, when participants were faced with a difficult decision problem, overplacement simply changed to average placement, rather than underplacement, as expected (Enslin, 2022, p. 841). Further results revealed that the higher participants placed themselves, the more incorrect their answers were on average (Enslin, 2022, p. 841).

The present study adopted a research design to overcome the concerns raised in the literature. The details of the approach followed by the present study regarding the measurement of overconfidence bias is addressed in Chapter 4.

Based on the literature reviewed, overconfidence bias can be seen as a key cognitive bias which financial professionals are susceptible to in decision-making. The present study focuses on overplacement, testing the following hypothesis:

Hypothesis H_{1d}: Financial professionals are susceptible to bias related to *overconfidence* when they make financial decisions.

2.4.4 Affect bias

Kida et al. (2001, p. 480) define affect as emotions and moods that can lead to a complex assortment of both negative and positive reactions, and that may lead to wrongful decision-making. Kida et al. (2001, p. 480) conducted an experiment with four different capital budgeting scenarios, each designed to evoke negative emotional reactions from experienced business managers. Their results showed that the negative information presented to the managers on certain alternatives led them to reject the investment decision

in the given scenario, even though the investment alternative had higher expected values (Kida et al., 2001, p. 481).

In another investigation into capital budgeting, Moreno et al.'s (2002) results supported the previous findings showing that affective reactions resulted in managers' selection of investments with lower expected values. The study considered fund managers and the effect that positive and negative affective reactions had on choosing investments. In their study, they had three decision-making scenarios. Two scenarios were designed to elicit negative affective reactions and one was designed to elicit positive affective reactions. Their study also included a control group, where no reactions were elicited from the fund managers. Two investment options were provided to each participant, where one investment had a higher economic value than the other. The results indicated that fund managers chose the investment with the lower economic value when negative affect reactions were present in the option with the higher economic value, leading to suboptimal decision-making (Moreno et al., 2002, p. 1337).

Bhattacharjee and Moreno (2002, p. 371) presented auditors with a manufacturing case study, together with information designed to evoke a negative interpersonal emotional reaction towards the client. Only some of the participants in the experiment received the negative information, and the auditors were expected to make a risk judgement on inventory obsolescence. The study found that less experienced auditors who received the negative information provided a higher risk assessment than the auditors who received no information. The judgements of more experienced auditors displayed no differences, which indicates that professional experience influenced affect bias amongst the auditors in that study. Bhattacharjee et al. (2012, pp. 1094-1095) extended the research by Bhattacharjee and Moreno (2002, p. 371) by focusing on how the presence of realistic, but irrelevant, affective information differentially influences judgement. Bhattacharjee and Moreno (2012, p. 1104) reported that the level of competence perceived by auditors regarding their client's management evoked either a positive, negative or neutral affect toward the client's management. The results obtained indicated that auditors gave client management a higher inventory obsolescence rating in the scenario where auditors perceived a negative affect from management having lower competence.

Enslin (2019) and Fehrenbacher et al. (2020) expanded the work of Kida et al. (2001) by adopting the capital budgeting scenarios used in Kida et al.'s (2001) study and determining

whether management accountants also exhibited affect bias in decision-making. Enslin's (2019, p. 229) results revealed that management accountants were prone to affect bias in their decision-making, but this population was much less affected by affect bias than the group of experienced business managers in Kida et al.'s (2001) sample. Similar to Enslin (2019), Fehrenbacher et al. (2020) conducted their study on a group of management accountants; however, in their study, accountability and its influence on affect bias was also considered. Their results revealed that in both cases where positive and negative affect was included, management accountants preferred the non-financially viable capital budget project, therefore demonstrating the presence of affect bias. However, accountability did mitigate affect bias in circumstances where positive affect was evoked.

The present study takes note of the literature reporting the role that emotion may have on decision-makers' judgement. The last hypothesis developed to address Research Question 1 is the following:

Hypothesis H_{1e}: Financial professionals are susceptible to bias related to the use of *affect (emotion)* when they make financial decisions.

The biases discussed above do not form an exhaustive list of behavioural heuristic-related and other biases in decision-making. However, for the purposes of conducting the present study, these biases are most applicable to individuals in the finance profession, and were therefore the most appropriate to use in research on financial professionals, as defined in Chapter 1, using a survey method.

Table 2.1 below summarises the hypotheses developed to address Research Question 1 in the present study.

Table 2.1: Hypothesis 1 – summary

Main Hypothesis 1	Sub-hypotheses	Supporting heuristic
Financial professionals are susceptible to a number of heuristics-related and other biases	H_{1a}: Financial professionals are susceptible to *confirmation bias* related to the representativeness heuristic when they make financial decisions.	Representativeness
	H_{1b}**:** Financial professionals are susceptible to *misconception of regression to the mean bias*	Representativeness

when they make financial decisions.	related to the representativeness heuristic when they make financial decisions.	
	H_{1c}: Financial professionals are susceptible to *conjunctive events bias* related to the anchoring and adjustment heuristic when they make financial decisions.	Anchoring and adjustment
	H_{1d}: Financial professionals are susceptible to bias related to *overconfidence* when they make financial decisions.	Not applicable
	H_{1e}: Financial professionals are susceptible to bias related to the use of *affect (emotion)* when they make financial decisions.	Not applicable

Source: Own compilation

2.5 SUMMARY

Chapter 2 introduces three important decision-making theories, namely the normative, prescriptive, and descriptive theories. These theories form the foundation of decision-making behaviour and provide insight into why human decision-making is not always rational. From descriptive theory, we can deduce that decision-makers use simplified information processing strategies called heuristics, which induce bias, which may cause such irrational behaviour. The foundational heuristics identified in the literature, as well as the biases that originate from these heuristics, have been discussed in this chapter to further support the simplifying strategies used by decision-makers. The three foundational heuristics identified were the representativeness, availability, and anchoring and adjustment heuristics.

The context in which heuristic-related and other biases are used was further explored to indicate its relevance in a finance environment. This context was included specifically to elaborate on biases that are relevant to financial decision-making, as this topic forms the main focus of Research Question 1. Financial decision-makers, in the context of the present study, are individuals responsible for preparing financial statements, auditors, financial analysts and even accountants. They all use judgement in their day-to-day decision-making activities. The key biases that the present study focuses on were identified and elaborated on to provide clear support from the literature regarding the presence of these biases in financial decision-making environments. These biases include confirmation and

misconception of regression to the mean bias, stemming from the representativeness heuristic; conjunctive events bias, stemming from the anchoring and adjustment heuristic; as well as overconfidence bias and affect bias. Based on these biases five hypotheses were developed to specifically consider whether financial professionals are susceptible to confirmation bias, misconception of regression to the mean bias, conjunctive events bias, overconfidence bias, and affect bias, when they are making financial decisions.

The next chapter identifies the key determinants from the literature that have been shown to influence heuristic-related and other biases in financial decision-making environments. The focus is mainly on the main personal variable of interest, namely the trait of professional scepticism, but other determinants that have been reported in the literature as having an influence on bias in decision-making are also discussed. These other determinants include gender, age, experience and personality traits.

CHAPTER 3:
DETERMINANTS OF HEURISTICS AND BIASES IN FINANCIAL DECISION-MAKING

The determinants of heuristics and biases in financial decision-making is discussed in Chapter 3. Figure 3.1 illustrates a graphical representation of the information presented in this chapter.

CHAPTER 3: DETERMINANTS OF HEURISTICS AND BIASES IN FINANCIAL DECISION-MAKING
3.2 PROFESSIONAL SCEPTICISM
3.2.1 Professional scepticism as a trait and bias in decision-making 3.2.2 Professional scepticism research in finance 3.2.3 Defining professional scepticism 3.2.4 Determinants of professional scepticism 3.2.5 Trait and state scepticism 3.2.6 Professional scepticism as a trait scale 3.2.7 Research Question 2: hypothesis development
3.3 GENDER
3.4 AGE
3.5 EXPERIENCE
3.6 EDUCATION
3.7 PERSONALITY TRAITS

Figure 3.1: Outline of Chapter 3

Source: Own compilation

3.1 INTRODUCTION

The judgement and decision-making framework of Bonner (1999, p. 390) acknowledges that research into judgement and decision-making need to consider person, task and environmental variables which may affect the decision-maker. The present study focuses mainly on individual or personal variables that affect a person's judgement and decision-making. Personal factors refer to characteristics that a decision-maker brings to the task being performed (Bonner, 1999, p. 390). Personal factors can affect how the decision-maker makes decisions, and can therefore be an indicator of higher or lower susceptibility to heuristic-related and other biases in decision-making. The main personal factor considered in the present study is professional scepticism as a personal trait. There have been only a limited number of prior research studies that have considered the relationship between the

trait of professional scepticism and heuristic-related and other biases in financial decision-making. The present study is exploratory, as it aims to investigate a relationship that has not yet been clearly defined or researched.

The present study further acknowledges that there are personal factors and determinants that have been identified in the literature as having an influence on bias in financial decision-making. These personal factors include gender, age, experience, and personality traits. For the purposes of this study, these personal variables are not considered the main independent variables, but are included as determinants. These variables are included to determine and acknowledge the effect of these determinants on bias in decision-making. All personal factors considered in this study are discussed in more detail below.

3.2 PROFESSIONAL SCEPTICISM

This section introduces professional scepticism and bias in decision-making, and reviews research supporting the possible relationship between professional scepticism as a *trait* and heuristic-related and other biases in financial decision-making. Thereafter it elaborates on the importance of professional scepticism in a finance environment. The discussion defines professional scepticism from a neutrality and presumptive doubt perspective, and emphasises the differences between the trait and the state of scepticism. This distinction is important, because it outlines how professional scepticism is measured in the present study. Lastly, this section includes a review of the literature on the scale chosen to measure professional scepticism, and the hypotheses developed to address Research Question 2.

3.2.1 Professional scepticism as a trait and bias in decision-making

Research into professional scepticism has expanded enormously in the last few decades. Multiple studies shed light on environmental influences which may have an impact on professional scepticism. However, little insight has been gained on how professional scepticism influences certain decision-making areas. Regulatory bodies such as the International Auditing and Assurance Standard Board (IAASB), the Association of Chartered Certified Accountants (ACCA) and the International Ethics Standards Board for Accountants (IESBA) have highlighted the importance of being professionally sceptical, as it leads to better quality judgements (IESBA, 2018, p. 4). In conjunction with the IAASB's attempt to focus on professional scepticism, the Independent Regulatory Board of Auditors (IRBA) in South Africa responded to the lack of professional scepticism being applied by auditors by

initiating a research programme that investigates auditor independence in South Africa (IRBA, 2017). A spokesperson for the IRBA highlights that an individual's mindset plays an important role in being sceptical. The following areas that play a differentiating role in respect of an individual's mindset were outlined: "characteristics of the auditors, personal attributes and awareness of biases that can help them better apply professional scepticism" (IRBA, 2017). The expectation is therefore that professional scepticism as a trait should lead to better quality judgements, and, in the context of the present study, to less susceptibility to bias in decision-making. However, so far, only a limited number of studies could be located in the course of the present study that have empirically tested the relationship between professional scepticism as a trait and heuristic-related and other biases. The biases that have been empirically tested by prior studies include recency bias (Koch et al., 2016), optimism bias and framing (Teye, 2023).

Several studies have looked at factors that affect levels of professional scepticism as a trait, but only a limited number of studies have truly considered the impact that professional scepticism has on bias in decision-making. Nelson (2009, p. 6) developed a model to enhance understanding of how knowledge, experience, personality traits and incentives interact with audit evidence to determine the level of professional scepticism that is applied in audit judgement and actions. The model emphasises that cognitive limitations such as confirmation bias and recency bias can influence a person's professional scepticism. This argument was supported by the ACCA (2022), recognising that if an individual is aware of the influence of cognitive bias, this awareness could result in a more robust application of professional scepticism. Both aforementioned arguments conflict with the views of Hurtt et al. (2013) and Cruz et al. (2020). Hurtt et al. (2013, p. 72) identified an opportunity for future research, commenting that a lack of professional scepticism may affect unconscious bias, which in turn influences an auditor's judgement or actions. Cruz et al. (2020, p. 3) have similarly argued that professional scepticism may be beneficial in addressing certain heuristic-related and other biases. Cruz et al. (2020) note that overconfidence bias can be overcome with the trait of professional scepticism, because it would prevent financial professionals from overestimating the precision of information, as professional scepticism promotes a questioning mind when it comes to the relevance of the evidence received. However, the aforementioned study calls for future research on the relationship between professional scepticism and heuristics, arguing that financial professionals who are more sceptical are likely to be less susceptible to biases such as overconfidence, and that financial

professionals who are less sceptical are likely to be more susceptible to biases such as overconfidence (Cruz et al., 2020, p. 3). The arguments made by Nelson (2009), Hurtt et al. (2013), Cruz et al. (2020) and the ACCA (2022) have not yet been empirically tested, and therefore a research opportunity exists to do so.

Koch et al. (2016) were among the first researchers to address the issue raised by Hurtt et al. (2013) and Cruz et al. (2020) by considering the inherent link between traits and cognition, in other words, between mental constructs and processes. In their study, they explored whether the trait of professional scepticism can mitigate recency bias amongst a group of professional auditors. Auditors were given an auditing scenario and divided into two groups. One group was given audit-related information in a step-by-step sequence; the other group received the audit-related information at the end of the sequence. Koch et al. (2016) argued that auditors' will process information (such as audit evidence) differently and will update their beliefs if they are more sceptical. Their study focused on the evidence-related construct of scepticism as a trait which relates to how information is processed. Their argument for using only the evidence-related construct was driven by the prior findings of Cushing and Ahlawat (2000). Cushing and Ahlawat (2000) argued that scepticism affects auditors' behaviour in that it influences the formation and revision of their beliefs. The way auditor's beliefs are impacted will lead auditors to process information (evidence) differently. Koch et al. (2016) found that the evidence-related construct of the trait of professional scepticism reduced recency bias when information was presented sequentially, but that it was associated with higher cognitive effort when the information was presented simultaneously (Koch et al., 2016, p. 4).

More recently, Teye (2023, p. 36) conducted an experimental study among a group of young auditing professionals. The study used a computerised test in which participants had to examine audit evidence. Various decision-making tasks were presented in which optimism bias and framing were assessed. The findings firstly revealed that optimism bias increased the participants' cognitive load, which in turn decreased their professional scepticism. Secondly, the findings revealed a direct association between framing and professional scepticism. Both Koch et al. (2016) and Teye (2023) used the professional scepticism scale developed by Hurtt (2010). The two studies focused on different perspectives: Koch et al. (2016) examined the relationship between the trait of professional scepticism and bias, whereas Teye (2023) examined the relationship between bias and the trait of professional scepticism.

Research Question 2 of the present study aims to expand the work conducted by Koch et al. (2016) by examining the relationship between the trait of professional scepticism and decision-making biases. The study also considers both the trait of professional scepticism as a whole, and looks at the sub-constructs of the scepticism trait, similar to Koch et al. (2016). The sub-constructs of professional scepticism as a trait are discussed in Section 3.2.6. Before the supporting hypotheses for Research Question 2 are discussed, professional scepticism in a finance environment is discussed and further defined for the purposes of the present study.

3.2.2 Professional scepticism research in finance

Professional scepticism has been identified as the single most important aspect in enhancing audit quality (IAASB, 2019, p. 1). A substantial amount of research has been conducted to define and understand professional scepticism better (Glover & Prawitt, 2014; Nelson, 2009; Shaub & Lawrence, 1996). A strong focus on the topic by international accounting and auditing bodies such as the ACCA and the IAASB have begun to emphasise the role that professional scepticism plays in decision-making. Such bodies are calling for research to determine how professional scepticism is applied by financial professionals. This call is driven by various occurrences globally of a lack of the application of professional scepticism by financial professionals in the last few decades (ACCA, 2017; IAASB, 2019), and specifically in the South African audit and commercial industries environment, with damaging effects for the reputation of the finance profession (IRBA, 2017).

Professional scepticism should be applied not only by auditors, but by all financial professionals in making judgements and decisions (IFAC, 2017, p. 5). In the context of the auditing environment, a lack of professional scepticism has been identified as one of the top three reasons for audit failures (Beasley et al., 2001). A study by Cruz et al. (2020, p. 1) argues that financial professionals face an increasingly complex financial and social environment and must therefore sharpen their professional scepticism and their judgement and decision-making. Cruz et al. (2020) claim that professional scepticism improves investment decisions when it comes to socially responsible investments, but did not test this assertion empirically. In an accounting context, a study by Charron and Lowe (2008, p. 10) emphasises the importance of professional scepticism in the management accounting profession to assist with fraud detection. Agarwalla et al. (2017, p. 91) support this view, as they found that managers with higher levels of professional scepticism were more likely to

identify unethical earnings management techniques. The studies mentioned above support the ongoing call to apply a higher level of professional scepticism in financial decision-making environments. This view is also specifically expressed by regulating bodies across financial fields for both the preparers of the financial statements and the auditors of such statements (IFAC, 2017, p. 3).

The literature reviewed above highlights the importance of professional scepticism in a finance context, and supports the argument that elevated professional scepticism plays a role in improved quality decision-making. This literature, together with the literature reviewed in Section 3.2.1, supports the point made in the present study that elevated levels of professional scepticism can reduce susceptibility to bias in decision-making, as having this trait should lead to improved quality in financial decision-making.

3.2.3 Defining professional scepticism

The academic literature has neither provided a consistent definition of professional scepticism, nor offered a clear method to measure this trait (Hurtt et al., 2013, p. 45). The word “scepticism” is derived from the Greek word “skeptikos”, which refers to the suspension of judgement or disbelief until enough proof is obtained (Pigliucci, 2009). Glover (2013, p. 2) defines professional scepticism as those

> attributes commonly associated with being a sceptic 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, rationalization, and so forth.

The international auditing standards define professional scepticism as

> an attitude that includes a questioning mind, being alert to conditions which may indicate possible misstatement due to error or fraud, and a critical assessment of audit evidence (IFAC, 2009, p. 77).

Furthermore, professional scepticism could be seen as either taking a neutral perspective or a presumptive doubt perspective.

A *neutral perspective* defines the state of being sceptical as having a questioning mind, carefully observing, engaging in probing reflection and suspending one’s belief before a decision is made (Glover & Prawitt, 2014, p. 4). This closely relates to the widely accepted definition that the International Standards of Auditing (ISA) has assigned to professional scepticism, namely having a questioning mind and being alert to events which may indicate areas of fraud or error (Glover & Prawitt, 2013, p. 11). A neutral perspective allows an auditor

to defer judgement without forming a presumption that management is trustworthy or untrustworthy (Popova, 2013, p. 142).

In order to develop a professional scepticism measure, Hurtt (2010, p. 151) defines professional scepticism mostly under a neutral perspective, which sees scepticism as a multi-dimensional construct, where a decision-maker postpones making any judgement until sufficient evidence is obtained to support any conclusion presented. Another way of stating this is that auditors diligently perform their work in good faith, without assuming wrongdoing on the part of the depicted management or the firm itself (Nelson, 2009, p. 3).

A *presumptive doubt perspective* assumes a presumption of dishonesty from management when audit risks are assessed – this implies that dishonesty is assumed until sufficient evidence is obtained to prove otherwise (Bell et al., 2005). This definition applies where auditors are deemed to be more sceptical when they gather more evidence to come to the conclusion that an assertion is free of material misstatement (Nelson, 2009, p. 4). Quadackers et al. (2014, p. 641) found that the presumptive doubt approach to professional scepticism is a more reliable interpretation of an auditor's sceptical judgements and actions, as auditors should focus more on obtaining evidence to support material misstatements or fraud. This view is supported by Harding et al. (2016, p. 251), who note that dispositional and situational trust may increase professional scepticism in an auditing environment, unlike in a neutrality perspective, where trust is assumed. Dispositional trust refers to the propensity to trust someone else, whereas situational trust refers to the propensity to trust in a specific situation or circumstance. However, Harding et al. (2016) acknowledge the difficulty of implementing dispositional trust in practice, seeing that these attributes of trust are a product of a lifetime of experience, which is difficult to change or replicate. Similarly, situational trust relates to perceptions of management's integrity in a specific situation, but perceptions can be deceptive.

There are therefore mixed views and results regarding whether professional scepticism should be considered from the neutral or presumptive doubt perspective. Both views have been supported in the literature as stated above. Under both perspectives, a decision-maker who is characterised by the trait of being more sceptical would want to acquire more evidence and information to make a decision, compared to someone who is less sceptical (Quadackers et al., 2014, p. 641). Hurtt (2010, p. 167) takes the view that scepticism as a trait may relate more strongly to having a neutral perspective of professional scepticism.

However, it may be argued that when a person's scepticism as a state is stimulated, a position of presumptive doubt is taken. Both perspectives can be deemed appropriate for the present study, as the aim is to determine the levels of scepticism as a trait which are evident in either of the perspectives. The present study therefore chooses to take a neutral perspective regarding professional scepticism.

3.2.4 Trait and state scepticism

Another key aspect when looking at professional scepticism is whether it should be seen as a trait or a set of skills and behaviours that can be taught over time (Plumlee et al., 2012). It has been argued that professional scepticism involves knowledge and experience, but is also driven by personality traits (Glover & Prawitt, 2013, p. 6). Many researchers agree that professional scepticism consists of a combination of individual characteristics and traits, as well as situational factors. The classification of professional scepticism as either a trait or state is based on how it is measured in research studies. Whether professional scepticism should be seen as a trait or as a state is discussed below from an academic perspective.

Hurtt (2010, p. 150) defines a trait as "a relatively stable, enduring aspect of an individual". She argues that scepticism as a trait is a combination of the multi-dimensional characteristics of sceptics, which establish an individual's degree of scepticism as a trait, subsequently shaping the person's behaviour (Hurtt, 2010, p. 165). If professional scepticism is regarded as a trait, it is treated as part of an individual's personality. Nelson (2009, p. 6) takes this definition further by describing traits as individual characteristics that are expected to stabilise by the time a person starts studying or enters their profession. Hurtt (2010, p. 150) proposes that professional scepticism as a trait should be seen as a "multi-dimensional individual characteristic" and subsequently developed a scale to measure the level of professional scepticism as a trait based on characteristics identified by psychology, consumer behaviour research and audit standards. Her scale included characteristics such as having a questioning mind, the ability to analyse and critically evaluate, having problem-solving abilities, ethical and moral reasoning, a willingness to suspend judgement, a tendency to search for knowledge, abilities relating to interpersonal understanding, a sense of autonomy, and confidence based in self-esteem (Hurtt, 2010, p. 152).

A second dimension of professional scepticism established by Hurtt (2010, p. 166) is state scepticism. This dimension deals with the situational factors that can influence an

individual's sceptical judgements and actions. Unlike scepticism as a trait, which is assumed to remain stable, scepticism as a state can vary according to the presence or absence of various situational factors, such as high-risk audit circumstances, prior client experiences, or positive or negative social interactions with clients, to name only a few.

Hurtt et al. (2008, p. 24) presented a group of auditors with working papers in which risk cues were present or absent to trigger scepticism for specific audit circumstances. The participants' task was to provide review notes to the working papers, based on the risk cues that were triggered. The results revealed that participants in whom higher scepticism was a trait displayed increased sceptical behaviour, identifying a greater number of errors and contradictions in the working papers, compared to participants in whom lower scepticism was a trait. Popova (2013, p. 152) conducted a study on a group of auditors to see whether scepticism as a trait and prior client experience affected audit judgements. The results showed that auditors with higher scepticism as a trait who had negative prior client experience made significantly different judgements compared to auditors with lower scepticism as a trait who had negative prior client experiences. Popova's (2013) research thus confirmed that scepticism as a trait is developed long before the auditors obtained any of their training or professional experience, and situational factors only affected auditors with lower scepticism as a trait. Popova's (2013) results were later confirmed by Fatmawati and Fransiska (2018, p. 231) who conducted a similar study.

Eutsler et al. (2018, p. 158) expanded the literature by conducting a live simulation on a group of auditors in the form of an interview setting to examine the effects between a interpersonal style of client management and professional scepticism from both a trait and state perspective. This study firstly considered whether scepticism as a trait influenced the quality of the auditors' judgements made in the interview. Results revealed that auditors with higher levels of scepticism as a trait acted with more scepticism in the interview setting, therefore supporting scepticism as a trait as a stabilised characteristic (Eutsler et al., 2018, p. 157). Secondly, the study considered whether situational factors such as a change in the client's interpersonal style influenced how sceptical auditors' judgements were. Eutsler et al. (2018, p. 158) found that a perception of a friendly interpersonal style from client management was more likely to decrease professional scepticism in junior auditors than an intimidating interpersonal style, therefore supporting the claim that situational factors can have an impact on scepticism (Eutsler et al., 2018, p. 158). Further results supported the consistency in the differences between the effects of scepticism as a trait versus a state.

Specifically, the results revealed that auditors with higher levels of scepticism as a trait were unaffected by the adoption by management of either interpersonal style, which was considered a situational factor (Eutsler et al., 2018, p. 158). These findings are consistent with those of Hurtt et al. (2013, p. 51), who argue that professional scepticism is both a trait and state.

In the present study, professional scepticism is seen as a trait, which is a stable characteristic that an individual has (even though another valid dimension of professional scepticism exists). A number of prior research studies do show a positive relationship between scepticism as a trait and as a state, but state scepticism may not always be present as it might be task-dependent. The next section considers literature supporting the measurement of professional scepticism as a trait.

3.2.5 Determinants of professional scepticism

Prior literature on professional scepticism acknowledges that there are factors that may influence the level of scepticism being exercised by individuals. Nelson (2009, p. 23) highlighted the importance of how traits may interact in different ways with a person's experience and knowledge to determine an individual's professional trait scepticism. Other research studies have supported the influence that other variables such as experience (Grenier, 2017) and gender (Schmitt et al., 2017) also has on professional scepticism. The factors mentioned above is not an exhaustive list but are some of the most frequent factors associated with trait scepticism. Each of these factors and its influence on professional scepticism is briefly expanded on below.

The knowledge an individual has obtained during their lifetime can play a key role in the professional scepticism levels an individual exercises. If consideration is given to a person's knowledge, Fatmawati and Fransiska (2018, p. 222) found that education plays a key role in professional scepticism as a trait. The aforementioned study was conducted on a sample of students in both undergraduate and professional programs in accounting fields. Participants were given a judgement task related to fraud and results indicated that formal higher education played a key role in the professional trait scepticism levels of participants. More importantly the results further indicated that participants with higher levels of trait scepticism had increased levels of professional state scepticism as these participants' judgements were not affected by situational circumstances in the fraud judgement task.

For personality traits, the studies of Farag and Elias (2016) and Janssen, Hardies, Vanstraelen, and Zehms (2020) both found a person's personality traits to be associated with the levels of trait scepticism the person exercised. Farag and Elias (2016, p. 124) found an association with four of the five personality traits, and trait scepticism in their study which considered the association of personality traits with anticipatory socialisation and trait scepticism on a group of accounting students. Results showed that extraversion, openness to experience, and conscientiousness were positively associated with trait scepticism whereas agreeableness was negatively associated with trait scepticism. Janssen, Hardies, Vanstraelen, and Zehms (2020) added further support to literature by supporting the association between personality traits and professional scepticism as a trait in their sample on auditors, where auditors who were more conscientious showcased higher levels of professional trait scepticism.

Experience has also been showcased to be a key factor affecting professional scepticism. Payne and Ramsay (2005, p. 326) conducted a study including a fraud risk assessment task on audit seniors and audit staff. Results indicated that due to the lack of experience of fraud tasks, audit seniors exhibited low levels of professional scepticism as a trait. A decreased level of professional scepticism was noted overall even where individuals had more general experience due to the lack of exposure to fraud specific experience in an auditor's career. Rose (2007, p. 226) conducted a similar study on auditors in which results of Payne and Ramsay (2005) was supported. Results revealed that fraud specific experience was positively related to sceptical judgement, whereas general experience had no effect. More recently, the study by Grenier (2017, p. 252) further supported these results in an audit fraud assessment scenario, where results indicated that industry specialists showed less sceptical judgement than non-industry specialists. These results, apart from Ramsay (2005) where general experience had no effect, indicated a pattern that less scepticism was evident in more experienced auditors.

Only a limited number of research studies have been conducted on the subject of trait scepticism and gender. However, prior literature has revealed that gender has a significant influence on personality traits (Schmitt et al., 2017, p. 45) and due to professional scepticism being a trait, an argument has been made that a relationship between gender and trait scepticism can be established. Schmitt et al. (2017, p. 47) conducted various studies to look at personality traits and gender differences on a global front. The study found that women tend to be more agreeable and neurotic than men, suggesting a potential negative

correlation with trait scepticism. This implies that women may demonstrate lower levels of professional trait scepticism. These results were support by Janssen, Hardies, Vanstraelen, and Zehms (2020) who found women to exhibit lower levels of professional scepticism as a trait.

The present study acknowledges that professional scepticism can be influenced by education, personality traits, experience and gender based on the literature reviewed in Section 3.2.5, however this aspect is not being investigated in the present study.

3.2.6 Professional scepticism as a trait scale

The concept of professional scepticism has been widely accepted; however, up until the early 2000s very little research was done to determine what comprises professional scepticism (Hurtt, 2010, p. 149). Professional scepticism has been measured in the past by using scales to measure a construct of trust, independence and suspicion. Hurtt (2010, p. 150) considered professional scepticism to be a *trait* consisting of "multi-dimensional individual characteristics" and developed a scale to encompass the multiple facets of scepticism. The scale was developed using auditing standards literature, as well as philosophy literature, to identify six characteristics, distinct from knowledge and ethics, which can define how sceptical an individual is.

The scale consists of three distinct categorisations for the trait of professional scepticism, which are outlined as follows: the way information and evidence is examined (a questioning mind, suspension of judgement, 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). The three categorisations contain six characteristics (sub-constructs) associated with an individual being sceptical. Each of these six sub-constructs is briefly elaborated below (Hurtt, 2010, p. 151).

A *questioning mind* is a key attribute of professional scepticism that is already defined by the auditing standards as important (IFAC, 2009, p. 77). This attribute relates to the ability to interrogate information and evidence until comfort is achieved (Hurtt, 2010, p. 152). The expectation is that an individual does not merely trust what is said, but verifies all evidence to gain comfort (Zwane, 2018, p. 17). Cheng (2023) has elaborated on the concept of possessing a questioning mindset, characterising it as encouraging critical thinking, displaying curiosity and open-mindedness, and being willing to challenge assumptions. A

suspension of judgement indicates that no decision-making should be rushed and that enough time should be spent in gathering evidence to arrive at the most appropriate conclusion (Hurtt, 2010, p. 153). This characteristic is supported by Kim and Trotman (2015, p. 1036), who state that exercising scepticism implies that one is focused on the process and not necessarily just the outcome, and thereby a point should be reached where the conclusion cannot be doubted. This characteristic motivates the next characteristic, namely the *search for knowledge.* An individual's search for knowledge should go beyond the information that is given, and requires a more curious mind – one which desires more knowledge (Hurtt, 2010, p. 153). All three characteristics refer to how a person evaluates evidence.

The next characteristic relates to *interpersonal understanding*. A sceptical person needs to be able to understand people to be able to distinguish between the possible biases that might be present in the information presented to them. The key is understanding the motivations and assumptions of the person presenting the information, in order to be able to challenge the information appropriately (Hurtt, 2010, p. 154). The *autonomy* construct refers to self-direction and moral independence (Hurtt, 2010, p. 155). The expectation is that sceptical people will act with moral independence, as well as self-direction, to ensure that they are not persuaded by other people (Hurtt, 2010, p. 155). This characteristic is also referred to as *self-determining*. Lastly, the *self-esteem* characteristic deals with the confidence that individuals need to have to value their own opinion as greatly as they do that of others, to enable them to challenge other people's conclusions (Hurtt, 2010, p. 155). This characteristic is also referred to as *self-confidence*.

The inputs to the scale discussed above were already in development by Hurtt et al. in 2008. In the same period, Nelson (2009, p. 11) considered the six characteristics described by the scale as being consistent with both the neutral and presumptive doubt perspectives regarding professional scepticism. The professional scepticism measurement scale was also rigorously tested for its reliability to determine the correct factor loading from a variety of questions supporting each characteristic. The result produced a scale of 30 questions, with an equal number of questions supporting each of the six characteristics. Each question requires a 6-point Likert scale answer, ranging from 1 (strongly disagree) to 6 (strongly agree). which enables a score out of 180 to be calculated for each participant.

Since the development of the scale, researchers have widely adopted this scale to successfully measure professional scepticism as a trait. In an auditing environment, the Hurtt (2010) scale has been used to measure the effect of professional scepticism on fraud identification (Glover & Prawitt, 2014; Harding & Trotman, 2017), risk cue identification (Hurtt et al., 2008), prior client experiences (Popova, 2013), the influence of client management style (Eutsler et al., 2018), and recency bias (Koch et al., 2016) to mention only a few. The Hurtt (2010) scale has also been used to measure whether other determinants have an effect on the levels of professional scepticism being exercised, such as gender (Janssen et al., 2020; Ratna & Anisykurlillah, 2020), basic human values (Khan & Harding, 2020) and personality traits (Farag & Elias, 2016; Janssen et al., 2020). These studies represent only some of the research which incorporated the scale. This supports the validity of the scale which has been researched over the last decade.

3.2.7 Research Question 2: hypothesis development

Based on the literature review performed above on professional scepticism, the importance of this trait and its possible relationship with heuristic-related and other biases is explored further in the present study. Research Question 2 specifically aims to establish the relationship between professional scepticism as a trait and the identified heuristics-related and other biases, as established in Section 2.4, in the financial decision-making behaviour of financial professionals. Hypothesis 2 aims to expand the study of Koch et al. (2016) by assessing a range of heuristic-related and other biases that financial professionals are most prone to, and by assessing whether there is a relationship between professional scepticism as a trait and these biases identified in the present study. The objective of the present study is not only to examine professional scepticism as a trait as a singular construct, but also to deconstruct professional scepticism as a trait into its six respective sub-constructs, similar to the study conducted by Koch et al. (2016). These sub-constructs are a questioning mind, suspension of judgement, search for knowledge, interpersonal understanding, self-determining and self-confidence, as defined in Section 3.2.6.

The following hypotheses are developed based on the heuristic-related and other biases identified in Chapter 2:

Hypothesis H_{2a} to H_{2e}: A relationship exists between professional scepticism as a trait 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.

Hypothesis $H_{2.1a}$ to $H_{2.1e}$: A relationship exists between questioning mind ($H_{2.1}$) and ***confirmation bias ($H_{2.1a}$), misconception of regression to the mean bias ($H_{2.1b}$), conjunctive events bias ($H_{2.1c}$), overconfidence bias ($H_{2.1d}$) and affect bias ($H_{2.1e}$)*** in the financial decision-making of financial professionals.

Hypothesis $H_{2.2a}$ to $H_{2.2e}$: A relationship exists between suspension of judgement ($H_{2.2}$) and ***confirmation bias ($H_{2.2a}$), misconception of regression to the mean bias ($H_{2.2b}$), conjunctive events bias ($H_{2.2c}$), overconfidence bias ($H_{2.2d}$) and affect bias ($H_{2.2e}$)*** in the financial decision-making of financial professionals.

Hypothesis $H_{2.3a}$ to $H_{2.3e}$: A relationship exists between search for knowledge ($H_{2.3}$) and ***confirmation bias ($H_{2.3a}$), misconception of regression to the mean bias ($H_{2.3b}$), conjunctive events bias ($H_{2.3c}$), overconfidence bias ($H_{2.3d}$) and affect bias ($H_{2.3e}$)*** in the financial decision-making of financial professionals.

Hypothesis $H_{2.4a}$ to $H_{2.4e}$: A relationship exists between interpersonal understanding ($H_{2.4}$) and ***confirmation bias ($H_{2.4a}$), misconception of regression to the mean bias ($H_{2.4b}$), conjunctive events bias ($H_{2.4c}$), overconfidence bias ($H_{2.4d}$) and affect bias ($H_{2.4e}$)*** in the financial decision-making of financial professionals.

Hypothesis $H_{2.5a}$ to $H_{2.5e}$: A relationship exists between self-determining ($H_{2.5}$) and ***confirmation bias ($H_{2.5a}$), misconception of regression to the mean bias ($H_{2.5b}$), conjunctive events bias ($H_{2.5c}$), overconfidence bias ($H_{2.5d}$) and affect bias ($H_{2.5e}$)*** in the financial decision-making of financial professionals.

Hypothesis $H_{2.6a}$ to $H_{2.6e}$: A relationship exists between self-confidence ($H_{2.6}$) and ***confirmation bias ($H_{2.6a}$), misconception of regression to the mean bias ($H_{2.6b}$), conjunctive events bias ($H_{2.6c}$), overconfidence bias ($H_{2.6d}$) and affect bias ($H_{2.6e}$)*** in the financial decision-making of financial professionals.

The literature has also identified several determinants that influence either increasing or decreasing levels of bias in decision-making. In the present study, these variables are included as determinants and are treated as independent variables. This acknowledgement is important, as their influence on bias needs to be understood. The present study further

acknowledges that the variables listed in the next few sections are not an exhaustive list, and that other person, task or environment variables may also exist. The determinants gender, age, education, experience, and personality traits are discussed below.

3.3 GENDER

Gender has been linked to various heuristic-related and other biases, such as the representativeness heuristic, the anchoring and adjustment heuristic, as well as overconfidence bias and affect bias.

The literature has considered various biases that stem from the representativeness heuristic and its association with gender. Ohlert and Weißenberger (2015, p. 54) conducted a study on management accountants which indicated men displayed less judgement error than women for base rate neglect in probability judgements. However, their results applied only to one bias, stemming from the representativeness heuristic. The studies of AlKhars et al. (2019) and Lucena et al. (2021) tested six biases arising from the representativeness heuristic, namely insensitivity to prior probability of outcomes bias, insensitivity to sample size bias, misconception of chance bias, insensitivity to predictability bias, the illusion of validity bias (confirmation bias), and misconception of regression to the mean bias. AlKhars et al. (2019, p. 273) used a sample of students specialising in business; they identified a significant relationship between gender and two biases: men were less prone to insensitivity to prior probability of outcomes bias, but were more prone to insensitivity to predictability bias. Lucena et al. (2021, p. 194) found differences between the genders in five of the six biases, but a significant relationship was observed only for men being more prone to insensitivity to predictability bias. However, no support was found for a relationship between gender and confirmation bias, or gender and misconception of regression to the mean bias in either study. The results reviewed above imply that gender is not a strong predictor of most of the cognitive biases stemming from the representativeness heuristic, and this applies also specifically to confirmation bias and misconception of regression to the mean bias, which are considered in the present study.

Kudryavtsev and Cohen (2011, p. 18) confirmed a relationship between gender and the anchoring and adjustment heuristic in their study conducted on MBA students. They provided the MBA students with irrelevant anchors to determine to what extent they used these anchors to recall significant economic events that had taken place. They found that

women were affected more by the anchoring and adjustment heuristic than men were. Similar results were reported by Rajdev and Raninga (2016) and Enslin (2019). Rajdev and Raninga (2016, p. 36) found amongst a group of individual investors that male investors were less prone to the anchoring and adjustment heuristic than women were. Enslin (2019, p. 245) conducted his study on a group of management accountants, and specifically looked into conjunctive events bias. His results revealed that a significant proportion of the women in his sample were influenced in their decision-making by bias stemming from the anchoring and adjustment heuristic. The results reported by Baker et al. (2019, p. 132) contradicted the results of the research studies mentioned above in this paragraph. Although Baker et al (2019) did find that individual investors were prone to using the anchoring and adjustment heuristic, they did not find that the use of the heuristic differed between male and female participants. The aforementioned studies did not all specifically consider conjunctive events bias, but these biases do stem from the anchoring and adjustment heuristic. An overall trend in the literature is the finding that women are more susceptible to biases that stem from the anchoring and adjustment heuristic, even though there were instances where gender played no role.

To test overconfidence bias, Barber and Odean (2001, p. 289) conducted a study on a group of investors working at an investment brokerage. They found that male investors were more overconfident than their female counterparts, and tended to overestimate the accuracy of the information they processed, which led to lower than expected trading profits. In more recent studies, the findings of both Mishra and Metilda (2015) and Baker et al. (2019) supported Barber and Odean's (2001) results amongst a group of individual investors. Mishra and Metilda (2015, p. 237) found that men were more confident than women in a study measuring the "better-than-average effect" amongst mutual fund investors, whereas Baker et al. (2019, p. 132) found that men were more overconfident than women in respect of their own knowledge of the stock market. The literature notes that men are thus more susceptible to overconfidence bias.

Studies in psychology have shown that women experience emotions more strongly than men (Harshman & Paivio, 1987). Experiencing strong emotions may lead to affect bias in decision-making. For example, in a study by Croson and Gneezy (2009), judgements made by men and women differed in the face of a risky situation. Because men and women have different emotional reactions in circumstances of uncertainty, different risk-taking behaviour and preferences were noted (Croson & Gneezy, 2009, p. 454). These results show that

affective reactions led to different decisions amongst different genders: women were more risk-averse than men. The results of Harshman and Paivio (1987) and Croson and Gneezy (2009) were confirmed by a more recent study by Bacha and Azouzi (2019) and Enslin (2019). Bacha and Azouzi (2019) used banking employees and their study highlighted that women have a bigger emotional reaction when faced with uncertain situations, which leads to different risk-taking behaviour. Enslin (2019, p. 248) used a different group of participants, namely management accountants. A significant proportion of the women in Enslin's (2019) sample were influenced by affect bias in their decision-making. Baker et al. (2019, p. 132) studied a sample of individual investors in India, and, in contrast to the results of the two studies by Croson and Gneezy (2009), Bacha and Azouzi (2019) and Enslin (2019), found no relationship between emotional bias and gender. The literature review shows that, while every research study had its own specific measure of affect bias, an overall trend is that women seem to be more susceptible to affect bias.

The literature review above, covering gender and susceptibility to heuristic-related and other biases reveals that gender displays a relationship with certain biases in decision-making. The present study therefore included gender and its relationship with heuristic-related and other biases as a determinant in the present study. The following hypotheses are developed based on the literature reviewed above:

Hypothesis H_3: A relationship exists between gender and heuristic-related and other biases in the financial decision-making of financial professionals.

Hypothesis H_{3a}: A relationship exists between the gender of decision-makers and their susceptibility to confirmation bias related to the representativeness heuristic when they make financial decisions.

Hypothesis H_{3b}: A relationship exists between the gender of decision-makers and their susceptibility to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions.

Hypothesis H_{3c}: Financial professionals who are *women* are <u>more susceptible</u> than financial decision-makers who are *men* to conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions.

Hypothesis H_{3d}: Financial professionals who are *women* are less susceptible than financial decision-makers who are *men* to bias related to overconfidence when they make financial decisions.

Hypothesis H_{3e}: Financial professionals who are *women* are more susceptible than financial decision-makers who are *men* to bias related to the use of affect (emotion) when they make financial decisions.

3.4 AGE

Age has been linked to various heuristics-related biases such as the representativeness heuristic, the anchoring and adjustment heuristic, and as well as overconfidence bias and affect bias.

The literature has considered various biases that stem from the representativeness heuristic and its association with age. Arend et al. (2016) used a sample of entrepreneurs, specifically focusing on base rate neglect bias, which stems from the representativeness heuristic. Their results revealed the presence of base rate neglect bias. Older individuals were specifically correlated with making more rational choices in relation to the tested bias (Arend et al., 2016, p. 1161). Ossareh et al. (2021) expanded on research relating to age focusing on other biases stemming from the representativeness heuristic, including confirmation bias. Ossareh et al. (2021, p. 16) conducted their study on a group of stock exchange investors to determine the occurrence of cognitive biases in their decision-making. Their study classified investors between the ages of 20 and 40 years as young, and investors older than 40 years as old. Their results revealed that more experienced, older investors were subject to more confirmation bias in their decision-making. Sinha and Shunmugasundaram (2023, p. 207) found different results: in their sample of insurance policy-makers, participants' ages did not influence the level of confirmation bias that was exhibited. The results on this topic are therefore mixed, and in some studies no results were reported for or against the influence of age on confirmation bias.

Tekçe et al. (2016, p. 520) tested for extrapolation bias, also known as misconception of regression to the mean bias, amongst a group of individual investors. Tekçe et al. (2016, p. 524) found that susceptibility to this bias increased with age. Enslin (2019, p. 238) found further supporting evidence of these results in his study on a group of management accountants. Age proved to be a significant indicator of higher susceptibility to

misconception of regression to the mean bias. These results were different from those in a study by Baker et al. (2019). Baker et al. (2019, pp. 137-138) also considered misconception of regression to the mean bias, using a sample of individual investors, and found that investors older than 60 years of age were less prone to the tested bias, which stems from the representativeness heuristic. Mixed results can therefore be noted for the influence of age on susceptibility to the misconception of regression to the mean bias.

For the anchoring and adjustment heuristic, a study by Kudryavtsev and Cohen (2010, p. 172) on a group of MBA students found that older students were more prone to the anchoring and adjustment heuristic than younger students. In Kudryavtsev and Cohen's (2010) study, students older than 33 years were classified as old. These results were not supported by Baker et al. (2019), as their study found that individual investors in the age range of 31 to 45 years were less prone than younger investors to use the anchoring and adjustment heuristic. Both studies focused on anchoring bias, where participants make estimates based on an initial value which they adjust, based on additional information received. These two studies did not specifically consider conjunctive events bias, although this related bias stems from the anchoring and adjustment heuristic. Mixed results can be noted for the influence that age has on biases that stem from the anchoring and adjustment heuristic.

It appears that age plays a role in susceptibility to overconfidence bias. Prosad et al. (2015, p. 248) found evidence of the influence of age on overconfidence bias in their study, which showed that male investors between the age of 31 and 60 years were more affected by overconfidence bias than younger male investors. For the relationship between age and overconfidence bias Arend et al. (2016) found the opposite to be true. Arend et al. (2016, p. 1161) found in their study using a sample of entrepreneurs that increased levels of overconfidence bias was evident for younger entrepreneurs, and that this bias decreased with age. Mixed results have thus been reported in the literature regarding age and susceptibility to overconfidence bias.

In respect of affect bias, one might argue that older people should exhibit greater emotional competence, compared to younger people, enabling them to regulate their emotions better when making decisions (Kennedy & Mather, 2007, p. 256). Such an argument is adopted by Peters et al. (2000) and Blanchard-Fields et al. (2004), who reported that older participants were more flexible in dealing with interpersonal problems, as they could adjust their problem-solving strategies. Eberhardt et al. (2019, p. 79) conducted a study on a

sample of adults who had to make financial decisions. Their results showed that older participants were less impacted by negative emotion when they made decisions. You et al.'s (2019, p. 802) findings regarding a sample of adults investigated for age differences in a decision-making scenario in which negative emotion was induced support the contention that older participants were less affected by negative emotion in their decision-making. Older participants in You et al.'s (2019) study regulated their emotions better and were not impacted by the negative emotions, compared to younger participants. As an overall trend, the literature notes that older individuals are less susceptible to affect bias.

Several prior research studies used different measures to distinguish between older and younger participants. However, overall, the literature still supports the contention that age may be a factor that influences bias susceptibility. The following hypotheses are developed based on the literature reviewed above:

Hypothesis H_4: A relationship exists between age and heuristic-related and other biases in the financial decision-making of financial professionals.

Hypothesis H_{4a}: A relationship exists between the age of decision-makers and their susceptibility to confirmation bias related to the representativeness heuristic when they make financial decisions.

Hypothesis H_{4b}: A relationship exists between the age of decision-makers and their susceptibility to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions.

Hypothesis H_{4c}: A relationship exists between the age of decision-makers and their susceptibility to conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions.

Hypothesis H_{4d}: A relationship exists between the age of decision-makers and their susceptibility to overconfidence bias when they make financial decisions.

Hypothesis H_{4e}: Financial professionals who are *relatively older* are <u>less susceptible</u> to bias related to the use of affect (emotion) than *younger* financial professionals when they make financial decisions.

3.5 EXPERIENCE

Experience has been linked to various heuristics, such as the representativeness heuristic, the anchoring and adjustment heuristic, as well as overconfidence bias and affect bias. It is, however, essential to consider the specific levels of experience that are referred to in the literature. Several studies have used domain experience (Messier Jr & Tubbs, 1994), task experience or general experience in a specific field as reference point when referring to whether or not experience decreases bias in decision-making (Hogarth & Einhorn, 1992). The literature review performed below refers to several measures of experience.

For biases stemming from the representativeness heuristic, research has found mixed results regarding whether experience mitigates bias. For confirmation bias, a research study by Park et al. (2010, p. 29) on a sample of individual investors found that trading experience did not influence confirmation bias. Ossareh et al.'s (2021) study among a sample of individual investors observed that less experienced investors exhibited higher susceptibility to confirmation bias. In contrast to these results, a study by Chalissery et al. (2023, p. 16) reported that individual investors' trading experience influenced their susceptibility to confirmation bias (the more experienced investors were, the more prone they were to this bias). Mixed results can thus be noted for the influence of experience on confirmation bias.

Experience appeared to reduce misconception of regression to the mean bias among a sample of individual investors, where experience was measured based on the number of investment decisions made (Tekçe et al., 2016, p. 524). The study concluded that a decision-maker reaches a level of sophistication with more experience and therefore becomes less prone to this bias (Tekçe et al., 2016, p. 524). However, Chalissery et al. (2023) found the opposite to be true amongst a sample of individual investors. This suggests that there are mixed results regarding whether misconception of regression to the mean bias is lowered with more experience.

Ateş et al. (2016) considered conservatism bias stemming from the anchoring and adjustment heuristic in their study using a sample of individual investors. The results revealed that participants with more than one year of experience were more prone to conservatism bias driven by the anchoring and adjustment heuristic than inexperienced investors were (Ateş et al., 2016, p. 8). Henrizi et al. (2021) and Chalissery et al. (2023) have reported different results from those of Ateş et al. (2016). Henrizi et al.'s (2021, p. 611) study on various biases stemming from the anchoring and adjustment heuristic, including

insufficient adjustment from the anchor bias, showed that their sample of professional auditors with more experience were less prone to these respective biases. Chalissery et al. (2023, p. 16) tested anchoring and adjustment bias on a sample of individual investors. They were interested specifically in whether participants were prone to making estimates based on an initial value which they then adjust on the basis of additional information received. Results revealed that increased trading experience made investors less prone to bias related to the anchoring and adjustment heuristic (Chalissery et al., 2023, p. 16). The studies mentioned in this paragraph were performed on different biases driven by the same heuristic. The most recent findings reveal a trend – more experience leads to less susceptibility to biases stemming from the anchoring and adjustment heuristic.

Doukas and Petmezas (2007) looked at successful mergers and acquisitions completed by managers in companies listed on the London Stock Exchange. They focused on managers who had participated in several successful mergers and acquisitions. The findings showed that these experienced managers tended to display a strong tendency to be overconfident in subsequent acquisition deals. Deaves et al. (2010) and Mishra and Metilda (2015) reported similar results amongst a group of market forecasters and individual investors respectively. In both studies, participants with more experience displayed higher overconfidence levels. Individual investors held the perception that, because of their experience, they had better knowledge of the stock market, which led them to believe that they make better investment decisions (Prosad et al., 2015, p. 246). The results reported by Ateş et al. (2016, p. 8) and Beatrice et al. (2021, p. 22) support this trend in an investment decision-making environment, confirming that levels of overconfidence increased in a group of individual investors who had more than one year's experience. This suggests that some behavioural biases are not lowered with more experience, but seem to increase.

For affect bias, in a study conducted on a group of auditors, less experienced auditors were found to be more prone to affect bias when it came to making decisions in an inventory assessment task where negative client affect reactions were introduced, compared to more experienced auditors, who were unaffected by the negative affect information provided (Bhattacharjee & Moreno, 2002, p. 371).

Prior studies which focused on experience and bias in decision-making did not distinguish between general experience per industry or in relation to role-specific experience. Instead, most studies were conducted using samples from the same financial environment. The

present study differs in that respect, as financial professionals as defined in the present study work in various fields of finance, although they still work in a finance environment. Therefore, the focus of the present study is the total experience of an individual in a financial business environment, but also the experience gained making key judgements in decision-making. This differentiates the targeted population into financial professionals who have experience in less complex decision-making environments and finance professionals who make decisions in more complex decision-making environments. The decision taken in the present study to include key decision-making is in line with a study by Hogarth and Einhorn (1992). They claimed in their belief adjustment model centred on recency bias stemming from the availability heuristic that experience only mitigates bias if experience reduces task difficulty. This aspect is crucial in the present study, which explores whether there is a relationship between key (complex) decision-making experience and bias in financial decision-making.

The following hypotheses are developed based on the literature reviewed above:

Hypothesis H_5: A relationship exists between experience and bias in the financial decision-making of financial professionals.

Hypothesis $H_{5.1a}$: A relationship exists between the level of experience of decision-makers and their susceptibility to confirmation bias related to the representativeness heuristic when they make financial decisions.

Hypothesis $H_{5.2a}$: A relationship exists between the level of decision-making experience of decision-makers and their susceptibility to confirmation bias related to the representativeness heuristic when they make financial decisions.

Hypothesis $H_{5.1b}$: A relationship exists between the level of experience of decision-makers and their susceptibility to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions.

Hypothesis $H_{5.2b}$: A relationship exists between the level of decision-making experience of decision-makers and their susceptibility to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions.

Hypothesis $H_{5.1c}$: Financial professionals with *more experience* are less susceptible to conjunctive events bias related to the anchoring and adjustment heuristic when making financial decisions, compared to financial professionals with *less experience*.

Hypothesis $H_{5.2c}$: Financial professionals with *more decision-making experience* are less susceptible to conjunctive events bias related to the anchoring and adjustment heuristic when making financial decisions, compared to financial professionals with *less decision-making experience*.

Hypothesis $H_{5.1d}$: Financial professionals with *more experience* are more susceptible to bias related to overconfidence when making financial decisions, compared to financial professionals with *less experience*.

Hypothesis $H_{5.2d}$: Financial professionals with *more decision-making experience* are more susceptible to bias related to overconfidence when making financial decisions, compared to financial professionals with *less decision-making experience*.

Hypothesis $H_{5.1e}$: Financial professionals with *more experience* are less susceptible to bias related to the use of affect (emotion) when making financial decisions, compared to financial professionals with *less experience*.

Hypothesis $H_{5.2e}$: Financial professionals with *more decision-making experience* are less susceptible to bias related to the use of affect (emotion) when making financial decisions, compared to financial professionals with *less decision-making experience*.

3.6 EDUCATION

Education refers to a learning opportunity in which certain areas of knowledge can be accumulated and therefore plays a key role in how individuals make decisions (Libby & Luft, 1993, p. 427). In a study conducted by Ateş et al. (2016, p. 8) on a sample of investors, they found that investors with no undergraduate degree were more prone to the representativeness heuristic. These findings are supported in a more recent study by Baker et al. (2019, p. 138), who reported differences between individual investors who had graduated from a tertiary educational establishment and individual investors who had completed education only up to school level. Individual investors who had graduated were less prone to the representativeness heuristic.

Education also plays a role in whether investors are more overconfident. A study by Deaves et al. (2010, p. 411) found that highly educated men displayed higher levels of overconfidence. In their study, they distinguished between educational level (degree) and educational field (area of study) as proxies for education. Similar results were reported by Mishra and Metilda (2015, p. 228), who differentiated between participants with a high school education, graduates and post-graduates. When the participating investors were asked how good they were, relative to other investors, overconfidence increased with the level of education of the investor.

The present study considers financial professionals ranging from chartered accountants to professional accountants who all have financial educational backgrounds at a graduate level and professional certifications, with the additional distinct similarity that they are all members of an accredited professional body. For the present study, the targeted population are members of professional bodies such as the IAASB and the ACCA. Therefore, educational background is not expected to play a differentiating role in how professional scepticism as a trait is exercised, given the inclusion criterion of having a professional certification for the targeted population of the study.

3.7 PERSONALITY TRAITS

The literature categorises personality traits into a Big Five framework, namely extraversion, agreeableness, openness to new experience, conscientiousness, and neuroticism (Costa & McCrae, 1999). According to Costa & McCrae (1999), every individual has an inherent tendency towards certain traits and characteristics, and interpersonal features are developed over time based on these basic tendencies.

The basic tendencies and examples of characteristics of each of the five personality traits are further explained below.

- The basic tendency of extraversion is being gregarious which is furter described as a preference for compansionship and social stimulation (Costa & McCrae, 1999). John and Srivastava (1999) further elaborate on the trait of extraversion, describing it as an energetic engagement with the social and material world. This includes characteristics such as sociability, assertiveness, and positive emotionality.
- Agreeableness has the basic tendency of being compliant which can further be associated with a willingness to defer to others during interpersonal conflict (Costa &

McCrae, 1999). The agreeableness trait is also associated with tender-mindedness, trust and modesty (John & Srivastava, 1999).

- The openness to new experience trait is characterised by a need for variety, novelty and change (Costa & McCrae, 1999). John & Srivastava (1999) further describes the openness to new experience trait as the complexity of an individual's mental and experiential life.
- The conscientiousness trait is related to the basic tendency to achieve and having a high aspiration level (Costa & McCrae, 1999). The conscientiousness trait can further be described as having a social prescribed impulse control that facilitates thinking before acting and following norms and rules (John & Srivastava, 1999).
- The neuroticism trait is the basic tendency to experience sadness, hopelessness or guilt. John & Srivastava (1999) also defines the neuroticism trait as negative emotionality such as feeling anxious, nervous or tense.

Individual differences such as personality traits have been found to play a key role in people's subjective perception when making financial decisions (Nga & Yien, 2013, p. 230). Nga and Yien (2013) conducted their study on a sample of undergraduate students from a business school to determine the role of personality traits, gender and education in financial planning. They specifically tested susceptibility to cognitive biases in financial decision-making, by using an adapted version of the Big Five personality scales, namely extraversion, agreeableness, openness to new experience, conscientiousness and neuroticism (as developed by McCrae and Costa Jr, 1997). They found that conscientiousness, openness and agreeableness as personality traits had a significant influence on cognitive biases (Nga & Yien, 2013, p. 239).

The literature review below shows that each heuristic-related bias, together with overconfidence bias and affect bias, which are considered in the present study, can be influenced by personality traits. Research showing evidence of the influence (or lack of influence) of each of the Big Five traits (extraversion, openness to new experience, conscientiousness, neuroticism, and agreeableness) on each of these biases is reviewed.

Chalissery et al. (2023, p. 15) focused specifically on the effect of confirmation bias (amongst other biases) on a group of individual investors. Their results revealed that the traits of agreeableness, conscientiousness, openness to new experience and neuroticism played a significant moderating role between trading experience and exhibiting confirmation bias.

Individual investors displaying traits such as an agreeableness and openness to new experience were less prone to confirmation bias than investors displaying traits such as conscientiousness and neuroticism, who were found to be more prone to confirmation bias. Baker et al.'s (2021, p. 361) study on the misconception of regression to the mean bias reported a positive association between personality traits such as extraversion, conscientiousness and neuroticism. In their study, individual investors exhibiting these three traits were more prone to misconceptions of regression to the mean bias in decision-making.

The study by Baker et al. (2021, p. 361) also tested the effect of the presence of the anchoring and adjustment heuristic in a group of individual investors. Their study revealed that extraversion, conscientiousness and neuroticism were positively associated with this heuristic in investment decision-making – investors with these personality traits were more prone to anchoring bias. Chalissery et al.'s (2023, p. 15) findings supported those of Baker et al. (2021), in that they also found that both conscientiousness and neuroticism played a significant moderating role between trading experience and anchoring bias. However, they found no evidence that extraversion played a similar role. Instead, they found that individual investors with neuroticism as a personality trait were more prone to anchoring bias, whereas individual investors with conscientiousness as a personality trait were less prone to that bias. Moreover, Chalissery et al. (2023) reported that both openness to new experience and agreeableness also played significant roles in their study, which showed that those individual investors in their sample who displayed these two traits were less prone to anchoring bias. Thus Baker et al.'s (2021) and Chalissery et al.'s (2023) studies found contradictory results for the conscientiousness trait.

Bashir et al. (2013, p. 289) assessed financial advisors and individual investors' personality types, together with their investment biases, such as overconfidence, herding behaviour, disposition effect and risk taking in making an investment decision. Their results indicated that personality traits such as extraversion and conscientiousness had a significant positive relationship with being overconfident. More recent research studies found further evidence of a relationship between overconfidence and personality traits such extraversion and conscientiousness (Ahmad, 2020; Baker et al., 2021). Ahmad's (2020, p. 481) study using a sample of students studying towards various academic degrees found that students who were extroverted and conscientious were more confident in their social skills, knowledge, and decision-making abilities. These results are in line with the findings of Baker et al. (2021,

p. 364), whose study also showed that extraversion and conscientiousness were associated with being overconfident.

A study by Tjandrasa and Tjandraningtyas (2018) found evidence that two other personality traits, namely agreeableness and openness to new experience, influence overconfidence. Their study was conducted on a group of finance students who had already been exposed to enough theoretical investment theories in their academic studies to test for bias in investment choice. Their study used the Meyers Briggs Type Indicator to assess the Big Five personality types. They found a significant relationship between overconfidence bias and the traits of agreeableness and openness to new experience. Students who were more agreeable tended to be the least overconfident, whereas students who were more open to new experiences displayed more overconfidence bias (Tjandrasa & Tjandraningtyas, 2018, p. 59).

For affect (emotion) bias, Baker et al.'s (2021, p. 361) study found that individual investors exhibiting traits such as extraversion, conscientiousness and neuroticism were more prone to affect bias. These results were supported for neuroticism only in a study conducted by Khan and Abid Usman (2021, p. 772), who also found that the openness to new experience trait had an influence on susceptibility to affect bias. Khan and Abid Usman's (2021, p. 772) study was conducted on a sample of individual investors making investment decisions, and their results revealed that both openness to new experience and neuroticism had a sizable positive effect on susceptibility to emotional biases.

Prior research studies have, however, been limited in the number of biases tested together with personality traits. Nevertheless, the literature on the effect of personality traits discussed in the paragraphs above provide a sound reason to include this determinant in the present study. Decision-makers' personality traits can affect their decision-making, as their personality might be more susceptible to certain biases. The following hypotheses are developed based on the literature reviewed above:

Hypothesis H_6: A relationship exists between personality traits and bias in the financial decision-making of financial professionals.

Hypothesis $H_{6.1a}$: A relationship exists between *extraversion* and confirmation bias related to the representativeness heuristic in the financial decision-making of financial professionals.

Hypothesis H6.2a: Financial professionals who exhibit personality traits such as *agreeableness* are less susceptible to confirmation bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis H6.3a: Financial professionals who exhibit personality traits such as *openness to new experience* are less susceptible to confirmation bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis H6.4a: Financial professionals who exhibit personality traits such as *conscientiousness* more susceptible to confirmation bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis H6.5a: Financial professionals who exhibit personality traits such as *neuroticism* are more susceptible to confirmation bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis H6.1b: Financial professionals who exhibit personality traits such as *extraversion* are more susceptible to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis H6.2b: A relationship exists between *agreeableness* and misconception of regression to the mean bias related to the representativeness heuristic in the financial decision-making of financial professionals.

Hypothesis H6.3b: A relationship exists between *openness to new experience* and misconception of regression to the mean bias related to the representativeness heuristic in the financial decision-making of financial professionals.

Hypothesis H6.4b: Financial professionals who exhibit personality traits such as *conscientiousness* are more susceptible to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.5b}$: Financial professionals who exhibit personality traits such as *neuroticism* are more susceptible to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.1c}$: Financial professionals who exhibit personality traits such as *extraversion* are more susceptible to by conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.2c}$: Financial professionals who exhibit personality traits such as *agreeableness* are less susceptible to conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.3c}$: Financial professionals who exhibit personality traits such as *openness to new experience* are less susceptible to conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.4c}$: A relationship exists between *conscientiousness* and conjunctive events bias related to the anchoring and adjustment heuristic in the financial decision-making of financial professionals.

Hypothesis $H_{6.5c}$: Financial professionals who exhibit personality traits such as *neuroticism* are more susceptible to conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.1d}$: Financial professionals who exhibit personality traits such as *extraversion* are more susceptible to overconfidence bias when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.2d}$: Financial professionals who exhibit personality traits such as *agreeableness* are less susceptible to overconfidence bias when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.3d}$: Financial professionals who exhibit personality traits such as *openness to new experiences* are more susceptible to overconfidence bias when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.4d}$: Financial professionals who exhibit personality traits such as *conscientiousness* are more susceptible to overconfidence bias when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.5d}$: A relationship exists between *neuroticism* and overconfidence bias in the financial decision-making of financial professionals.

Hypothesis $H_{6.1e}$: Financial professionals who exhibit personality traits such as *extraversion* are more susceptible to biases related to affect (emotion) when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.2e}$: A relationship exists between *agreeableness* and affect bias in the financial decision-making of financial professionals.

Hypothesis $H_{6.3e}$: Financial professionals who exhibit personality traits such as *conscientiousness* are more susceptible to biases related to affect (emotion) when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.4e}$: Financial professionals who exhibit personality traits such as *openness to new experience* are more susceptible to biases related to affect (emotion) when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Hypothesis $H_{6.5e}$: Financial professionals who exhibit personality traits such as *neuroticism* are more susceptible to biases related to affect (emotion) when they make financial decisions, compared to financial professionals who do not exhibit these traits.

3.8 SUMMARY

Chapter 3 has focused on the key determinants of heuristic-related and other biases in a finance environment. The chapter firstly looked at the key main independent variable of interest of the present study, namely the trait of professional scepticism and its relationship with bias in decision-making, which addresses Research Question 2.

Professional scepticism has been identified as an important aspect in the finance environment. This view is driven by the call from professional accounting bodies such as the

IAASB and the ACCA for increased professional scepticism amongst financial professionals, as well as for more guidance to be incorporated in auditing and accounting standards. Professional scepticism is defined in this context as "an attitude that includes a questioning mind, being alert to conditions that may indicate possible misstatement due to error or fraud, and a critical assessment of audit evidence" (IFAC, 2009, p. 77). A distinction was made between professional scepticism as a neutral perspective or as a presumptive perspective taken by decision-makers. Although there is evidence of both perspectives in the literature, the present study takes the view that professional scepticism requires a neutral perspective. A neutral perspective of professional scepticism is denoted by possessing a questioning mind, being observant, as well as engaging in probing reflection. Furthermore, in the present study, professional scepticism is defined as a trait, although it can be argued that situational factors (state) may influence a person's application of scepticism. There is support in the literature for the argument that people with higher levels of scepticism as a trait ultimately exercise higher levels of state scepticism. Therefore the present study focuses on the trait element of professional scepticism.

This chapter has furthermore introduced a key measurement scale for the trait of professional scepticism, developed by Hurtt (2010). The scale is adopted in the present study to measure scepticism as a trait. The professional scale differentiates between six sub-constructs (characteristics) of professional scepticism, namely having a questioning mind, suspension of judgement, search for knowledge, the human aspect of having interpersonal understanding, self-determining (autonomy) and the individual's ability to act on the evidence and information gathered, which supports the characteristics of self-confidence (self-esteem). Hypothesis 2 and its related sub-hypotheses are summarised in Table 3.1.

Table 3.1: Hypothesis 2 – summary

Main Hypothesis 2	Sub-hypotheses
Professional scepticism as a trait	
A relationship exists between professional scepticism as a trait and heuristic-related and other biases in the financial decision-making of financial professionals.	***Hypothesis H_{2a} to H_{2e}:*** A relationship exists between professional scepticism as a trait 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.

Main Hypothesis 2	Sub-hypotheses
Professional scepticism as a trait	
Professional scepticism as a trait – sub-constructs	
A relationship exists between the constructs of professional scepticism as a trait and heuristic-related and other biases in the financial decision-making of financial professionals.	***Hypothesis $H_{2.1a}$ to $H_{2.1e}$:*** A relationship exists between questioning mind ($H_{2.1}$) and ***confirmation bias ($H_{2.1a}$), misconception of regression to the mean bias ($H_{2.1b}$), conjunctive events bias ($H_{2.1c}$), overconfidence bias ($H_{2.1d}$) and affect bias ($H_{2.1e}$)*** in the financial decision-making of financial professionals.
	Hypothesis $H_{2.2a}$ to $H_{2.2e}$: A relationship exists between suspension of judgement ($H_{2.2}$) and ***confirmation bias ($H_{2.2a}$), misconception of regression to the mean bias ($H_{2.2b}$), conjunctive events bias ($H_{2.2c}$), overconfidence bias ($H_{2.2d}$) and affect bias ($H_{2.2e}$)*** in the financial decision-making of financial professionals.
	Hypothesis $H_{2.3a}$ to $H_{2.3e}$: A relationship exists between search for knowledge ($H_{2.3}$) and ***confirmation bias ($H_{2.3a}$), misconception of regression to the mean bias ($H_{2.3b}$), conjunctive events bias ($H_{2.3c}$), overconfidence bias ($H_{2.3d}$) and affect bias ($H_{2.3e}$)*** in the financial decision-making of financial professionals.
	Hypothesis $H_{2.4a}$ to $H_{2.4e}$: A relationship exists between interpersonal understanding ($H_{2.4}$) and ***confirmation bias ($H_{2.4a}$), misconception of regression to the mean bias ($H_{2.4b}$), conjunctive events bias ($H_{2.4c}$), overconfidence bias ($H_{2.4d}$) and affect bias ($H_{2.4e}$)*** in the financial decision-making of financial professionals.
	Hypothesis $H_{2.5a}$ to $H_{2.5e}$: A relationship exists between self-determining ($H_{2.5}$) and ***confirmation bias ($H_{2.5a}$), misconception of regression to the mean bias ($H_{2.5b}$), conjunctive events bias ($H_{2.5c}$), overconfidence bias ($H_{2.5d}$) and affect bias ($H_{2.5e}$)*** in the financial decision-making of financial professionals.
	Hypothesis $H_{2.6a}$ to $H_{2.6e}$: A relationship exists between self-confidence ($H_{2.6}$) and ***confirmation bias ($H_{2.6a}$), misconception of regression to the mean bias ($H_{2.6b}$), conjunctive events bias ($H_{2.6c}$), overconfidence bias ($H_{2.6d}$) and affect bias ($H_{2.6e}$)*** in the financial decision-making of financial professionals.

Finally, this chapter has discussed additional personal factors and determinants which increase or decrease decision-makers' susceptibility to bias in decision-making. The present study aims to be aware of these variables in determining the relationship between professional scepticism as a trait and bias in decision-making. The study includes gender, age, experience and personality traits as determinants which may play a role in the susceptibility of decision-makers to bias, but acknowledges that this is not an exhaustive list of variables, and that other person, task or environment variables may also exist. Four additional hypotheses were developed for the present study for gender, age, experience,

and personality traits. Hypotheses 3, 4, 5 and 6 and their related sub-hypotheses are summarised in Table 3.2.

Table 3.2: Summary of Hypotheses 3 to 6

Research Hypothesis	Statistical hypotheses
Hypothesis 3: Gender	
A relationship exists between gender and heuristic-related and other biases in the financial decision-making of financial professionals.	***Hypothesis H_{3a}:*** A relationship exists between the gender of decision-makers and their susceptibility to confirmation bias related to the representativeness heuristic when they make financial decisions.
	Hypothesis H_{3b}: A relationship exists between the gender of decision-makers and their susceptibility to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions.
	Hypothesis H_{3c}: Financial professionals who are *women* are more susceptible than financial decision-makers who are *men* to conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions.
	Hypothesis H_{3d}: Financial professionals who are *women* are less susceptible than financial decision-makers who are *men* to bias related to overconfidence when they make financial decisions.
	Hypothesis H_{3e}: Financial professionals who are *women* are more susceptible than financial decision-makers who are *men* to bias related to the use of affect (emotion) when they make financial decisions.
Hypothesis 4: Age	
A relationship exists between age and heuristic-related and other biases in the financial decision-making of financial professionals.	***Hypothesis H_{4a}:*** A relationship exists between the age of decision-makers and their susceptibility to confirmation bias related to the representativeness heuristic when they make financial decisions.
	Hypothesis H_{4b}: A relationship exists between the age of decision-makers and their susceptibility to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions.
	Hypothesis H_{4c}: A relationship exists between the age of decision-makers and their susceptibility to conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions.
	Hypothesis H_{4d}: A relationship exists between the age of decision-makers and their susceptibility to overconfidence bias when they make financial decisions.
	Hypothesis H_{4e}: Financial professionals who are *relatively older* are less susceptible to bias related to the use of affect (emotion) than *younger* financial professionals when they make financial decisions.
Hypothesis 5: Experience	
A relationship exists between experience and heuristic-related	***Hypothesis $H_{5.1a}$:*** A relationship exists between the level of experience of decision-makers and their susceptibility to confirmation bias related to the representativeness heuristic when they make financial decisions.

Research Hypothesis	Statistical hypotheses
and other biases in the financial decision-making of financial professionals.	***Hypothesis $H_{5.2a}$:*** A relationship exists between the level of decision-making experience of decision-makers and their susceptibility to confirmation bias related to the representativeness heuristic when they make financial decisions.
	Hypothesis $H_{5.1b}$: A relationship exists between the level of experience of decision-makers and their susceptibility to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions.
	Hypothesis $H_{5.2b}$: A relationship exists between the level of decision-making experience of decision-makers and their susceptibility to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions.
	Hypothesis $H_{5.1c}$: Financial professionals with *more experience* are <u>less susceptible</u> to conjunctive events bias related to the anchoring and adjustment heuristic when making financial decisions, compared to financial professionals with *less experience*.
	Hypothesis $H_{5.2c}$: Financial professionals with *more decision-making experience* are <u>less susceptible</u> to conjunctive events bias related to the anchoring and adjustment heuristic when making financial decisions, compared to financial professionals with *less decision-making experience*.
	Hypothesis $H_{5.1d}$: Financial professionals with *more experience* are <u>more susceptible</u> to bias related to overconfidence when making financial decisions, compared to financial professionals with *less experience*.
	Hypothesis $H_{5.2d}$: Financial professionals with *more decision-making experience* are <u>more susceptible</u> to bias related to overconfidence when making financial decisions, compared to financial professionals with *less decision-making experience*.
	Hypothesis $H_{5.1e}$: Financial professionals with *more experience* are <u>less susceptible</u> to bias related to the use of affect (emotion) when making financial decisions, compared to financial professionals with *less experience*.
	Hypothesis $H_{5.2e}$: Financial professionals with *more decision-making experience* are <u>less susceptible</u> to bias related to the use of affect (emotion) when making financial decisions, compared to financial professionals with *less decision-making experience*.
Hypothesis 6: Personality traits	
A relationship exists between personality traits and heuristic-related and other biases in the financial decision-making of financial	***Hypothesis $H_{6.1a}$:*** A relationship exists between *extraversion* and confirmation bias related to the representativeness heuristic in the financial decision-making of financial professionals.
	Hypothesis $H_{6.2a}$: Financial professionals who exhibit personality traits such as *agreeableness* are <u>less susceptible</u> to confirmation bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Research Hypothesis	Statistical hypotheses
professionals.	***Hypothesis $H_{6.3a}$***: Financial professionals who exhibit personality traits such as *openness to new experience* are <u>less susceptible</u> to confirmation bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.4a}$: Financial professionals who exhibit personality traits such as *conscientiousness* <u>more susceptible</u> to confirmation bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.5a}$: Financial professionals who exhibit personality traits such as *neuroticism* are <u>more susceptible</u> to confirmation bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.1b}$: Financial professionals who exhibit personality traits such as *extraversion* are <u>more susceptible</u> to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.2b}$: A relationship exists between *agreeableness* and misconception of regression to the mean bias related to the representativeness heuristic in the financial decision-making of financial professionals.
	Hypothesis $H_{6.3b}$: A relationship exists between *openness to new experience* and misconception of regression to the mean bias related to the representativeness heuristic in the financial decision-making of financial professionals.
	Hypothesis $H_{6.4b}$: Financial professionals who exhibit personality traits such as *conscientiousness* are <u>more susceptible</u> to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.5b}$: Financial professionals who exhibit personality traits such as *neuroticism* are <u>more susceptible</u> to misconception of regression to the mean bias related to the representativeness heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.1c}$: Financial professionals who exhibit personality traits such as *extraversion* are <u>more susceptible</u> to by conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.2c}$: Financial professionals who exhibit personality traits such as *agreeableness* are <u>less susceptible</u> to conjunctive events bias related to the anchoring and adjustment heuristic when they make

Research Hypothesis	Statistical hypotheses
	financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.3c}$: Financial professionals who exhibit personality traits such as *openness to new experience* are <u>less susceptible</u> to conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.4c}$: A relationship exists between *conscientiousness* and conjunctive events bias related to the anchoring and adjustment heuristic in the financial decision-making of financial professionals.
	Hypothesis $H_{6.5c}$: Financial professionals who exhibit personality traits such as *neuroticism* are <u>more susceptible</u> to conjunctive events bias related to the anchoring and adjustment heuristic when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.1d}$: Financial professionals who exhibit personality traits such as *extraversion* are <u>more susceptible</u> to overconfidence bias when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.2d}$: Financial professionals who exhibit personality traits such as *agreeableness* are <u>less susceptible</u> to overconfidence bias when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.3d}$: Financial professionals who exhibit personality traits such as *openness to new experiences* are <u>more susceptible</u> to overconfidence bias when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.4d}$: Financial professionals who exhibit personality traits such as *conscientiousness* are <u>more susceptible</u> to overconfidence bias when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.5d}$: A relationship exists between *neuroticism* and overconfidence bias in the financial decision-making of financial professionals.
	Hypothesis $H_{6.1e}$: Financial professionals who exhibit personality traits such as *extraversion* are <u>more susceptible</u> to biases related to affect (emotion) when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.2e}$: A relationship exists between *agreeableness* and affect bias in the financial decision-making of financial professionals.
	Hypothesis $H_{6.3e}$: Financial professionals who exhibit personality traits such as *conscientiousness* are <u>more susceptible</u> to biases related to affect (emotion) when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Research Hypothesis	Statistical hypotheses
	Hypothesis $H_{6.4e}$: Financial professionals who exhibit personality traits such as openness to new experience are more susceptible to biases related to affect (emotion) when they make financial decisions, compared to financial professionals who do not exhibit these traits.
	Hypothesis $H_{6.5e}$: Financial professionals who exhibit personality traits such as *neuroticism* are more susceptible to biases related to affect (emotion) when they make financial decisions, compared to financial professionals who do not exhibit these traits.

Chapter 4 outlines the research philosophy and research design of the present study. The chapter also discusses how data were collected and how the present study tested for non-response bias. Thereafter the key data analysis techniques that were employed to generate results are presented. Finally, Chapter 4 briefly indicates how the data collected were and will be protected, the ethics protocol followed to collect the data, and the research design limitations of the present study.

CHAPTER 4:
RESEARCH DESIGN AND METHODS

4.1 INTRODUCTION

The research problem investigated in the present study revolves around whether there is a relationship between professional scepticism as a trait and heuristic-related and other biases in the decision-making process. Chapters 2 and 3 have reviewed the literature which critically analyses aspects relevant to the problem explored in the present study. The research questions addressing the research problem are the following:

Research Question 1: Which of the most prevalent heuristic-related and other biases are present in the financial decision-making behaviour of financial professionals?

Research Question 2: What is the relationship between professional scepticism as a trait and the identified heuristics-related and other biases in the financial decision-making behaviour of financial professionals?

In Chapter 4, the research methods used in the present study are described, starting with the research philosophy and research design. The research design section specifically elaborates on the chosen research instrument and its development, the contents of the questionnaire, the population and how sampling was performed. Thereafter consideration is given to how the data were collected, and non-response bias. The discussion is then directed towards the different data analysis techniques that were used to analyse the data, as well as the rigorousness and quality of the chosen research design and data techniques. Finally, data storage and protection protocols and ethical considerations are discussed, followed by the limitations resulting from the research methods used in the present study.

4.2 RESEARCH PHILOSOPHY

The present study conducted research into behavioural heuristics by means of a quantitative research approach. The use of quantitative research approaches is increasing in the fields of behavioural research (Nigam et al., 2018). The most common research paradigms are considered to be positivism, post-positivism, constructivism and critical theory (Guba & Lincoln, 1994). Although some elements of behavioural research may align with post-

positivist principles, it is important to recognise the diversity in the field of behavioural research. Research can be undertaken from various theoretical perspectives, depending on whose study and research questions are considered.

The present study adopts a post-positivist research paradigm. The positivism paradigm focuses on quantitative research, where objective truths from studies can be replicated (Plack, 2005, p. 225). Based on the underlying assumptions of positivism, it is believed that the world of social behaviour can be studied and researched in a similar way to the natural world (Mertens, 2014, p. 11). Positivism therefore assumes that one true reality exists, which is in line with the view of post-positivism (Ponterotto & Grieger, 2007, p. 410). However, post-positivism, in contrast to positivism, believes that the truth being studied in social sciences is limited to what can be observed, and that therefore conclusions should be based on probability, and not on certainty (Mertens, 2014, p. 12). A post-positivist approach suits research conducted in behavioural decision-making, as it aims to understand human behaviours better from an objective perspective, as opposed to prescriptive research, which suggests how decisions should be made optimally (Enslin, 2019, p. 99). Post-positivist theory aligns with what the present study aims to accomplish, which is to study behavioural aspects of financial professionals' judgement and decision-making.

4.3 RESEARCH DESIGN

An empirical research design using a quantitative data analysis approach was employed in the present study. A deductive research approach was followed, where hypotheses were developed from existing theory and statistically tested, as suggested by Trochim (2006). Primary data were collected by means of questionnaires. Although prior behavioural research has relied on experiments to a large extent, research on behavioural aspects of individual decision-making has also employed surveys as a research tool (Tversky & Kahneman, 1981, p. 453), and surveys have since been employed in research into financial decision-making as well (Ahmad et al., 2017, p. 5). It is relevant to this study that Hofstee (2006, p. 122) and Leedy and Ormrod (2013, p. 195) indicate that surveys are regularly used to conduct research into human preferences.

A number of prior studies have researched heuristic-related and other biases in the financial decision-making process, as well as studied the levels of professional scepticism of financial professionals separately, but only a few studies have attempted to research whether a

relationship exists between professional scepticism as a trait and bias in financial decision-making. Furthermore, advanced statistical techniques such as structural equation modelling (SEM) have not been frequently used in research studies on heuristic-related and other biases in financial decision-making, or in the exploration of professional scepticism. The primary data collected in the present study were analysed by means of a measurement model and structured path model testing to study how decision-making preferences are influenced by these variables.

The population of financial professionals, as previously defined in Chapter 1, could be any professionals around the world with a degree that is accredited by the International Auditing and Assurance Board (IAASB) or the Association of Chartered Certified Accountants (ACCA). This includes people who have completed their post-graduate diplomas and are currently gaining work experience to complete the professional examinations of either the IAASB and/or the ACCA to receive a professional designation.

Considering the possible locations and cost implications of this large dispersed sample, using an experiment would be impracticable. Prior studies support the use of an online survey for studies such as the present one, as such surveys are better suited for such a widely dispersed sample and are the most logical means by which data can be collected to provide insight into research questions such as those in the present study (Brandon et al., 2014, p. 2; Evans & Mathur, 2005, p. 208). A cross-sectional research study using a survey design was therefore deemed the most appropriate approach to address the research problem.

4.3.1 Research instrument

Data were collected by means of a questionnaire, where respondents were surveyed only once. There were no archival decision data for this research problem, so a questionnaire was considered appropriate to investigate judgement and decision-making in the present study. This choice is in line with similar studies that have been done in related fields in accounting behavioural research, including studies by Tversky and Kahneman (1981), Lowies et al. (2016) and Enslin (2019).

The most important functions of a research instrument are to provide validity in measuring theoretical constructs at the outset of a study, provide reliability in the data collection process (Hofstee, 2006, p. 116) and ultimately ensure both reliability and validity in the use of data

after they have been collected for testing purposes (Collier, 2020, p. 18). The aspects of reliability and validity are discussed in the following parts of the thesis:

- validity in measuring theoretical constructs at the outset of the study (paragraphs below in the remainder of Section 4.3.1);
- reliability in the data collection process (Section 4.4); and
- reliability and validity in the use of data after collection for testing purposes (Chapter 5).

Various methods were implemented to ensure the validity in how the theoretical constructs were measured in the present study by means of thorough consideration of the questions that formed part of the questionnaire, as discussed below.

Firstly, existing scales and questions validated from prior research studies were used in the questionnaire design to measure certain constructs. The questions were carefully constructed to ensure that the correct response was elicited. The wording of the questions was checked by a language editor, and input was gleaned from experts in the field of behavioural decision-making to ensure that the questions addressed the stated research problems and were also clear and understandable. Three experts in the field of behavioural decision-making (two local and one international) were approached to review the questionnaire. Adjustments were made on the basis of the insightful feedback received from these experts. The services of a professional language editor were also employed to ensure that the English aligns with the target population and that the survey questions are clear and unambiguous. This step was taken to enhance the appropriateness of language and structure of the survey questions in the present study.

Secondly, a pilot study was conducted to test the questionnaire further. The pilot study was conducted on academic staff in the Department of Financial Management at the University of Pretoria, as well as financial professionals currently in various areas of corporate practice. The minimum required number of respondents for a pilot study is 10 (Saunders et al., 2009, p. 451). The present study had a pilot sample of 10, of which five were academic staff members and five were financial professionals in corporate practice. The academic staff were considered appropriate to form part of the pilot study because these staff members are also professionals in the fields of management accounting, financial management and investment management, and together with their work experience, they possess similar skills to those of the target population (financial professionals). Additionally, these staff members also possess knowledge of questionnaire design, as behavioural finance is one of

the research focus areas in the Department of Financial Management at the University of Pretoria.

In view of the measures taken as described above, small amendments were made to a few questions, with the aim of enhancing the questions' relevance to the business context and provide additional clarity where needed. The final selection and contents of the questionnaire are discussed in more detail in the next section.

4.3.2 Contents of questionnaire

The questionnaire was developed to gather information in the following three main areas: the demographic information of each respondent as discussed in Chapter 3; the levels of professional scepticism as a trait of each respondent based on questions from the Hurtt (2010) Professional Scepticism Scale (HPSS); and the decision preferences of each respondent, based on questions developed with the purpose of identifying heuristic-related and other biases in financial decision-making. A copy of the questionnaire is attached in Appendix 1. The information below outlines the questions included in the respective sections of the questionnaire.

Participants completed Sections 1 and 2 in the questionnaire in exactly this order, but the questions in Section 3 of the questionnaire that related to the decision preferences were randomised. The randomisation of questions in Section 3 was introduced for several reasons. Firstly, randomisation mitigates the impact of participants rushing to complete items (Malhotra, 2008, p. 929). Secondly, it reduces systematic response patterns, which helps with more accurate and less biased data collection. Lastly, it ensures minimal influence from fatigue and timing issues (AlKhars et al., 2019).

Figure 4.1 shows the demographic determinants, dependent and independent variables and where these were included in the respective questionnaire sections.

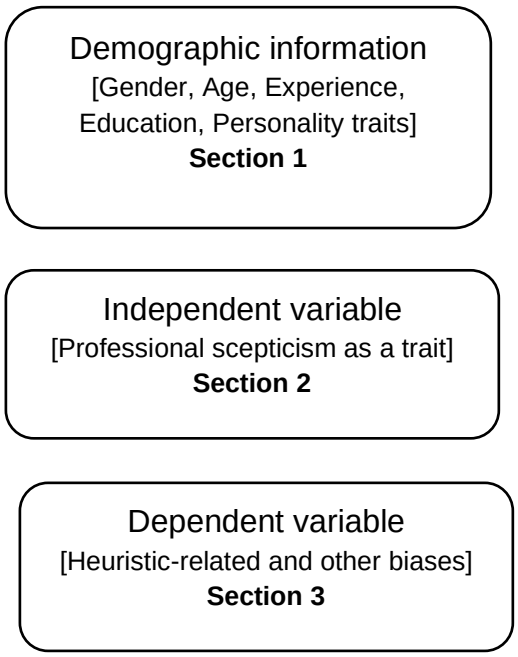


Figure 4.1: Outline of variables in the questionnaire

Source: Own compilation

4.3.2.1 Section 1

The *first section* consisted of questions which relate to demographic information, as well as other determinants affecting judgement in the decision-making of each participant. The answers to these questions provide valuable opportunities for analysis to investigate differences among participants relating to aspects of demographics and other determinants which may influence their decision-making. The following variables are discussed below: gender, age, experience, education, and personality traits.

In *Question 1*, the participants needed to identify their *gender*, namely whether they are male, female, other, or prefer not to say. The literature review indicates that gender may be associated with higher or lower susceptibility to certain biases. Prior research studies show that in some samples women were more prone to biases related to the anchoring and adjustment heuristic (Enslin, 2019; Rajdev & Raninga, 2016), specifically to affect bias (Bacha & Azouzi, 2019; Enslin, 2019), but were less prone to overconfidence bias (Baker et al., 2019; Mishra & Metilda, 2015). By contrast, for confirmation bias and misconception of

regression to the mean bias, gender was not a strong predictor (AlKhars et al., 2019; Lucena et al., 2021).

Question 2 requested participants to disclose their *age* in years on the date on which they completed the questionnaire. Prior research studies indicate that age may be associated with higher or lower susceptibility to certain biases. For confirmation bias, misconception of regression to the mean bias, conjunctive events bias and overconfidence, mixed results were reported regarding whether age plays a role in susceptibility to these biases. For affect bias, the trend noted in the literature reviewed was that relatively older participants were influenced less by bias related to affect (emotion) (You et al., 2019).

Education is not considered a differentiating factor, as noted in Section 3.6, but *Question 3* was asked to check that the participants did fulfil a key inclusion criterion for the sample. The population of the sample was defined in Chapter 1 and in the introduction to Section 4.3 above.

Questions 4 and 5 measured e*xperience*, requesting information about the number of years for which a participant has been listed as a professional with an IAASB and or ACCA accreditation, and the number of years the professional has been making key business decisions requiring significant judgement. The questionnaire provided a definition to clarify how key business decisions were defined in the present study, to ensure the accuracy with which this question was answered. The following definition was given: “Key decisions are considered decisions which can relate to either strategic, financial or operational decisions that may have a noticeable financial impact on business operations.”

As the overall population of the present study was all people with a financial background, but in various fields within finance, the aim was to determine whether the sample had financial decision-making experience, rather than experience in a specific finance field. Prior research studies indicate that experience may be associated with higher or lower susceptibility to certain biases. The literature review included evidence that people with more experience were less prone to biases stemming from the anchoring and adjustment heuristic (Chalissery et al., 2023; Henrizi et al., 2021) and affect bias (Bhattacharjee & Moreno, 2002), but more prone to overconfidence bias (Ateş et al., 2016; Deaves et al., 2010; Mishra & Metilda, 2015). Mixed results were noted in the literature for confirmation bias and misconception of regression to the mean bias. Contradictory results in prior studies may have arisen from the use of different ways to measure experience, which included

measuring experience as general, industry-specific, or task-specific. The present study acknowledges the role that different types of experience might have played and therefore distinguished between total years of experience in a financial environment and years of experience in making key business decisions, in line with Hogarth and Einhorn (1992). Section 3.5 reviews the literature around experience and its influence on bias in financial decision-making).

Question 6 measured *personality traits* and required participants to complete 10 questions, consisting of a 7-point Likert scale answer, ranging from 1 (strongly disagree) to 7 (strongly agree). The literature categorises personality traits into a Big Five framework, namely extraversion, agreeableness, openness to experience, conscientiousness, and neuroticism (Costa & McCrae, 1999; McCrae & John, 1992). Prior research studies indicate that personality traits may be associated with higher or lower susceptibility to confirmation bias (Chalissery et al., 2023), misconception of regression to the mean bias (Baker et al., 2021), biases stemming from the anchoring and adjustment heuristic (Baker et al., 2021; Chalissery et al., 2023), overconfidence bias (Ahmad, 2020; Baker et al., 2021; Tjandrasa & Tjandraningtyas, 2018), and affect bias (Baker et al., 2021; Khan & Abid Usman, 2021). Section 3.7 discusses the literature around personality traits and their influence on bias in financial decision-making.

The literature contains several lengthy scales that vary from 40 to over 200 questions to measure the Big Five personality traits (Costa & McCrae, 1999; Goldberg, 1990; John & Srivastava, 1999). Gosling et al. (2003) responded to the need for a shorter scale which can still measure the relevant five traits accurately with the Ten-Item Personality Inventory (TIPI) scale. Two questions support each of the Big Five personality traits. The TIPI scale, derived from the Big Five markers included in the study of Goldberg (1992), has undergone several analyses, including comparisons with established scales such as those of John and Srivastava (1999) and McCrae and John (1992). It showed promising results with regard to convergent validity and discriminant validity. The TIPI scale has been re-tested and used in various studies, for example, those of Romero et al. (2012), Nunes et al. (2018) and Clements (2020), all supporting its use as a personality scale.

The present study, however, does acknowledge that any shortened version of a scale consisting of only two indicators per construct is likely to be inferior to a standard multi-item instrument, and may exhibit low internal consistency scores. However, results from Gosling

et al.'s (2003) study state that the most appropriate use of the TIPI scale is where a shorter measure is needed or where a personality trait is not the main area of interest in the research study. The use of the TIPI scale in the present study is in line with Gosling et al.'s (2003) position – the intention was to use a short measure to save time for each participant, and personality traits were not the main area of interest of the present study.

4.3.2.2 Section 2

The *second section* of the questionnaire consists of 30 questions which relates to the *professional scepticism as a trait* of each participant. The 30 questions can be categorised into six constructs, consisting of five questions each. These constructs are questioning mind, suspension of judgement, search for knowledge, interpersonal understanding, self-determining, and self-confidence. These questions are adopted directly from the validated professional scepticism scale (HPSS) developed by Hurtt (2010; see Section 4.3.1). According to the study by Hurtt (2010, p. 168), who has used this scale across multiple samples, the questions take less than five minutes to complete in total, and consist of statements that participants use to describe themselves. The HPSS has been validated by many other research studies in both financial and non-financial environments. For example, in an auditing environment, the HPSS has been used to measure the effect of professional scepticism as a trait on fraud identification (Glover & Prawitt, 2013; Harding & Trotman, 2017), risk cue identification (Hurtt et al., 2008), decisions about client risk settings (Quadackers et al., 2014), prior client experiences (Popova, 2013), the influence of client management style (Eutsler et al., 2018), recency bias and behavioural intentions (Janssen et al., 2020; Koch et al., 2016), to mention only a few. The HPSS has also been applied to assess factors other than financial considerations influencing professional scepticism as a trait, such as gender (Charron & Lowe, 2008; Ratna & Anisykurlillah, 2020), experience (Moroney, 2007; Rose, 2007), and personality traits (Farag & Elias, 2016; Khan & Harding, 2020).

4.3.2.3 Section 3

The *third section* consists of eight questions which relate to the *behavioural influence that heuristics and biases* have on the judgement and decision-making of the participants. Each question and its case study are derived from prior studies, and contain a variety of tasks

across various job responsibility descriptions that fall into the scope of financial professionals. Case studies vary between management and investment scenarios.

The first three questions relate to the *representativeness heuristic*. *Questions 1 and 2* test confirmation bias, using questions borrowed from a study by Einhorn and Hogarth (1978, pp. 399-400). Their study provided a scenario to a sample of statisticians, who had to check a claim by a share market consultant which related to a specific rise in the share market (Einhorn & Hogarth, 1978, pp. 399-400). The sample of statisticians was told that when this particular share market consultant made a claim which predicted that the market would rise, the outcome was consistently correct. The statisticians had to check the consultant's claim and had the choice of one or a combination of pieces of evidence to choose from, but were tasked to select the minimum amount of evidence required. Confirmation bias emanates from the tendency to look for confirming evidence, rather than to consider disconfirming evidence. Therefore, the rational expectation is that individuals should look for disconfirming evidence, as its presence would contradict the claim made by the share market consultant. More recently Enslin (2019) used the same question in his study on a group of management accountants. Questions 1 and 2 provided similar information to that of Einhorn and Hogarth (1978, pp. 399-400) and Enslin (2019, p. 108) to elicit from participants what the minimum amount of information would be that they would look for to confirm the claim.

Question 3 tests misconception of regression to the mean bias. The question was adapted from a question identified by Enslin (2019, p. 215), who used an extended version of the original question by De Bondt and Thaler (1985, p. 797). In these prior studies, participants were presented with two investment scenarios. The first investment outperformed other investments in the recent past and was appropriately priced higher than other investments. The second investment performed worse than the average of other investments in the recent past and was accordingly priced slightly lower than the average. Based on the participant's selection, the researcher(s) could assess whether a participant was prone to misconception of regression to the mean bias. In the original study, De Bondt and Thaler (1985, p. 797) illustrated empirically that investments that performed worse but had promising future prospects outperformed an investment which had good results over the recent past (the previous three-year period). These findings suggest a natural tendency towards regression back to the mean: selecting the first investment (the one that performed well in the recent past) indicates the presence of misconception of regression to the mean bias.

Question 4 tests conjunctive events bias. The question was identified and sourced from a study by Joyce and Biddle (1981). Their study presented participants with a decision to acquire another company, based on the likelihood that a new product would be successfully introduced by the company. Additional information, as well as probability estimates, was provided regarding the further steps that needed to be taken for the successful introduction of the new product line. Participants were then assessed based on their estimate and whether they made overly conservative adjustments from the initial probabilities (anchors) provided. Enslin (2019) also adopted and adapted the question from Joyce and Biddle (1981) in his study on a sample of management accountants.

Questions 5, 6 and 7 relate to *overconfidence bias*. The questions were developed from various prior studies. Question 5 looks specifically at financial professionals' overconfidence in their own ability compared to that of other financial professionals in general terms, whereas Questions 6 and 7 look at financial professionals' overconfidence in their own ability when faced with a more unfamiliar problem.

Question 5 was developed from questions originally used by Gort (2009, p. 80) and thereafter adapted and used by both Lowies (2012, p. 95) and Enslin (2022). In Enslin's (2022) study, the participants were asked to compare themselves, using a 5-point Likert scale, to business managers and other management accountants to determine whether participants had overplaced themselves, compared to other business managers and management accountants. Enslin (2022) found that management accountants tended to be overconfident when measuring themselves against others with similar job roles (management accountants, as well as other business managers). The question by Gort (2009) was included in this study on the premise that decision-makers may neglect to compare themselves to the reference group (Bazerman & Moore, 2012). Concerns were raised when it was observed that prior research studies provided intervals that were too big, allowing participants to overestimate their placement compared to others. To overcome the concerns raised for this type of overconfidence measure, Benoît et al. (2015, p. 296) have suggested that researchers should have participants place themselves in more narrow bands, such as 10% increments, compared to only others in the top or bottom half (50%). Question 5 in the presented study therefore addressed this concern from prior research by providing participants with a sliding scale on which they could select any percentage from 0 to 100%.

Questions 6 and 7 were specifically included to address the concern in prior research that overplacement is highest when participants are faced with easy tasks, which can be reasoned out and can be wrongly considered to show overconfidence (Benoît & Dubra, 2011). This effect is similar to what Question 5 as included in the present study requests from participants, namely compare your own ability against those of others with similar abilities in a financial environment. Benoît et al. (2015) and Moore and Schatz (2017) point out that there is a possibility that participants in some studies may in fact have above average abilities, compared to the populations from which the sample was drawn.

New research responding to these concerns has found that overplacement of participants when comparing their own abilities to those of others might be reversed or disappear in the presence of unfamiliar, but easy tasks or difficult tasks (Benoît et al., 2015; Moore & Healy, 2008, p. 504). Moore and Healy (2008) provided individuals with multiple unfamiliar quizzes, ranging from easy, medium to difficult. Their results revealed that participants overplaced their performance on easy quizzes, but underplaced their performance on difficult quizzes (Moore & Healy, 2008, p. 509). Benoît et al. (2015) similarly adopted quizzes to measure overplacement, but their study focused only on easy quizzes. Their study found overplacement of their participants on easy quizzes (Benoît et al., 2015, p. 321). Enslin (2022) took a different approach and used unfamiliar, difficult questions in his study on management accountants to determine whether both underplacement and overplacement existed. Results indicated that the higher participants placed themselves, the more incorrect and more widely dispersed their answers were on average. Questions 6 and 7 differ from Question 5 in that the participants need to place themselves based on an unfamiliar easy quiz, compared to a familiar context provided in Question 5. Although the general knowledge quiz is seen as easy, it presents in a slightly less familiar context and may therefore be regarded as being more difficult, when comparing oneself to one own's general ability in Question 5.

The present study used aspects of Moore and Healy's (2008) study and adopted the approach from Benoît et al. (2015) to create a more contextualised question setting, with an unfamiliar easy quiz to measure overplacement better. To determine overplacement by participants in the present study, the placement confidence indicated by the participants was compared to their actual performance. This addressed the concern from Moore and Schatz (2017) that a more accurate measure of overplacement can only be achieved if placement is measured against actual performance.

In designing overconfidence measures, recent studies have begun to highlight the importance of the context given to participants (Merkle, 2017, p. 69). The need to do so is supported by studies such as those of Burks et al. (2013) and Benoît et al. (2015). Both studies provided a sample question to their participants before their respective quizzes. Burks et al. (2013) provided only a single sample question to provide additional context, whereas Benoît et al. (2015, p. 296) gave their participants 20 sample questions to gauge the difficulty of the test without giving test results scores. The present study provided two sample questions to help participants gauge the difficulty of the quiz.

In *Question 6* in the present study, participants were told that they had to complete a general knowledge quiz consisting of 10 questions. To contextualise the quiz, in line with Benoît et al. (2015, p. 296), two examples of the questions that can be expected were presented to the participants. After the participants had been shown the two example questions, they were asked to indicate their confidence level in respect of how well they expected they would perform in the quiz, compared to other financial professionals who would also take the quiz. Questions 7.1 to 7.10 contained the 10 quiz questions. *Question 7.11* followed once the participants had completed the quiz, and requested each participant again to provide a confidence level as to how well they would perform in the quiz, compared to other financial professionals who would also take the quiz. Providing participants with an unfamiliar quiz, establishing the context of the quiz for participants, and measuring placement confidence against actual performance, addressed the concerns raised in the literature (Benoît et al., 2015; Benoît & Dubra, 2011; Moore & Healy, 2008; Moore & Schatz, 2017).

Question 8 relates to *affect bias*. The case study used in the present study was taken from a study by Kida et al. (2001, p. 484). In that case study, participants were given a scenario from which an affective response was generated towards one of two decisions. In their study, two groups were presented with the same background information to an investment decision-making problem. Only one group received additional affective context. Both groups were required to make a choice between investment alternatives with the same risk profiles, but different return outcomes (Kida et al., 2001, p. 484). The investment alternative with the higher return was also the alternative in which additional affect information was included. Affect bias was noted in the group which had been presented with affective information. Affect bias was evident in the group, as they chose an alternative investment from the group that had not been presented with affective information. Clearly, the affective information led to a different investment decision. Both Enslin (2019) and Fehrenbacher et al. (2020)

adapted Kida et al.'s (2001) scenario to make it more applicable to management accountants. The present study used the case study from Enslin (2019) and adapted it where necessary to make it more applicable to financial professionals.

The validity of the questions that were included in the questionnaire was confirmed, since the questions used in the present study were developed from those in prior studies, and since experts in the field were approached to review the questionnaire, and a pilot study was performed before the questionnaire was sent out to the participants of the present study.

4.3.3 Population and sampling

The present study is concerned with the decision-making behaviour of financial professionals, as defined in Section 1.3, in the respective fields of auditing, financial accounting and financial management. Financial professionals were chosen as the target population of the present study, because of the expectation placed on this population to exercise sound professional scepticism and make quality judgements (Cruz et al., 2020, p. 1). A key criterion for inclusion in the study was that the financial professionals used as the population for the study needed to be accredited by international bodies, signified by their belonging to either the IAASB or the ACCA or both. This included 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 professional certification. Financial professionals that form part of these international bodies are expected to apply professional scepticism as a trait in their judgement and decision-making.

Two non-probability sampling methods were adopted in the present study. Firstly, a convenience sampling method was adopted, because a complete list of financial professionals locally and internationally cannot be obtained. This method of sampling is adopted when it is not practical to obtain a contact list of information for the target population (Fogelman & Comber, 2002). Secondly, a snowball sampling method was adopted, where existing participants had an opportunity to recruit further participants by distributing the survey link. A question regarding education was included in the questionnaire to ensure that only financial professionals who met the inclusion requirements of the present study were used for data analyses. This check was performed by means of data screening once all the data had been collected.

To establish the trustworthiness of the sample, information is provided regarding the population and the sample response collection in Section 4.4. The present study acknowledges the external validity concerns raised by Brandon et al. (2014) around the use of convenience sampling. Notwithstanding their concerns, Brandon et al. (2014) note that this method of sampling can be an adequate substitute for probability samples where populations are widely dispersed and difficult to reach. A further limitation was loss of researcher control over the circumstances in which the responses were framed. However, one benefit of adopting an online survey was that it led to larger sample sizes.

The present study aimed to investigate behavioural aspects of decision-making and therefore required a sample of qualified financial professionals to ensure that the findings are representative of the population in the professional environments in which the relevant decisions are made. The sample consisted of qualified professionals from diverse backgrounds. By using a large diverse target population of qualified financial professionals, issues around external validity were also partially resolved. The various channels used to distribute the questionnaire for the survey are explained in the next section.

4.4 DATA COLLECTION

The instrument used to collect the data was a self-administered questionnaire using the Qualtrics Online Survey software. The Qualtrics platform has previously been used in behavioural studies and researchers are encouraged to continue using it in behavioural accounting research (Brandon et al., 2014). The University of Pretoria currently has a licencing agreement supporting the use of this software for research purposes.

To increase the external validity of the sample as a representative sample of financial professionals, three methods were used for the distribution of the questionnaire, namely the use of social media, personal contacts and the South African Institute of Chartered Accountants (SAICA). The social media platforms that were used included LinkedIn, Facebook and Instagram, where respondents were encouraged to forward the survey to other financial professionals. The author also distributed the survey link to colleagues and personal contacts who met the criteria of financial professionals. Finally, the professional accountancy body in South Africa, SAICA, also distributed the survey link in their Chartered Accountant World Newsletter. This newsletter is sent to all Chartered Accountants in South Africa who voluntarily subscribe to the newsletter.

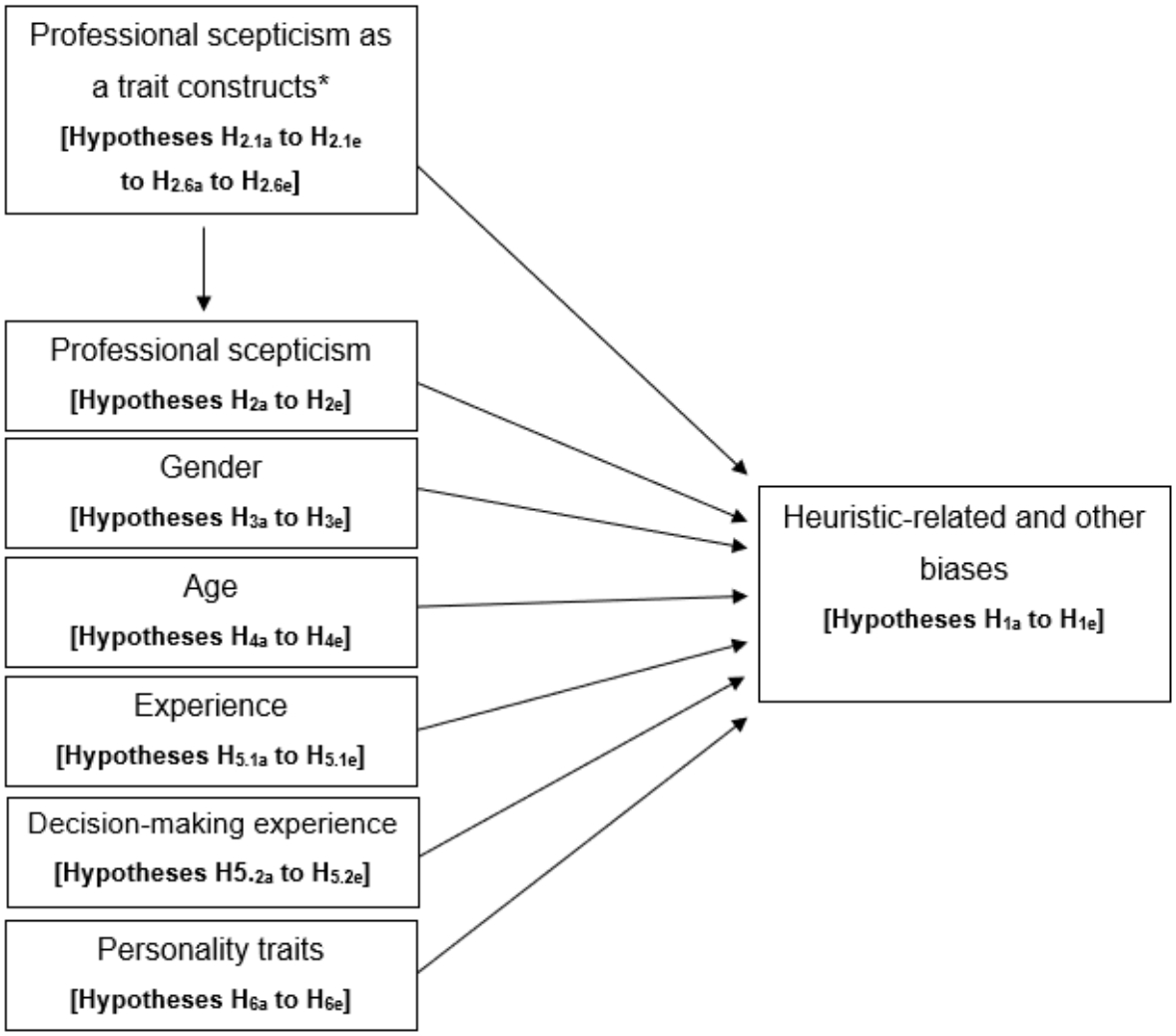
In the present study, 460 responses were gathered. Of the 460 participants who responded, only 301 (65%) participants completed every section of the questionnaire. Therefore 159 incomplete responses were removed from the dataset. The high dropout rate could be attributed to survey fatigue, leading participants to abandon the survey early. Prior research studies that also used online surveys and conducted research in similar focus areas to the present study have reported comparable challenges in respect of survey fatigue (AlKhars et al., 2019; Enslin, 2019).

4.5 NON-RESPONSE BIAS

Even though the present study pursued various avenues to collect responses to increase the representativeness of the sample, non-response bias was still a risk. Non-response bias refers to participants who never received the survey, participants who made the choice not to take part in the survey at all, or participants who dropped out of the survey before completing it (Groves, 2006). These groups of participants might be systemically different from the rest of the population, which poses the risk that a specific group of participants was underrepresented. To address this risk, a wave analysis was performed: the responses received at the end of the survey period (10% of the total sample) were compared to those of participants who completed the survey at the beginning of the survey period (10% of the total sample). The late responders were used as a proxy for potential “non-respondents”. No significant differences were found between the answers of the two groups. The fact that there was no significant difference between the responses of these two groups implies that non-response bias was not present.

4.6 DATA ANALYSIS

Data analysis is the process where the data collected are ordered, categorised, manipulated and summarised to be presented in an interpretable form from which relationships can be tested and conclusions can be reached (De Vos et al., 2012, p. 249). The present study used a quantitative data analysis strategy, where the interpretable data were analysed through various methods. The key hypotheses assessed through the data analysis of the present study are presented in Figure 4.2.



* Characteristics/sub-constructs of professional scepticism as a trait which consist of questioning mind, suspension of judgement, search for knowledge, interpersonal understanding, self-determining and self-confidence]

Figure 4.2: Research hypotheses

Source: Own compilation

Different statistical techniques were required to address the various hypotheses. Hypothesis 1 tested whether financial professionals are influenced by several heuristic-related and other biases when they make financial decisions. For the testing of Hypothesis 1, this study conducted detailed descriptive statistics, one-sample t-tests and Wilson binomial confidence intervals. Hypotheses 2 to 6 examined the relationship between heuristic-related and other biases, and professional scepticism as a trait, gender, age,

experience, and personality traits in the financial decision-making of financial professionals. For the testing of Hypotheses 2 to 6, multivariate statistical analyses were conducted, which included confirmatory and exploratory factor analyses and structural equation modelling.

The remainder of the data analysis section is presented in the following order:

- cleaning and validation of data (Section 4.6.1)
- descriptive statistics (Section 4.6.2)
- statistical techniques applicable to Hypothesis 1 (Section 4.6.3)
- statistical techniques applicable to Hypotheses 2 to 6 (Section 4.6.4)

4.6.1 Cleaning and validation of the data

The aim of data cleaning is to ensure that the data collected are free of omissions, ambiguities, and errors. The measurement level of variables influences the statistical analyses that can be performed. The measurement level of variables and descriptions used in the present study were selected from the literature and are defined in Table 4.1.

Table 4.1: Level of measurement

Measurement level	Description	Application to questionnaire
Dichotomous variable	Classify into two categories	**Section 3:** Bias
Nominal variable	Classify into categories	**Section 1**: Gender
Ordinal variable	Order by rank or magnitude	**Section 1**: Personality traits, Likert-response type items **Section 2:** Professional scepticism as a trait, Likert-response type items
Ratio/ continuous variable	Distance between the values is meaningful and there is an absolute zero point	**Section 1:** Age, experience, composite personality traits scores **Section 2:** Composite professional scepticism as a trait scores
Latent variable	Variable measured indirectly using observed variables	**Section 1:** Personality trait constructs

Measurement level	Description	Application to questionnaire
		Section 2: Professional scepticism as a trait constructs
Observed variable in context of SEM	Variable that captures an unobservable concept through observable means	**Section 1:** Personality traits, Likert-response type items **Section 2:** Professional scepticism as a trait, Likert-response type items **Section 3:** Bias

Source: Adapted from Blumberg et al. (2014) and Collier (2020)

Cleaning the data also involved checking the validity of the numbers provided by the participants, for example, the range of age and years of experience that participants reported. The study also inspected the time it took for each participant to complete the questionnaire to confirm the quality of data collected. No unusual items were noted in respect of the time spent to complete the questionnaire.

The descriptive statistics performed in the present study are described in the next section.

4.6.2 Descriptive statistics

For the present study, descriptive statistics assisted in describing the characteristics of the data collected and determined whether there were any violations of the assumptions of the statistical techniques used in the study. The study used the Statistical Package for Social Sciences (SPSS) version 28 to complete the descriptive statistics. Frequency tables that provide frequencies per category were applied for all ordinal and nominal data, and the descriptive statistics were inspected for continuous variable data. This included consideration of the generation of means, standard deviations, skewness, and kurtosis values. The results of the descriptive statistics are presented in Chapter 5.

The statistical techniques used in the testing of Hypothesis 1 and Hypotheses 2 to 6 are discussed in the next two sub-sections.

4.6.3 Statistical techniques – Hypothesis 1

This section considers the variable measurement for the data related to the testing of Hypothesis 1, and the various statistical techniques used to support or not support Hypothesis 1. The sub-hypotheses are outlined in Table 4.2.

Table 4.2: Summary of the research hypotheses

H_1:	**Financial professionals are susceptible to a number of heuristic-related and other biases when they make financial decisions.**
H_{1a}	Financial professionals are susceptible to **confirmation bias** related to the representativeness heuristic when they make financial decisions.
H_{1b}	Financial professionals are susceptible to **misconception of regression to the mean bias** related to the representativeness heuristic when they make financial decisions.
H_{1c}	Financial professionals are susceptible to **conjunctive events bias** related to the anchoring and adjustment heuristic when they make financial decisions.
H_{1d}	Financial professionals are susceptible to bias related to **overconfidence** when they make financial decisions.
H_{1e}	Financial professionals are susceptible to bias related to the use of **affect (emotion)** when they make financial decisions.

Source: Own compilation

4.6.3.1 Variable measurement

The main dependent variables of the present study were the various biases. These biases are considered to be derived and observed, dichotomous variables. A derived variable is a variable created by the researcher by calculating or categorising variables generated from the existing data set, based on categorisation rules. In the present study, the option chosen by a participant in Section 3 of the questionnaire allowed the researcher to categorise the participant as either biased or rational. The categorisation is based on the literature, specifically where questions or case studies were derived from other research studies. For two biases, namely conjunctive events bias and overconfidence bias, variables were also classified as continuous, as participants had to select a percentage from a range from 0% to 100%.

Table 4.3: Variable measurement – Hypothesis 1

Variable	Application to questionnaire	Measurement level	Measurement description
Confirmation bias	Section 3: Q1 & 2	Dichotomous (derived)	If participants selected Options A and D, they were considered rational. If the participants selected Options A and C they were considered biased. For all other remaining options chosen, no bias could be assigned.
Misconception of regression to the mean bias	Section 3: Q3	Dichotomous (derived)	If participants selected Option B, they were considered rational. The selection of Option A was considered biased.
Conjunctive events bias	Section 3: Q4	Dichotomous & Continuous (derived)	If participants selected a percentage between 50% and 60%, they were considered rational. If a percentage of more than 60% was chosen, the participant made an insufficient downward adjustment and was considered biased. For any value selected below 50%, no bias could be assigned.
Overconfidence bias – general ability	Section 3: Q5	Dichotomous & Continuous (derived)	Placement of the group was measured by how far the group mean differed from 50%.
Overconfidence bias – unfamiliar context	Section 3: Q6		The placement percentage that each participant chose ***before*** doing the quiz was compared with the participant's actual performance to determine whether the participants overplaced or underplaced themselves or were rational, based on their actual performance in the quiz.
Overconfidence bias – unfamiliar context	Section 3: Q7		The placement percentage that each participant chose ***after*** doing the quiz was compared with the participant's actual performance to determine whether the participants overplaced or underplaced themselves or were rational,

Variable	Application to questionnaire	Measurement level	Measurement description
			based on their actual performance in the quiz.
Affect bias	Section 3: Q8	Dichotomous (derived)	If participants selected Option A, they were regarded as rational. The selection of Option B was regarded as biased.

4.6.3.2 Wilson binomial confidence intervals

To address main Hypothesis 1, the present study tested whether the answers of the financial professionals in the sample were significantly different from rational choices. For confirmation bias, misconception of regression to the mean bias and affect bias, the actual response proportions between the two possible answers were compared to the expected proportions. Financial professionals were expected to choose the rational answer as their response and therefore a fully rational response from participants would require that 100% of the participants selected the rational option, with nobody selecting the biased option. To test whether the actual responses from the sample differed from the expected responses, a chi-square test for goodness-of-fit could not be used, as the outcome variable was either rational or biased (0% or 100%) (Enslin, 2019, p. 116). Therefore, the present study adopted a similar approach to that of Enslin (2019, p. 116), where a 95% Wilson binominal confidence interval, as identified by Brown et al. (2001), was implemented.

Financial professionals are expected to be rational in making financial decisions. Therefore, using the 95% Wilson binomial confidence interval level, the expected 100% unbiased proportion was compared to a 95% Wilson binomial confidence interval level of the actual proportion. The results of this test demonstrated whether the actual responses of this sample of financial professionals differed significantly from rationality. The 95% Wilson binominal confidence intervals were calculated by using an online tool generated and developed by Ausvet. Ausvet is an educational website which provides tools to researchers to assist them in determining statistical significance for cause-and-effect conditions amongst populations. This calculator was explicitly based on research initially conducted by Brown et al. (2001) in the health sciences. Later on, this tool was also used by Enslin (2019, p. 116), whose research involved a sample of management accountants. Cumming and Finch (2005, pp. 171,180) support the use of confidence interval levels, especially to test the statistical

significance of differences in proportions. Where results display no overlap between the two proportions, it can be concluded that the difference is statistically significant ($p < .01$).

4.6.3.3 One-sample t-test

To address the remaining two biases for Hypothesis 1, namely conjunctive events bias and overconfidence bias, a different test compared to the 95% Wilson binomial confidence interval was adopted. This decision was made because of the way both these biases were addressed in the questionnaire – participants could select any percentage in a range from 0% to 100% to answer the question. Therefore, a one-sample t-test was adopted to test whether the answers of the sampled financial professionals differed significantly from being rational. A one-sample t-test compares the expected mean with the actual mean of the same sample. For conjunctive events bias, the expected answer would require the participants to choose a percentage of 55.4%. For the purposes of the present study, a range between 50% and 60% was accepted as correct (rational). This range was chosen to accommodate rounding differences, and the fact that slight error could come into play if participants used the sliding scale to select a percentage. For overconfidence bias (general ability) the expected mean for the overall target population should be 50%, as the expectation is that some participants would be above the mean, whereas others would be below the mean, based on their abilities. This should balance the average to 50%. The present study used SPSS version 28 to conduct the one-sample t-tests. For the second and third measures of overconfidence bias, further analyses were required in the form of descriptive tests, as explained below.

4.6.3.4 Descriptive statistics

To address the other measures of overconfidence bias, which focus on an unfamiliar context, a one-sample t-test could not be performed. To determine whether participants were rational or whether they overplaced or underplaced themselves, the percentage selected needed to be compared with the actual performance of the participants on the quiz. The following comparison was done to make this determination:

- If participants placed themselves in the right category, considering where they were actually placed, based on their performance on the quiz, they were considered *rational*.
- If participants placed themselves higher than they were actually placed, based on their performance on the quiz, they *overplaced* themselves.
- If participants placed themselves lower than they were actually placed, based on their performance on the quiz, they *underplaced* themselves.

Table 4.4 summarises the statistical tests that were conducted to test Hypothesis 1.

Table 4.4: Statistical tests summary – Hypothesis 1

Hypothesis	Variable	Statistical test
Hypothesis H_{1a}, H_{1b} and H_{1e}	Confirmation bias, Misconception of regression to the mean bias, Affect bias	95% Wilson binomial confidence interval
Hypothesis H_{1c}, H_{1d}	Conjunctive events bias, Overconfidence bias (general ability)	One-sample t-test
Hypothesis H_{1d}	Overconfidence bias (unfamiliar context)	Descriptive statistics

Chapter 6 reports on the results for the testing of Hypothesis 1 and whether the hypothesis and sub-hypotheses were supported or not supported by the results.

4.6.4 Statistical techniques – Hypotheses 2 to 6

A multivariate statistical data analysis technique was required to test Hypotheses 2 to 6, given the series of separate relationships that needed to be tested for the set of bias-dependent variables used in the present study (Hair et al., 2009, p. 19) and its relationship with various independent variables, among which professional scepticism as a trait is the main independent variable. There are a wide range of possible multivariate techniques that could be used. A structural equation modelling (SEM) technique was chosen for the present study. The use of SEM has gained popularity over the years, because this

statistical technique is able to provide the most efficient estimation technique when a series of separate multi-regression relationships needs to be estimated (Hair et al., 2009, p. 19). In the present study, measurement model testing and structural path models were conducted. For the structural path model theory guided which independent variables predicted which dependent variables. The measurement model made it possible to use numerous indicators to validate the constructs. This was especially relevant for the present study where scales are used to measure concepts such as professional scepticism as a trait and personality traits. The statistical techniques required to address Hypotheses 2 to 6 of this study are illustrated in Figure 4.3.

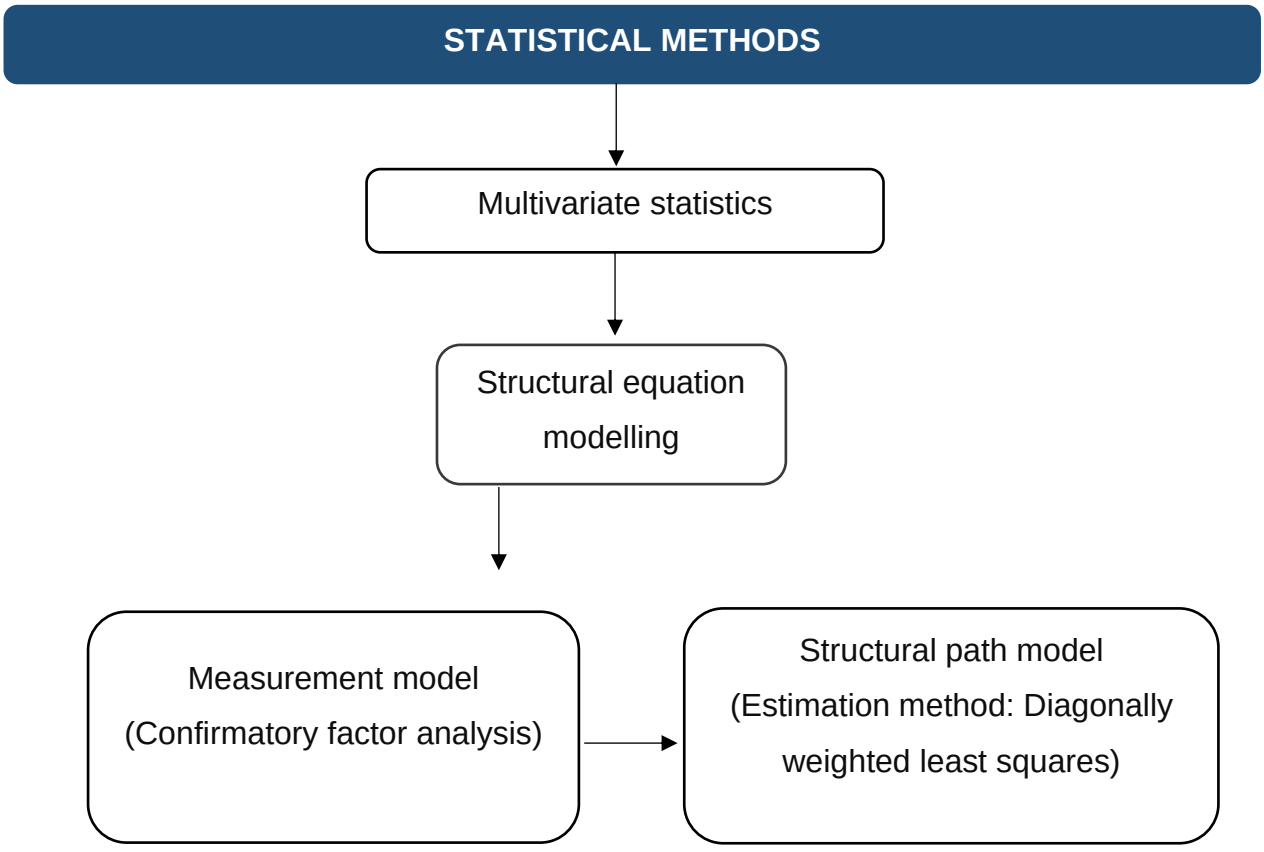


Figure 4.3: Multivariate statistics used in the study – Hypotheses 2 to 6

Source: Adapted from Taljaard (2020)

The remainder of this section on the statistical techniques used to address Hypotheses 2 to 6 includes a detailed review of the structural equation modelling used in the present study and the variable measurement adopted specifically in relation to Hypotheses 2 to 6.

4.6.4.1 Structural Equation Modelling (SEM)

Hair et al. (2009) define SEM as a

> multivariate technique combining aspects of factor analysis and multiple regression that enables the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and latent constructs as well as between several latent constructs.

The SEM statistical technique has many advantages over similar techniques such as regressions. Collier (2020, p. 1) notes three key advantages. Firstly, an SEM technique can estimate the influence of multiple independent (predictor) variables on dependent variables simultaneously. In the present study, based on prior research reported in the literature, the author distinguished between the independent variables that predicted the dependent variable, and the SEM technique translated it into a series of structural equations (Hair et al., 2009, p. 547). This sets SEM apart from other techniques. Secondly, the SEM technique accounts for latent variables that are not measured directly and for measurement error in the estimation process, which normal regression techniques do not account for (Hair et al., 2009, p. 617). Thirdly, the SEM technique can test an entire model instead of focusing just on individual relationships (Hair et al., 2009, p. 617). Similar techniques, such as a regression, have the disadvantage of testing only one dependent variable at a time, and not accounting for measurement error.

SEM is known as the most appropriate measure to use for testing interrelationships amongst observed and unobserved (latent) variables (Collier, 2020). To specify these relationships, researchers need to draw on theory or prior experience from which the proposed relationships are then translated into a series of structural equations (Hair et al., 2009, p. 617). SEM also can incorporate latent (unobserved concept) variables into the analysis that are not measured directly. This was especially relevant in the present study, because professional scepticism as a trait and personality traits constitutes latent constructs.

The process the present study followed in performing SEM is illustrated in Figure 4.4. The six-step process indicates two important components, namely the measurement model and the structural path model.

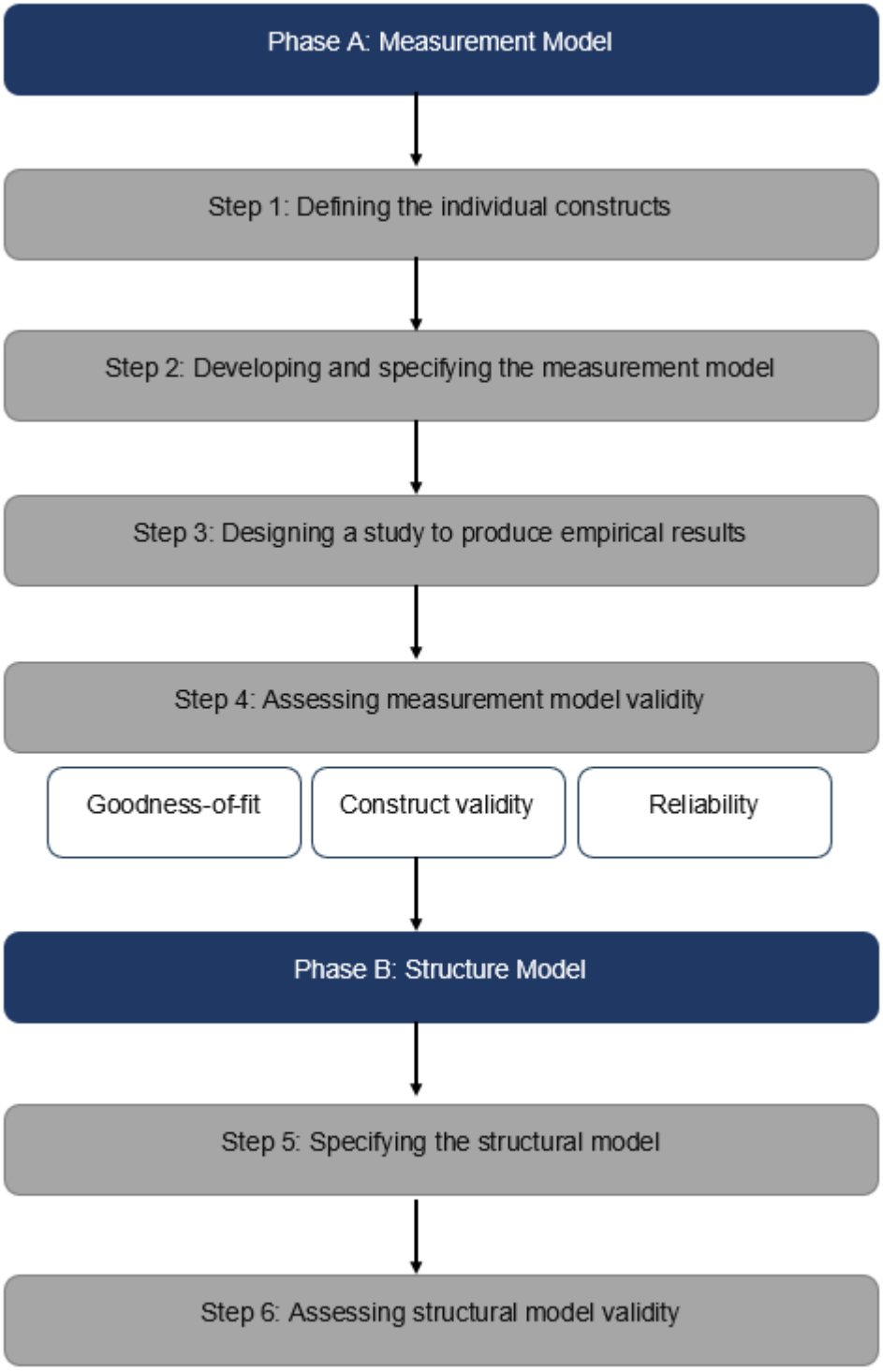


Figure 4.4: The SEM process

Source: Adapted from Hair et al. (2009, p. 635) and Taljaard (2020, p. 274)

4.6.4.2 Phase A: Measurement model

Hair et al. (2009, p. 614) define a measurement model as an "SEM model that (1) specifies the indicators for each construct and (2) enables an assessment of construct validity". Implementing a measurement model is a fundamental requirement before conducting a structural path model. Confirmatory factor analysis (CFA) was the measurement model adopted in the present study, which also used the maximum likelihood estimation method to confirm how well the indicators represented the unobserved constructs, in line with Collier (2020, p. 62). The constructs confirmed in the present study were derived from prior studies which developed and validated the constructs in scales, namely those studies in which the HPSS and the TIPI scale were originally used, in other words, the studies by Hurtt (2010) and Gosling et al. (2003). A CFA in SEM assesses the construct validity of the constructs (Collier, 2020, p. 13). Reliability measures are used to determine the extent to which the set of indicators of a latent construct measures a single concept (Hair et al., 2009, p. 618). Only once the validity of the measurement model and the reliability of the constructs has been confirmed can a research study proceed to a structural model. In the present study, the measurement model (CFA) was performed on both the HPSS and the TIPI scale.

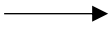
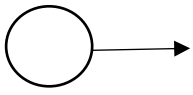
The analysis of moment structures (AMOS) in IBM SPSS version 28 was used to conduct the CFAs. The steps are discussed in more detail below.

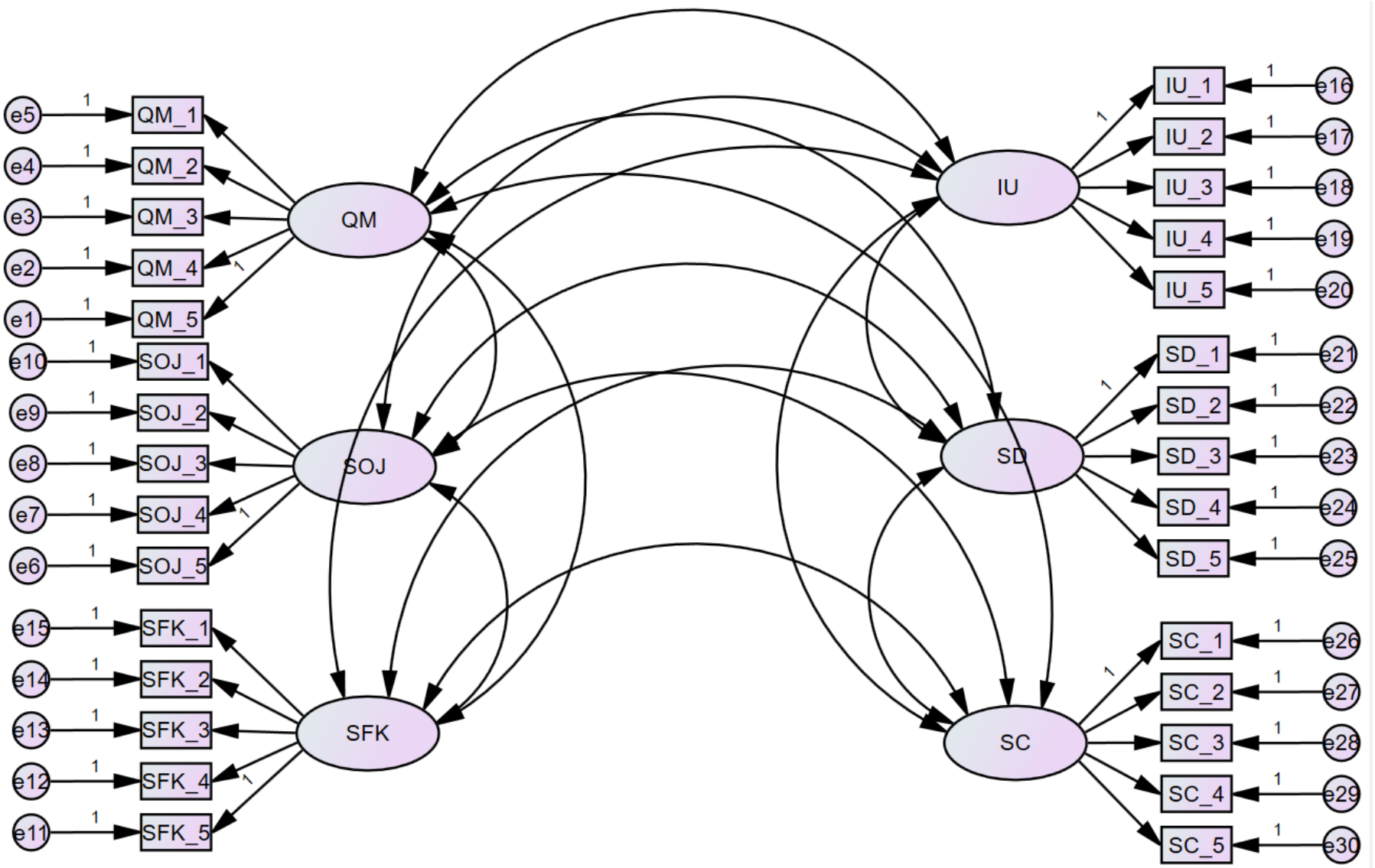
Step 1: Defining individual constructs. In the present study, there were two independent variables, namely professional scepticism as a trait and personality traits, each consisting of various constructs. The HPSS adopted from Hurtt (2010) was used to measure professional scepticism as a trait. For this latent construct, there are six sub-constructs, namely (1) Questioning mind, (2) Suspension of judgement, (3) Search for knowledge, (4) Interpersonal understanding, (5) Self-determining, and (6) Self-confidence. The TIPI scale adopted from Gosling et al. (2003) was used to measure five personality traits, namely (1) Extraversion, (2) Agreeableness, (3) Conscientiousness, (4) Openness to new experiences and (5) Neuroticism. Based on the variables and constructs discussed, two CFAs were tested in the present study. The relevant constructs' measurement theory was defined in Sections 3.2.6 and 4.3.2. From the validated scales, the measurement model was developed, as explained in Step 2, below.

Step 2: Developing and specifying the measurement model. For the development of the measurement model, the indicator variables making up each latent construct were identified.

The measurement model adopted in the present study was a CFA, as the constructs were confirmed from existing validated scales, and therefore CFA provided a confirmatory test of the measurement theory (Hair et al., 2009, p. 671). In the present study, all six latent constructs of the professional scepticism as a trait measurement model had five indicators whereas for the personality trait measurement model, all five latent constructs only had two indicators. Kline (2016, p. 201) states that if only a single construct exists in a given measurement model, a minimum of three indicators is required, but that if a measurement model has two or more constructs, the minimum required indicators per factor is two. Kline (2016, p. 201) warns that CFA models with only two indicators per construct are more prone to problems in the analyses when small samples are used (smaller than 200). This problem was addressed in the present study by the fact that the sample size for the data collected was considered sufficient, as it exceeded a sample size of 200. The measurement models for both professional scepticism as a trait and personality traits met this requirement, as both has more than one construct and a minimum of two indicators.

The diagram outlining the two measurement models is given in Figures 4.5 and 4.6. The model diagrams' symbols are displayed by the SEM computer tools and the symbols are further explained using guidance from Collier (2020).

- An *observed variable* is marked by a square or rectangle.
  For example: 
- A *latent variable* is marked by circles or oval shapes.
  For example: 
- A hypothesised *directional effect* of one variable on another is marked with a line with a single arrow head.
  For example: 
- *Covariances* or correlations between independent variables are marked with a curved line arrow with two arrowheads.
  For example: 
- An *error term***,** which explains an unidentified variance that an indicator causes on a latent variable, is marked by a circle with one arrow.
  For example: 



Abbreviations: QM = Questioning mind; SOJ = Suspension of judgement; SFK = Search for knowledge; IU = Interpersonal understanding; SD = Self-determining; SC = Self-confidence

Figure 4.5: Professional scepticism as a trait – CFA

Source: Own compilation

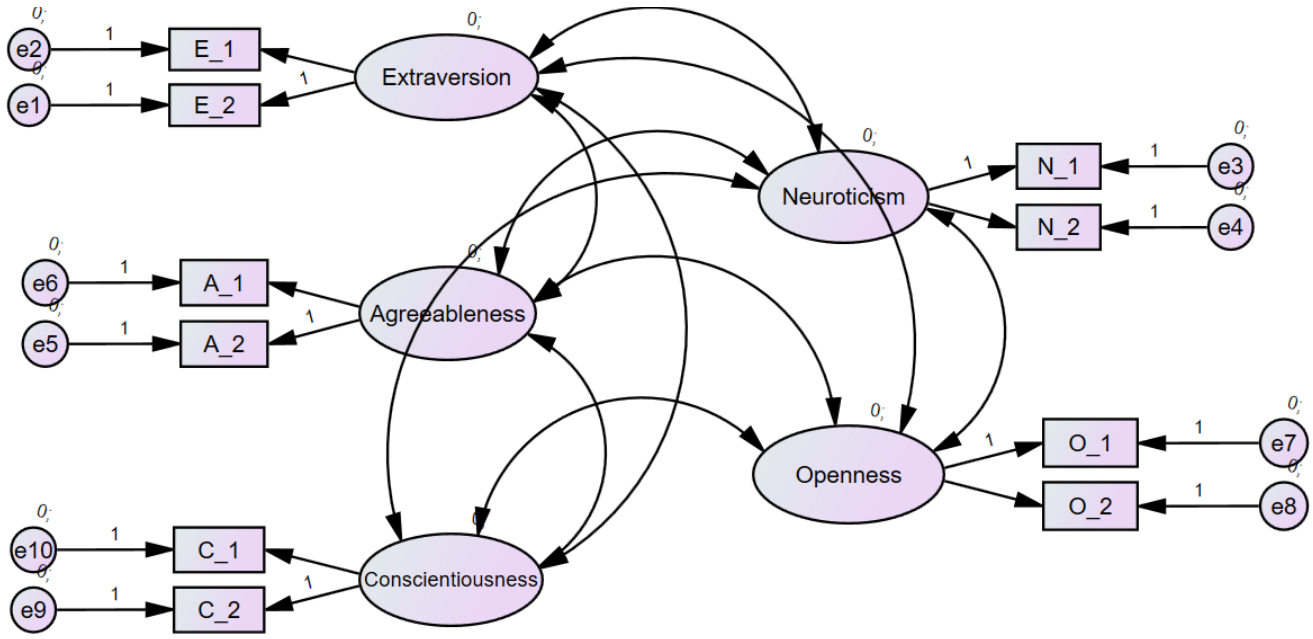


Figure 4.6: Personality traits – CFA

Source: Own compilation

Step 3: Designing a study to produce empirical results. Three important aspects were considered after the latent constructs had been identified, which were (1) the sample size, (2) how missing data were treated, and (3) the model estimation (Taljaard, 2020, p. 276). A sample size of n = 301 was obtained for the present study, and model complexity and communalities were considered. Model complexity was increased because of the number of constructs requiring measurement, and also because the personality trait constructs had only two indicators per factor.

The *sample size* used for SEM is important, as it may influence the fit indices of the model used in a study. Different sample size guidelines are given by various sources for the use of SEM – it is a point of criticism of SEM that there is no one single general number recommended for sample sizes in the use of SEM. Some research papers have pegged the critical sample size as 200 (Garver & Mentzer, 1999, p. 47), but some more recent papers have recommended a good sample size of 300 (Bacon, 2001, p. 6; Tabachnick et al., 2007, p. 613; Worthington & Whittaker, 2006, p. 817). The realised sample of the present study (n = 301) can therefore be considered appropriate for the use of SEM in view of the literature reviewed above.

Hair et al. (2009, p. 644) researched sample sizes when SEM is used and specify that factors other than size need to be considered as well. Table 4.5 provides additional specifications for sample sizes to be used in SEM.

Table 4.5: Sample size specifications for SEM

Type of model	Minimum sample size
Models containing five or fewer constructs, each with more than three items (observed variables), and with high item communalities (0.6 or higher).	100
Models with seven or fewer constructs, modest communalities (0.5), and no under-identified constructs.	150
Models with seven or fewer constructs, lower communalities (below 0.45), and/or multiple under identified (fewer than three items) constructs.	300
Models with large number of constructs, some of which have fewer than three measured items as indicators, and multiple low communalities.	500

Source: Hair et al. (2009, p. 644)

The SEM model was inspected and two independent variables containing constructs, namely professional scepticism as a trait and personality traits, each had fewer than seven constructs. The HPSS had more than three indictors per construct, whereas the TIPI scale had two indicators per construct. Both scales constructs had communalities in the modest to low ranges. Based on the guidelines above, a sample of 300 participants was required, and the present study met this target outlined by Hair et al. (2009, p. 644).

The present study included only complete responses after 159 incomplete responses had been removed, and therefore there were no *missing data*.

Lastly, the *estimation method* used for the measurement models was the maximum likelihood estimation (MLS) technique. This method is the most widely used estimation method for SEM, and is also the default method. The use of another technique requires further justification (Kline, 2016, p. 154). However, it should be noted that MLS can only be used if appropriate, based on the model developed, and the data collected. In the present study, the model and data collected adhere to the requirements for MLS. The MLS technique also improves parameter estimates to maximise a specified fit function (Hair et al., 2009, p. 632). As part of Step 3, an SEM model was estimated to provide an empirical measure of the respective constructs, as well as covariances between the constructs. The present study used the statistical program Amos version 28, and SPSS version 28, and the empirical

results derived from the two measurement models are outlined in the research results section in Chapter 5.

Step 4: Assessing measurement model validity. The measurement model's validity was measured firstly by assessing the model fit, after which construct validity was considered. Construct validity considers the extent to which the measured items reflect the latent theoretical construct(s) (Hair et al., 2009, p. 686). The construct validity of the measurement model was assessed by considering the following:

- convergent validity;
- discriminant validity; and
- the role of modification.

To assess *model fit*, the present study used appropriate goodness-of-fit measures. There are numerous indices which can show whether the measurement model used provides an appropriate means of data representation. Goodness-of-fit has various categories of fit indices, namely the parsimony-adjusted fit, incremental fit and absolute fit indices (Kline, 2016, p. 266). The following goodness-of-fit indices were considered in the present study:

- *Chi-square statistic to the Degrees of Freedom (CMIN/DF):*
  The CMIN/DF test is called "the normed Chi-square" and is the chi-square value divided by the number of degrees of freedom. This measure is a parsimony-adjusted fit index which includes a correction for model complexity (Kline, 2016, p. 270). A value of less than three is required to demonstrate goodness-of-fit (Kline, 2016).
- *Comparative Fit Index (CFI):*
  The CFI test compares the covariance matrix predicted by the model used in the present study to the observed covariance matrix of the null model. This measure is an incremental fit index that measures the relative improvement of the fit of the researcher's model compared to the baseline model (Kline, 2016, p. 266). A value between 0.95 and 1 indicates good fit, and a value between 0.9 and 0.95 is an acceptable fit (Collier, 2020, p. 125; Hu & Bentler, 1999). A value between 0.8 and 0.9 is still considered a marginal fit (Halim et al., 2018, p. 163).
- *Incremental Fit Index (IFI):*
  The IFI is used to adjust the Normed Fit Index (NFI) for the sample size and degrees of freedom, as the NFI measure is relatively sensitive to sample size. The IFI is calculated by taking the difference of the chi-square for the baseline model and the chi-square of the researchers' model and dividing the result by the difference between the chi-square

of the baseline model and the degrees of freedom of the researchers' model. This measure is a second index measure of incremental fit. A value between 0.95 and 1 indicates good fit and a value between 0.9 and 0.95 is an acceptable fit (Collier, 2020, p. 125; Hu & Bentler, 1999). A value between 0.8 and 0.9 is still considered a marginal fit (Halim et al., 2018, p. 163). The CFI and IFI are the most widely used fit measures (Hair et al., 2009).

- *Root Mean Square Error of Approximation Index (RMSEA):*
  The RMSEA is a "badness-of-fit" statistic. It determines the extent to which a model fails to fit the data (Kline, 2016, p. 266). This measure is an absolute fit index measure. A value of less than 0.05 indicates good fit, a value between 0.05 and 0.08 is an acceptable fit, and a value between 0.08 and 0.1 is a marginal fit. A value of 0.1 is the cut-off for poorly fitting models (Collier, 2020, p. 125; MacCallum et al., 1996).
- *Standardised Root Square Mean Residual (SRMR):*
  This measure is similar to the RMSEA, as it is a "badness-of-fit" statistic and is also considered an absolute fit index measure (Kline, 2016, p. 266). This measure calculates the average difference between the predicted and observed covariances in the model, based on standardised residuals (Collier, 2020, p. 67). An SRMR value of 0.08 and below is considered a good fit (Hu & Bentler, 1999), whereas a value between 0.08 and 0.1 is considered an acceptable fit (Kock, 2020). A value of 0.1 is the cut-off for poorly fitting models, however, it may be deemed acceptable if all other fit indices such as IFI, CFI and RMSEA are within an acceptable threshold range to confirm model fit (Hu & Bentler, 1999, p. 27).

Table 4.6 provides a summary of the fit indices' thresholds required for measurement and the SEM models as described in the literature reviewed above.

Table 4.6: Model fit summary

Type	Measure	Threshold
Parsimonious fit	Chi-square/df (CMIN/DF)	≤3.0
Incremental fit	CFI	> 0.95 – Good fit > 0.9 – Acceptable fit > 0.8 – Marginal fit
	IFI	
Absolute fit	RMSEA	≤ 0.05 – Good fit 0.05 to 0.08 – Acceptable fit 0.08 to 0.1 – Marginal fit

Type	Measure	Threshold
		> 0.1 – Poor fit
	SRMR	≤ 0.08 – Good fit 0.08 to 0.1 – Acceptable fit > 0.1 – Poor fit

Source: Own compilation

Convergent validity establishes whether indicators of a specific construct have a high proportion of variance in common (Hair et al., 2009, p. 686). Convergent validity can be measured in several ways. The present study focused on standardised factor loadings, the average variance extracted (AVE) and reliability measures as indicated by Hair et al. (2009, p. 686).

The first measure used in the present study to test convergent validity was the standardised factor loadings generated by the measurement models (CFAs) which assess the reliability of each individual indicator. A high factor loading indicates that indicators in a specific latent construct converge to that latent construct (Hair et al., 2009, p. 686). The literature calls for a minimum factor loading of 0.7 per indicator (Collier, 2020, p. 81). If the scale used in the study is an existing, validated scale, factor loadings between 0.4 and 0.7 can be justified if the internal consistency, composite reliability and convergent and discriminant validity measures are within accepted ranges (Hair et al., 2009). Two validated scales were used in the present study: the HPSS from Hurtt (2010), measuring professional scepticism as a trait, and the TIPI scale from Gosling et al. (2003), measuring personality traits. Therefore, factor loadings between 0.4 and 0.7 were deemed acceptable in the present study.

A second measure to test convergent validity was the calculation of the AVE. Hair et al. (2009, p. 669) define AVE as a "summary measure of convergence among a set of items representing a latent construct. It is the average percentage of variation explained (variance extracted) among the items of a construct*".* AVE is calculated as the mean of the variance for the items loading on a construct and is a summary variance (Hair et al., 2009, p. 687). The AVE calculation was developed by Fornell and Larcker (1981), who indicate that an AVE value needs to be calculated on every latent construct. A minimum AVE value of 0.5 is required to showcase that the indicators converge to measure a single concept (Collier, 2020, p. 83). An AVE value lower than 0.5 indicates that on average more error remains in the items than the variance explained (Hair et al., 2009, p. 687). However, Fornell and Larcker (1981) do support the use of latent constructs where the AVE value is less than 0.5

provided that a minimum composite reliability of 0.6 is achieved. Studies supporting the use of AVEs lower than 0.5 include those by Hair et al. (2009) and Psailla and Wagner (2007). Malhotra and Dash (2011) also argue that AVE is often too strict, and reliability can be established through composite reliability alone.

The last measure used was to consider the measurement model's internal consistency (reliability). For reliability, the present study measured internal consistency by means of a widely used index to determine the reliability of the measurement scale for professional scepticism as a trait and personality traits, namely the Cronbach's alpha. The required Cronbach's alpha coefficient needs to be between 0.8 and 0.9 to confirm good coefficient validity (Pallant, 2020). However, prior research has also supported a coefficient between 0.7 and 0.8 as sufficient (Bagozzi & Yi, 2012, p. 14; DeVellis, 1991). In the present study, the Cronbach's alpha value was obtained for each individual construct in each of the factor analyses measurement scales. However, the Cronbach's alpha measure has been criticised for underestimating values (Collier, 2020, p. 87). Therefore, a second measure of reliability was also included in the present study, namely composite reliability. This value is calculated using the guidance of Fornell and Larcker (1981). For composite reliability, a threshold above 0.7 is considered good, whereas a threshold between 0.6 and 0.7 is acceptable and permissible provided that the model's other construct validity results are good (Hair et al., 2009, p. 687).

Discriminant validity assesses whether the construct being measured is distinct and different from other constructs in the SEM model (Collier, 2020, p. 83). Multicollinearity is also assessed through the performance of discriminant validity checks where the covariance among constructs is assessed (Kumar, 2015, p. 27). Discriminant validity can be measured in two ways; firstly, by "comparing the AVE values for any two constructs with the square of the correlation estimate between these two constructs" (Hair et al., 2009, p. 688). The AVE should be greater than the squared correlation estimate. A second measure is the Heterotrait-monotrait ratio of the correlations (HTMT), which is a ratio that measures the quantitative relation between the within-trait correlations and between-trait correlations. An HTMT ratio of less than 0.85 is required to support discriminant validity (Hensler et al., 2015, p. 123).

The role of modification relates to the need for model respecification, which only arises if model fit measures report poor results. In this instance, the researcher has to refer to

theoretically justifiable changes that can be made to the specified initial model to improve model fit (Kline, 2016, p. 120). Any changes made to the initial model need to be guided by rational rather than statistical considerations (Kline, 2016, p. 120). The need for model respecification is considered in Chapter 5 for the measurement model testing, and in Chapter 8, where the SEM results are reported.

4.6.4.3 Phase B: Structural model

Only once the measurement models have been identified and validated are these measurement models integrated into SEM for the estimation of relationships between the dependent and independent variables (Hair et al., 2009, p. 713). The final two steps were completed to operationalise the structural model in the present study.

Step 5: Specifying the structural model.

From the various existing SEM techniques, the present study adopted a structural path model, using a diagonally weighted least squares (DWLS) estimation approach. The present study had a binary or ordinal dependent variable, for which the literature has supported the use of a DWLS estimation method as the most appropriate method for these types of variables (Kline, 2016; Li, 2016; Muthén et al., 1997; Newsom, 2010, 2018). A DWLS estimation method was implemented in the Mplus statistical modelling program, version 8.10. When an SEM design is adopted, size and identification are important aspects to consider. If the size and identification conditions are met for the measurement model (CFA), then both the requirements for the size and identification in SEM are likely to be met as well (Hair et al., 2009, p. 716). Potential convergence problems are known to arise in logistic regression models conducted in Mplus, because continuous independent variables are measured on different scales. The Mplus user guide provides guidance on how these convergence problems can be resolved, and may recommend alternative models conducted in SPSS to resolve these issues (Muthén & Muthén, 2017, p. 524).

The proposed theoretical model to address differences between variables as outlined in the hypotheses in the present study is the basis from which the set of structural equations for SEM was developed. These structural equations specified the relationships that were assigned between constructs and variables (Hair et al., 2009). In the present study, there were variables that were measured through constructs such as professional scepticism as a trait and personality traits, but there were also single-item measured variables such as the

dependent variable (bias) and other independent variables (gender, age and experience). Single-item measures were incorporated into the observed covariate matrix just as with any other variable (Hair et al., 2009, p. 717).

In Step 5, the structural path diagram showing the relationships are displayed for the structural equation model used in the present study. Figure 4.7 illustrates the path diagram for the *first order* path model in the context of the present study and its hypotheses. A first order model means that the covariances between the measured items are explained by a single latent factor (Hair et al., 2009, p. 739). In Figure 4.7, the single factors or latent constructs are shown, namely a questioning mind, suspension of judgement, search for knowledge, interpersonal understanding, self-determining, and self-confidence. The single-headed directional arrows show the dependence relationships that represent the structural paths.

Based on the theoretical foundation and how the professional scepticism as a trait latent variable and its six related constructs are measured, the present study tested whether a higher order model, also referred to as a second order model, could be executed. A second order model is considered a higher order construct model which allows for the examination of the relative strengths of the lower order constructs (Cheung, 2008; Collier, 2020, p. 109). Another way to view a higher order factor is that it accounts for covariances between constructs, just as first order constructs account for covariation between observed variables (Hair et al., 2009, p. 741). In the case of the present study, the six single latent constructs namely questioning mind, suspension of judgement, search for knowledge, interpersonal understanding, self-determining, and self-confidence, were the first order constructs which could also be considered indicators of the second order model, namely professional scepticism as a trait.

Figure 4.8 illustrates a structural path diagram using the second order factor representation of professional scepticism as a trait and its related hypotheses. Figure 4.8 shows a structural path diagram using the first order factor representation of professional scepticism as a trait and its related hypotheses. In the diagrams, the single-headed directional arrows show dependence relationships that represent the structural paths.

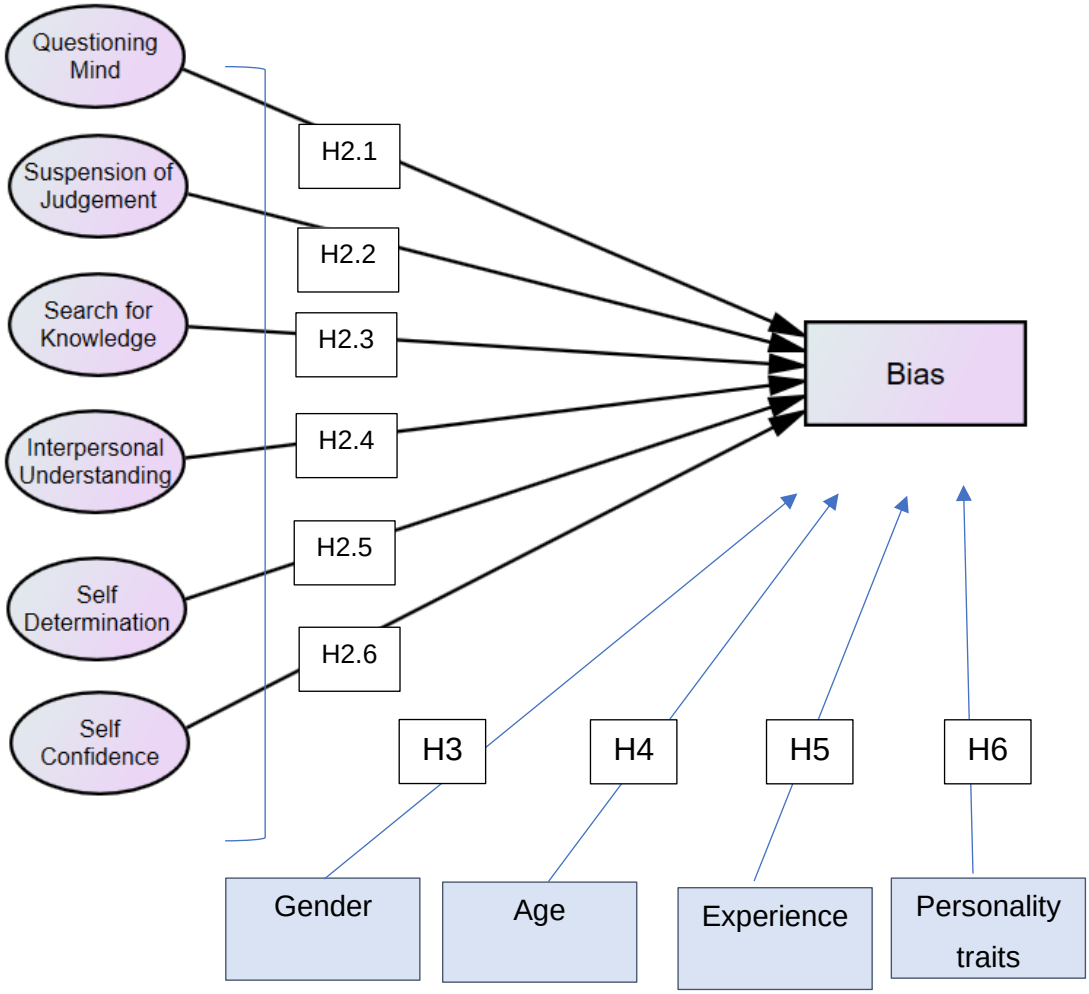


Figure 4.7: Illustration of structural path diagram – Model 1

Source: Own compilation

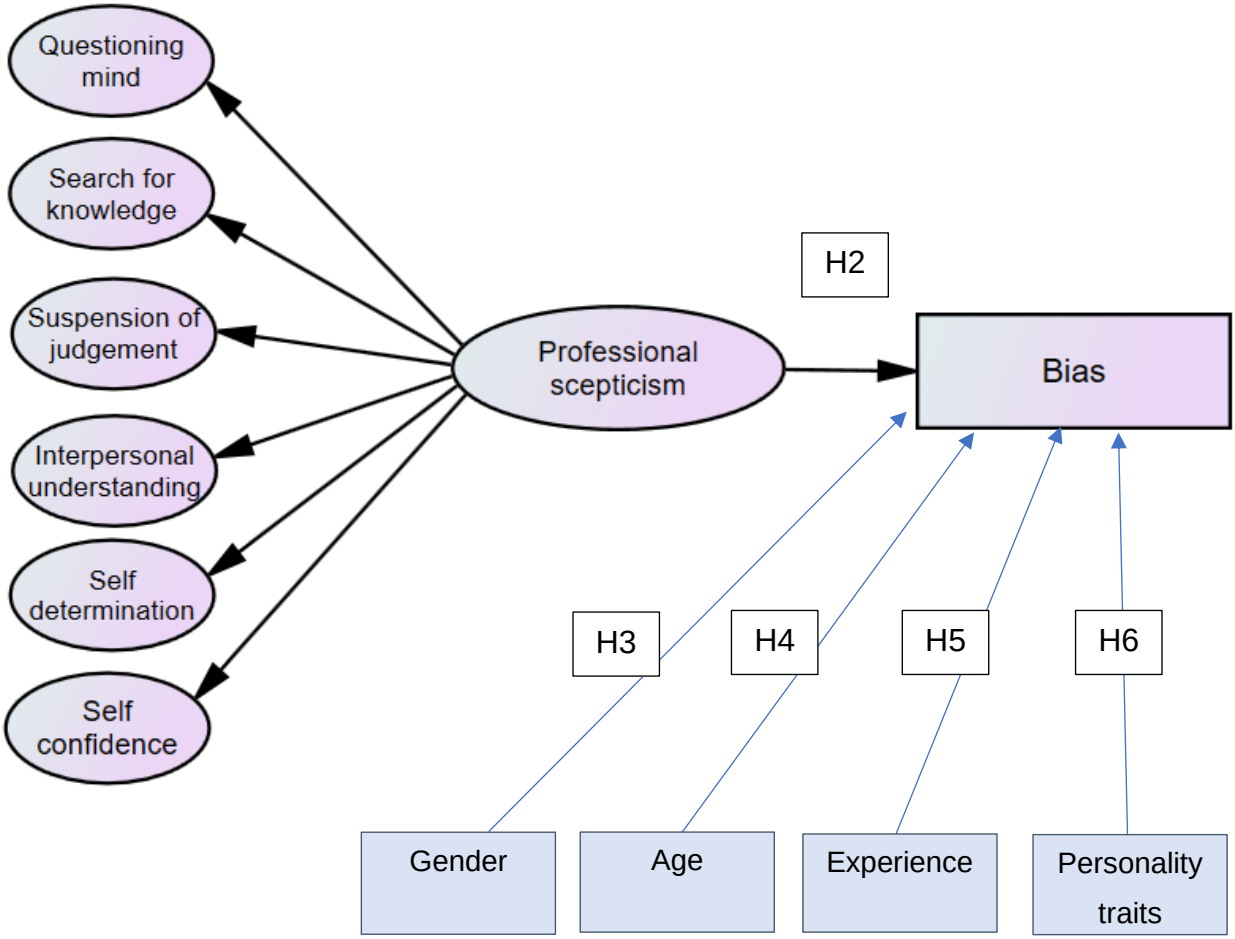


Figure 4.8: Illustration of structural path diagram – Model 2

Source: Own compilation

Hair et al. (2009, p. 743) refers to two key areas of consideration before higher order models can be used. Firstly, it must be determined whether the higher order model provides a good explanation for the correlations between the first order constructs. This can be measured by calculating the target coefficient ratio. A target coefficient is calculated by taking the chi-square of the standardised estimates of the first order model and dividing it by the chi-square of the standardised estimates of the second order model. If the ratio is above 0.9, it suggests that the higher order model provides a good explanation for the correlations between the first order constructs (Hong & Thong, 2013). Secondly, the higher order model needs to display model fit according to the set of fit indices. In the present study, the set of fit indices refers to the goodness-of-fit indices as set out in Step 4 above. The testing performed to confirm whether the second order models could be used in the present study is reported in Chapter 7.

The research hypotheses used for the conceptual models as illustrated in Figure 4.7 and Figure 4.8 of the present study are restated in Table 4.7, and align with Chapter 3.

Table 4.7: Summary of Hypotheses 2 to 6

Hypothesis	Main hypothesis
H_2	A relationship exists between professional scepticism as a trait and bias in the financial decision-making of financial professionals.
H_{2a} to H_{2e}	A relationship exists between professional scepticism as a trait and confirmation bias ($H_{2.1a}$), misconception of regression to the mean bias ($H_{2.1b}$), conjunctive events bias ($H_{2.1c}$), overconfidence bias ($H_{2.1d}$) and affect bias ($H_{2.1e}$) in the financial decision-making of financial professionals.
$H_{2.1}$ to $H_{2.6}$	A relationship exists between questioning mind ($H_{2.1}$), search for knowledge ($H_{2.2}$), suspension of judgement ($H_{2.3}$), interpersonal understanding ($H_{2.4}$), self-determining ($H_{2.5}$) and self-confidence ($H_{2.6}$) and bias in the financial decision-making of financial professionals.
H_3	A relationship exists between gender and heuristic-related and other biases in the financial decision-making of financial professionals.
H_4	A relationship exists between age and heuristic-related and other biases in the financial decision-making of financial professionals.
H_5	A relationship exists between experience and bias in the financial decision-making of financial professionals.
H_6	A relationship exists between personality traits and bias in the financial decision-making of financial professionals.

Source: Own compilation

Step 6: Assessing structural validity

The last step requires testing the validity of the proposed structural equation model by studying the structural model fit and examination of model diagnostics (Hair et al., 2009, p. 718). This requires consideration as to whether the structural relationships set out in the model are consistent with the theoretical expectations, as well as further consideration of the model fit, together with the required goodness-of-fit indices. Model fit pertains to the same fit indices as those referred to in Step 4 above. Modification indices can be used for the respecification of the model to improve model fit if required. Based on the model diagnostics results, it can be considered whether model respecifications are necessary. Strong theoretical support needs to be provided for any respecification made to the SEM (Hair et al., 2009, p. 728).

Chapter 7 sets out the results for the testing of Hypotheses 2 to 6 and addresses whether there is support (if any) for these hypotheses. The use of regressions coefficients reveals

the significance of the relationship (if any) between the constructs. The present study analysed significance as ranging from the 0.1, to the 0.05 and 0.001 levels.

4.6.4.4 Variable measurement

The main dependent variables in the present study were the various biases, namely confirmation bias, misconception of regression to the mean bias, conjunctive events bias, overconfidence bias, and affect bias. Each of these heuristic-related and other biases were considered dependent variables in their own models. These biases were considered to be derived dichotomous variables for SEM purposes. The main independent variable of interest (professional scepticism as a trait) consists of six latent constructs; the remainder of the determinants included in SEM were gender, age, experience, and personality traits. Table 4.8 provides details on how each variable was measured for SEM.

4.7 DATA STORAGE AND PROTECTION

Data collected in the present study were stored in the Department of Financial Management, as well as in the University of Pretoria's Research Data Management Repository. Research data will be stored for ten years after the completion of the present study, in line with Section 4 of the University of Pretoria's Research Data Management Policy. Data will remain on the Research Data Management Platform and will be archived by the researcher once the present study has been completed. The data will remain on the Research Data Management Platform until it is disposed of at the end of the ten-year period.

Table 4.8: Variable measurement – Hypotheses 2 to 6

Variable	Application to questionnaire	Measurement level	Measurement description
Confirmation bias	Section 3: Q1 & Q2	Dichotomous (derived)	If participants selected Options A and D, they were awarded a 0 (rational). If participants selected Options A and C, they were awarded a 1 (biased). For all other combinations no bias could be awarded.
Misconception of regression to the mean bias	Section 3: Q3	Dichotomous (derived)	If participants selected Option B, they were awarded a 0 (rational). Selecting Option A was awarded a 1 (biased).
Conjunctive events bias	Section 3: Q4	Dichotomous (derived)	If participants selected a percentage between 50% and 60%, they were awarded 0 (rational). If a percentage of more than 60% was chosen, the participant made an insufficient downward adjustment and was awarded a 1 (biased). For any other value selected, no bias could be assigned.
Overconfidence bias (general ability)	Section 3: Q5	Dichotomous (derived)	If participants selected a range between 45% and 55%, they were regarded as rational and awarded a 1. If participants selected a percentage above 55%, they were considered to have overplaced themselves and were awarded a 2. If participants selected a percentage below 45%, they are considered to have underplaced themselves and were awarded a 0.
Overconfidence bias (unknown context)	Section 3: Q6		The placement percentage that each participant made ***before*** taking the quiz was compared with the participant's actual performance to determine whether participants overplaced, underplaced or were rational regarding their placement, based on their actual performance on the quiz. If the participants were rational, 1 was awarded. If the participants overplaced themselves, 2 was awarded. If the participants underplaced themselves, 0 was awarded.

Variable	Application to questionnaire	Measurement level	Measurement description
Overconfidence bias (unknown context)	Section 3: Q7		The placement percentage that each participant made ***after*** taking the quiz was compared with the participant's actual performance to determine whether participants overplaced, underplaced or were rational regarding their placement, based on their actual performance on the quiz. If participant were rational, 1 was awarded. If participants overplaced themselves, 2 was awarded. If participant underplaced themselves, 0 was awarded.
Affect bias	Section 3: Q8	Dichotomous (derived)	If participants selected Option A, they were awarded 0 (rational). The selection of Option B was awarded a 1 (biased).
Professional scepticism as a trait	Section 2	Continuous (latent)	The HPSS consists of 30 questions, using a 6-point Likert scale. Questions 1, 10, 11, 16, 17, 19, 25, and 26 in Section 2 of the questionnaire were reverse-coded. Reverse-coded questions were labelled with an 'R' in the questionnaire.
Professional scepticism as a trait – constructs		Continuous (latent)	The HPSS can be divided into six sub-constructs (Hurtt, 2010). Each sub-construct has five questions supporting the construct which has been outlined in the questionnaire, in Appendix 1. These sub-constructs can act as independent variables on their own. The six constructs are described in detail in Section 3.2.6 and are repeated below: • Questioning mind (Questions 7, 13, 18, 24, and 28) • Suspension of judgement (Questions 3, 9, 20, 22, and 27) • Search for knowledge (Questions 4, 8, 15, 23 and 29) • Interpersonal understanding (Questions 5, 11, 14, 26, and 30) • Self-determining (Questions 1, 10, 16, 19, and 25) • Self-confidence (Questions 2, 6, 12, 17, and 21)
Gender	Section 1: Q1	Categorical (observed)	Four categories were given to participants to complete. 0 = male; 1 = female; 2 = other; 3 = prefer not to say

Variable	Application to questionnaire	Measurement level	Measurement description
Age	Section 1: Q2	Continuous (observed)	Age, in number of years, as on the date of the completion of the survey was given by participants.
Experience	Section 1: Q4	Continuous (observed)	Participants gave years (total).
Decision-making experience	Section 1: Q5	Continuous (observed)	Participants gave years (total key decision-making experience).
Personality traits	Section 1: Q6	Continuous (latent)	The TIPI scale consisted of ten questions, measuring five traits using a 7-point Likert scale. Two questions supported each trait. The followings questions in Section 1, Question 6 support each of the traits (constructs): • Extraversion (Questions 1 and 6) • Agreeableness (Questions 2 and 7) • Conscientiousness (Questions 3 and 8) • Neuroticism (Questions 4 and 9) • Openness to new experience (Questions 5 and 10) Questions 2, 4, 6, 8 and 10 were reverse-coded. Reverse-coded questions were labelled with an ‘R’ in the questionnaire.

Source: Own compilation

4.8 RESEARCH ETHICS

The questionnaire contained questions from a validated professional scepticism scale, as well as questions based on hypothetical scenarios with the aim of investigating whether behavioural aspects influenced the decision-making of financial professionals. The questionnaire did not require the participants to disclose any sensitive information about themselves or the businesses at which they are employed. Participants were also requested to complete an informed consent form before completing the questionnaire. The questionnaire did not require the identity of the respondents. 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. The responses for the survey were anonymous.

4.9 LIMITATIONS

The present study acknowledges the following limitations in its research design:

- The study used an online survey instrument, which takes away the researcher's control over the circumstances in which the responses are framed. This method of data collection does, however, lead to larger sample sizes, in view of the fact that the target populations were widely dispersed and difficult to reach. The bigger sample size received in return assisted in increasing the statistical power of the statistical techniques used and the ability to detect significant effects.
- The online survey instrument was distributed by means of two non-probability sampling methods, namely convenience sampling and snowball sampling, which may limit the diversity in the sample collected. The present study used numerous different channels to distribute the online survey to increase external validity where possible.
- Capturing decision-making preferences in an online survey is time-consuming. Fatigue could have played a role in participants' answering the last part of the questionnaire. This potential problem was mitigated to some extent by randomising the order of the decision-making preference questions in Section 3 of the questionnaire.
- Decision-making in the real world takes place with much richer information environments than the scenarios depicted in the present study. It is therefore not obvious what impact the provision of additional information might have had on decision-making preferences. Prior research studies have adopted similar approaches to those used in the present

study, and assumed the responses of participants to be a fair approximation of their behaviour in real world situations.

- Several participants did not complete the questionnaire in full. Given the number of responses received and the requirements for the statistical techniques used, only complete responses were used for data analyses purposes. Enough responses were obtained to analyse the data using appropriate SEM techniques.
- Given the nature and structure of the case studies and questions used from the literature, not all heuristics were included in the present study. Considerations taken into account were firstly related to the length of the questionnaire, to limit the number of behavioural aspects to only the key ones identified from the literature relating to this sample group. Secondly, one of the three main heuristics identified by Tversky and Kahneman (1974), namely the availability heuristic, was excluded from the present study because the questions obtained from the literature were better suited to an experimental design research study rather than an online survey study.

4.10 SUMMARY

Heuristics have been identified in the literature as simplification strategies for complex decision-making. The present study focused on financial professionals' susceptibility to heuristic-related and other biases in decision-making and whether professional scepticism as a trait is related to these biases. The relationship between professional scepticism as a trait and bias in the decision-making of financial professionals had not yet been studied extensively, and the present study attempted to focus on this gap in the literature.

The present study investigated six research hypotheses. The first main research hypothesis refers to the presence of heuristic-related and other biases in the financial professionals sampled in the present study. The second main research hypothesis addresses the relationship between professional scepticism as a trait and heuristic-related and other biases. The four remaining hypotheses aim to determine whether other variables, such as gender, age, experience, and personality traits make financial professionals more susceptible to the heuristic-related and other biases identified in the present study. Primary information was collected via a questionnaire for the empirical research. The questions were identified and adapted from previous research studies and, where possible, validated existing scales were adopted. The questionnaire was distributed to participants who were members of professional bodies such as the IAASB and the ACCA. The questionnaire

consisted of three sections. The first section related to demographic determinants such as gender, age, experience, education, and personality traits; the second section focused on professional scepticism as a trait, and the last section related to behavioural heuristic-related and other biases. A total of 301 complete responses were collected.

The main data analysis techniques to test the various hypotheses have been set out in Chapter 4. This included discussing the data cleaning techniques adopted and the variable measurement used. To test the first hypothesis (whether heuristic-related and other biases exist for the present sample), detailed descriptive statistics were used, together with binomial confidence intervals and one-sample t-tests. To test the relationship between heuristic-related and other biases, professional scepticism as a trait and the other four determinants (gender, age, experience, and personality traits, as stated in Hypotheses 2 to 6), SEM was conducted. The statistical plan was to perform measurement model testing and structural path models to generate the required results to support or not support Hypotheses 2 to 6. The results of the testing are reported in Chapter 5.

Finally, this chapter has detailed the data storage and protection plans followed to protect the data collected using the questionnaire, and the results generated from the data. Ethical approval considerations have been discussed, and it was noted that the required approval was gained. Finally, the research design limitations have been discussed in detail.

The next chapter focuses on the descriptive statistics of the main independent variable –, professional scepticism as a trait – and other determinants, such as gender, age, experience, education and personality traits. Chapter 5 also presents the results of the measurement model testing required before a structural path model could be constructed.

CHAPTER 5:
RESEARCH FINDINGS (PART 1):
DESCRIPTIVE STATISTICS AND FACTOR ANALYSES

The research findings of the present study are presented across three chapters. Figure 5.1 illustrates the outline of the research findings chapters in this thesis.

CHAPTER 5: RESEARCH FINDINGS (PART 1)
5.2 DESCRIPTIVE STATISTICS: DEMOGRAPHIC INFORMATION
• Gender • Age • Qualification
5.3 DESCRIPTIVE STATISTICS: LATENT CONSTRUCTS
5.3.1 Results for the constructs of professional scepticism as a trait 5.3.2 Results for the constructs of personality traits
5.4 VALIDITY AND RELIABILITY OF THE CONSTRUCTS
5.4.1 Results of the factor analyses – professional scepticism as a trait 5.4.2 Results of the factor analyses – personality traits
CHAPTER 6: RESEARCH FINDINGS (PART 2)
6.2 RESULTS FOR BIASES RELATED TO THE USE OF HEURISTICS
6.2.1 Confirmation bias 6.2.2 Misconception of regression to the mean bias 6.2.3 Conjunctive events bias
6.3 RESULTS FOR OVERCONFIDENCE BIAS
6.4 RESULTS FOR AFFECT BIAS
CHAPTER 7: RESEARCH FINDINGS (PART 3)
7.2 HIGHER ORDER FACTOR STRUCTURE
7.3 COMPILATION OF BIAS DATA
7.4 FIT OF STRUCTURAL EQUATION MODELS
7.5 RESULTS: PROFESSIONAL SCEPTICISM AS A TRAIT
7.6 RESULTS: DETERMINANTS

Figure 5.1: Outline of research findings chapters

Source: Own compilation

5.1 INTRODUCTION

Chapter 5 reports on the demographic information for the participants in the present study, together with key descriptive statistics to understand the data gathered on professional scepticism as a trait and personality traits better. In this chapter, the results are reported for the confirmatory factor analyses (CFA) and the supporting reliability and validity testing of the constructs of professional scepticism as a trait and personality traits. The results generated to address Hypothesis 1 and Hypotheses 2 to 6 are reported in Chapters 6 and 7 respectively.

5.2 DESCRIPTIVE STATISTICS: DEMOGRAPHIC INFORMATION

Typical demographic information such as gender, age and qualifications was requested from participants. Additional information included the years of experience and years of key decision-making experience of each participant in a finance environment.

The sample consisted of financial professionals who participated in the study from June 2022 to November 2022. A total of 460 questionnaires were returned. However, only 301 (65%) participants completed every section of the questionnaire. Therefore, the 159 incomplete responses were removed from the dataset. The results for the demographic information are presented in Table 5.1.

Table 5.1: Demographic information on the participants

Demographic variables	Frequency (n) N = 301	Percentage (%)
Gender		
Male	155	51.5%
Female	143	47.5%
Other	3*	1%
Age	**Mean = 32 years Standard deviation = 8.61**	
22 – 30	144	47.8%
31 – 40	120	39.7%
41 – 50	21	7%
51 – 60	11	3.5%
61 – 70	5	2%
Qualification		
Qualified Chartered Accountant (SAICA**)	219	73%
SAICA** trainee (not yet qualified)	72	24%
Other	10	3%

Demographic variables	Frequency (n) N = 301	Percentage (%)
Experience	**Mean = 9 years Standard deviation = 9.98**	
0 – 5	116	38.5%
6 – 10	107	35.5%
11 – 15	33	11.0%
16 – 20	15	5.0%
21 – 25	12	4.0%
26 – 30	7	2.3%
31 – 35	6	2.0%
36 – 40	2	0.7%
More than 40 years	3	1.0%
Decision-making experience	**Mean = 4.5 years Standard deviation = 6.41**	
0 – 5	227	75.4%
6 – 10	43	14.3%
11 – 15	9	3.0%
16 – 20	9	3.0%
21 – 25	9	3.0%
26 – 30	3	1.0%
31 – 35	1	0.3%

* For the results generated by the SEM in Chapter 7, the three responses of 'other' were deleted and only 298 responses were used.

** South African Institute of Chartered Accountants

Source: Own compilation

The *gender* distribution of the sample shows balanced representation of both men and women, with men contributing 51.5% of the completed responses and women 47.5%. The average age of the 301 participants was 32 years; the modal category was 22 to 30 years (47.8%) followed by 31 to 40 years (39.7%).

A large majority of the sample (73%) were *qualified* chartered accountants or professional accountants. Of the 219 qualified chartered accountants in the sample, 212 (97%) were accredited by SAICA, which is the professional accounting body for chartered accountants in South Africa. The remaining seven qualified chartered accountants were accredited by similar accounting bodies located in Scotland and England. It could not be established whether the seven participants are currently working in South Africa or abroad. Moreover, 72 (24%) of the participants were SAICA trainees, which means they were not yet fully qualified, but were completing their three-year traineeship to become a chartered accountant in South Africa. The remaining 10 participants (3%) had suitable finance qualifications to be

included in the sample, but they were not qualified chartered accountants or professional accountants.

From an *experience* perspective, the present study distinguished between participants' general experience and key decision-making experience in a finance environment. Key decisions were defined for the participants in the questionnaire as "decisions which can relate to either strategic, financial or operational decisions that may have a noticeable financial impact on business operations". The average number of years of general experience in finance was 9; the modal category was 0 to 5 years (38.5%), followed by 6 to 10 years (35.5%). For key decision-making experience in finance, the average number of years of experience was 4.5; the modal category was 0 to 5 years (75.4%), followed by 6 to 10 years (14.3%). A difference was noted between general and key decision-making experience, which indicates that not all financial professionals are involved in key decision-making.

As part of the descriptive statistics, a correlation matrix was compiled and collinearity diagnostics were performed to check for multi-collinearity amongst the independent variables. The results are presented in Table 5.2 and Table 5.3.

Table 5.2: Correlation matrix – independent variables

Independent variables	n = 301	Gender	Age	Experience	Decision-making experience
Gender	Pearson correlation	1	-9.111	-0.074	-0.174**
	Sig. (2-tailed)		9.056	.205	.003
Age	Pearson correlation	-0.111	1	0.876**	0.840**
	Sig. (2-tailed)	.056		< .001	< .001
Experience	Pearson correlation	-0.074	9.876**	1	0.852**
	Sig. (2-tailed)	.205	< 9.001		< .001
Decision-making experience	Pearson correlation	-0.174**	0.840**	0.852**	1
	Sig. (2-tailed)	.003	< .001	< .001	

** Significant at a 1% level of significance ($p < .01$)

Source: Own compilation

The literature states that the relationship between two independent variables should not exceed a correlation of 0.7, otherwise consideration should be given to whether one variable needs to be omitted (Pallant, 2020). Inspection of Table 5.2 shows that two variables had correlations exceeding 0.7, namely age and experience. Before a variable is omitted, the collinearity diagnostics should be inspected for the variable's tolerance and variance inflation factor (VIF). If the variables have a tolerance lower than 0.1 and a VIF value above 10, the multi-correlation between the variables is too high and deletion of a variable needs to be considered (Pallant, 2020).

Table 5.3: Collinearity diagnostics - Independent variables

	Beta	T	Significance	Tolerance	VIF
Gender	0.102	1.717	.087	0.949	1.054
Age	0.014	0.111	.912	0.201	4.967
Experience	0.018	0.134	.893	0.185	5.405
Decision-making experience	-0.066	-0.544	.587	0.226	4.427

Source: Own compilation

The tolerance value and VIF for all four independent variables were within the accepted ranges and therefore no deletion was required.

5.3 DESCRIPTIVE STATISTICS: LATENT CONSTRUCTS

The descriptive statistics based on the constructs used in the present study, namely professional scepticism as a trait and personality traits, are reported on in Sections 5.3.1 and 5.3.2. Professional scepticism as a trait is regarded a latent construct, consisting of six sub-constructs, namely questioning mind, suspension of judgement, search for knowledge, interpersonal understanding, self-determining, and self-confidence. Five personality traits were used in this study, each with its own construct, namely extraversion, agreeableness, conscientiousness, openness to new experience, and neuroticism. The main research constructs and items making up the respective constructs are summarised and further explained in the sections below.

5.3.1 Results for the constructs of professional scepticism as a trait

The six sub-constructs of professional scepticism as a trait were measured using the Hurt Professional Scepticism Scale (HPSS) which consists of 30 questions (Hurtt, 2010). Each

of the six constructs consists of five questions (items), each making up the respective construct. Participants had to rate Likert-response type items with a rating ranging from 1 (strongly disagree) to 6 (strongly agree). Table 5.4 sets out the six sub-constructs' abbreviations and number of items for each construct. Note that seven reverse-coded questions are included in the 30-question scale.

Table 5.4: Professional scepticism as a trait – constructs

Research construct	Abbreviation	Number of items
Professional scepticism	**PS**	**30**
Questioning mind	QM	5
Suspension of judgement	SOJ	5
Search for knowledge	SFK	5
Interpersonal understanding	IU	5
Self-determining	SD	5
Self-confidence	SC	5

Source: Own compilation

The results for each of the constructs of professional scepticism as a trait are presented in Figures 5.2 to 5.7. Note that only two categories are presented in the figures, namely "Agree" and "Disagree". All items indicating agreement with the statement, such as "agree a little", "moderately agree" and "strongly agree" were grouped together for presentation purposes. The same was done for items indicating disagreement, where items such as "disagree a little", "moderately disagree" and "strongly agree" were grouped together.

The responses for the reverse-coded questions are reported in their original format, but recoding was done for the descriptive statistics discussion, as reported in Section 5.3.1.7.

5.3.1.1 Questioning mind

As Figure 5.2 shows, all the responses displayed overwhelming agreement, with ranges between 73% and 94% for participants' agreeing with the questioning mind statements.

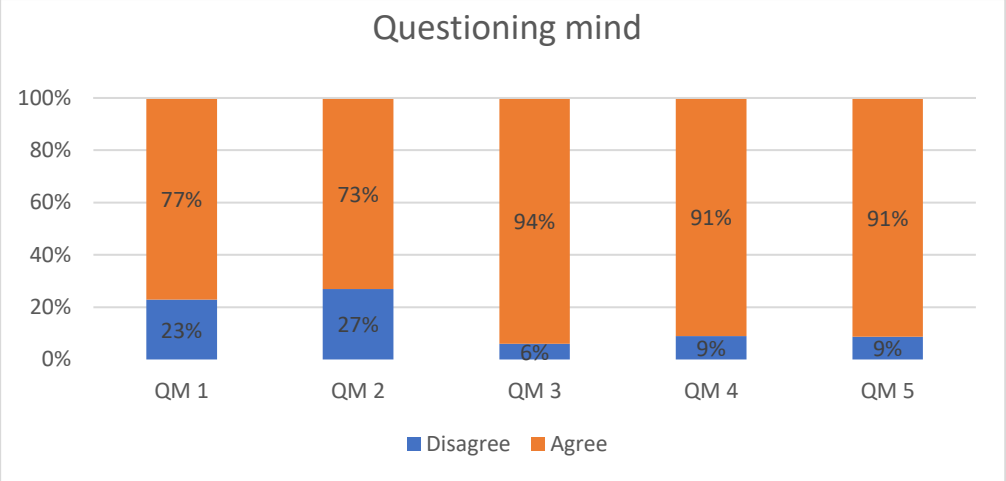


Figure 5.2: Questioning mind
Source: Own compilation

The statement with the most overall agreement for participants was related to QM 3 (94%), and stated, "*I usually notice inconsistencies in explanations*". The statement with the highest percentage of disagreement was related to QM 2 (27%), and stated, "*My friends tell me that I usually question things that I see or hear"*. There were no reverse-coded questions for the questioning mind construct.

5.3.1.2 Suspension of judgement

As Figure 5.3 shows, for all questions, except SOJ 3, there was overwhelming agreement, with ranges between 90% to 95% of participants agreeing with the suspension of judgement statements. The statement with the biggest overall agreement amongst participants was related to SOJ 5 (95%): "*I like to ensure that I have considered most available information before making a decision*". By contrast, the statement with the biggest overall disagreement was related to SOJ 3 (37%): "*I dislike having to make decisions quickly*". There were no reverse-coded questions for the suspension of judgement construct.

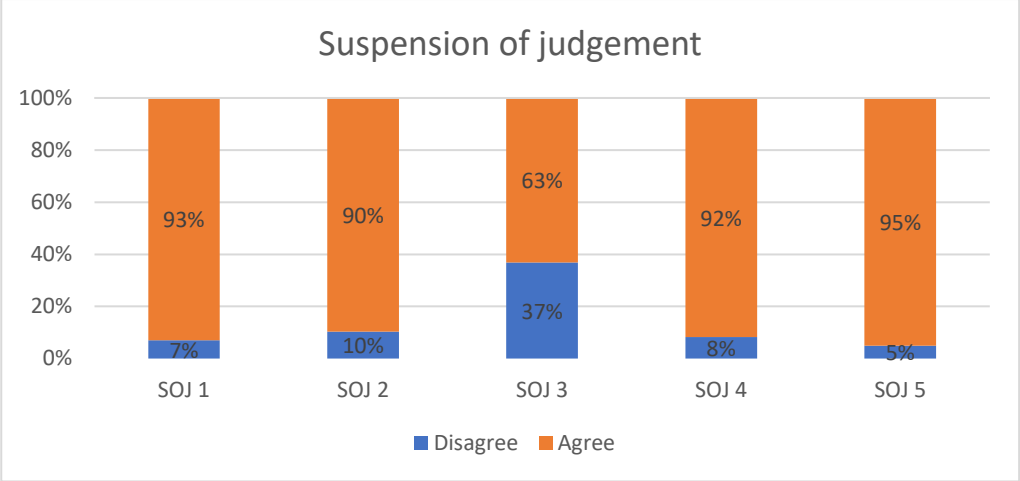


Figure 5.3: Suspension of judgement

Source: Own compilation

5.3.1.3 Search for knowledge

As Figure 5.4 shows, for all questions there was overwhelming agreement, with ranges between 90% and 98% of participants' agreeing with the search for knowledge statements. The statement with the biggest overall agreement amongst participants was related to SFK 2 (98%), which stated: "*The prospect of learning excites me*". The biggest overall disagreement was related to SFK 5 (10%), which stated: "*I relish learning*". There were no reverse-coded questions for the search of knowledge construct.

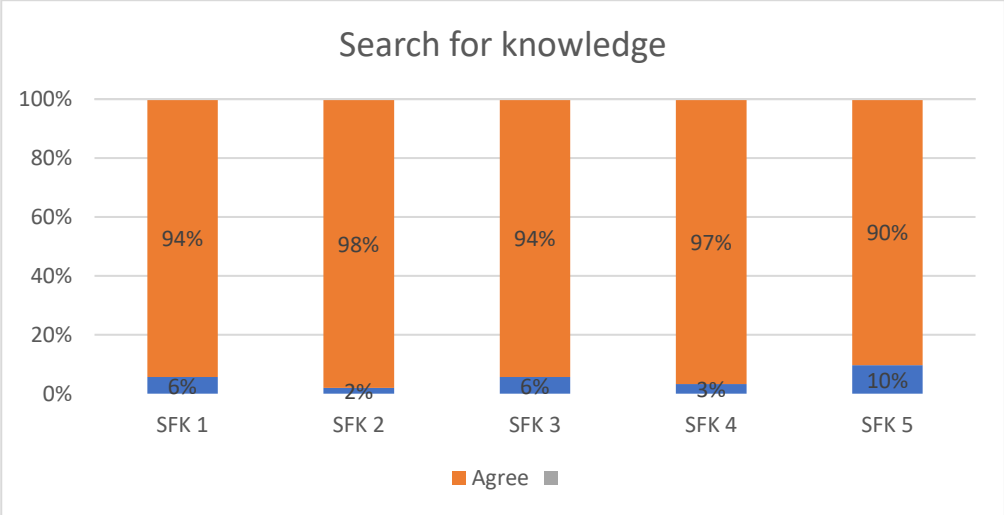


Figure 5.4: Search for knowledge

Source: Own compilation

5.3.1.4 Interpersonal understanding

For the interpersonal understanding construct, Question IU 2 and IU 4 were reverse-coded. Figure 5.5 shows that for all the non-reverse-coded questions, there was overwhelming agreement, with ranges between 89% and 90% of participants' agreeing with the interpersonal understanding statements. The statement with the biggest overall agreement amongst participants was related to IU 1 (90%) and IU 3 (90%): "*I am interested in what causes people to behave the way they do*" and "*I like to understand the reason for other people's behaviour*". For the reverse-coded questions, there was overwhelming disagreement, with ranges from 81% to 82%. The statement with the biggest overall disagreement was related to IU 2 (82%): "*Other people's behaviour does not interest me*".

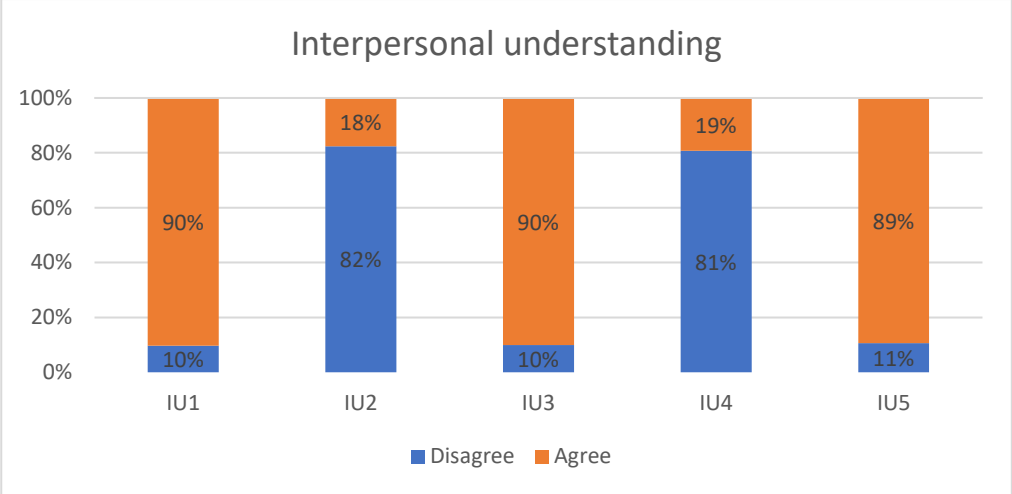


Figure 5.5: Interpersonal understanding

Source: Own compilation

5.3.1.5 Self-determining

For the self-determining construct, all five SD variables were represented by reverse-coded questions. As Figure 5.6 shows, for four questions, excluding SD 4, there was strong overall disagreement, with ranges between 71% and 81% of participants' disagreeing with the self-determining statements. The statement with the biggest overall disagreement was related to SD 2 (81%), which stated: "*I often accept other people's explanations without thinking about it further*". The statement with the biggest overall agreement was related to SD 4 (42%): "*Most often I agree with what the others in my group think*".

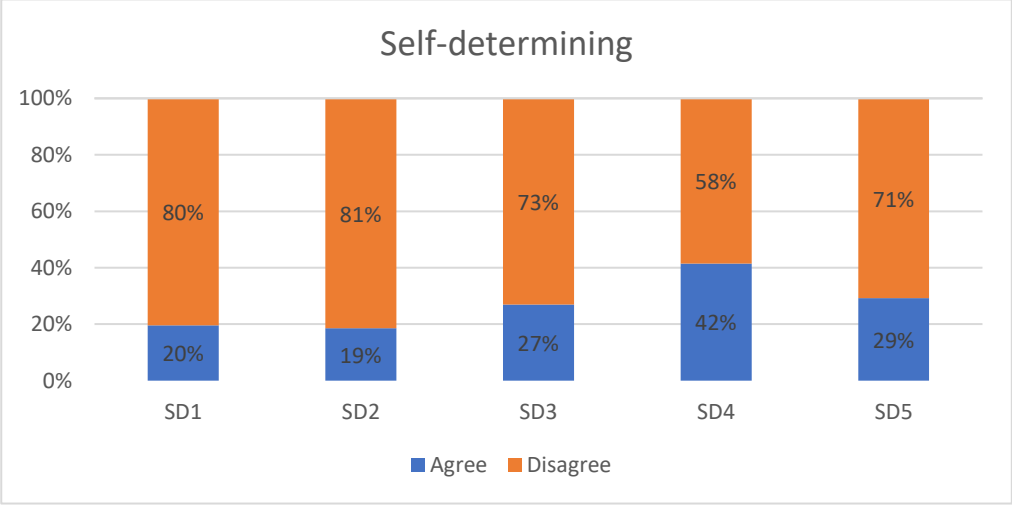


Figure 5.6: Self-determining

Source: Own compilation

5.3.1.6 Self-confidence

For the self-confidence construct, SC 4 was a reverse-coded question. Figure 5.7 shows that for all the non-reverse-coded questions, there was overwhelming agreement, with ranges between 92% and 95% of participants' agreeing with the self-confidence statements. The statement with the biggest overall agreement amongst participants was related to SC 2 (95%): "*I am confident of my abilities*". For the reverse-coded question, SC 4, overall disagreement of 93% was noted. The statement was: "*I do not feel sure about myself*".

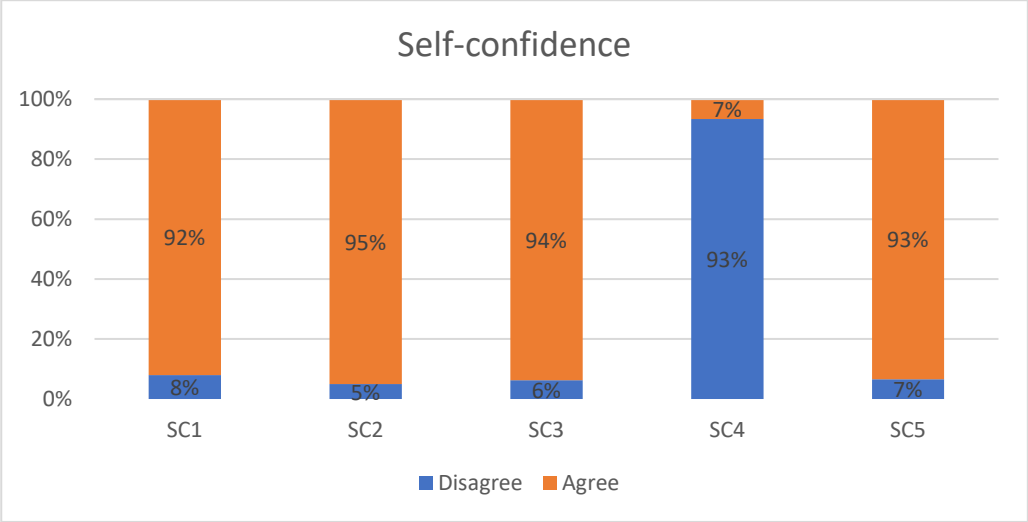


Figure 5.7: Self-confidence

Source: Own compilation

From this brief overview of the results for all six constructs, overall agreement with the respective aspect or trait was noted, which indicates the presence of professional scepticism as a trait. Each respective construct and its related items are now inspected further in the descriptive statistics section below.

5.3.1.7 Descriptive statistics for the professional scepticism as a trait constructs

The descriptive statistics are presented for exploratory purposes, to gain more insight on the data collected. The descriptive statistics for each item of the six constructs making up professional scepticism as a trait were used to determine the distribution of the items in terms of skewness and kurtosis. These descriptive statistics are based on the recoded dataset, which has taken into consideration the reverse-coded questions. These results are presented in Table 5.5.

Table 5.5: Descriptive statistics for the six constructs representing professional scepticism as a trait

Construct	Code	Mean (M)	Standard deviation	Skewness	Kurtosis
Professional scepticism as a trait	PS	140.61	14.099	-.338	.138
Questioning mind	QM				
QM_1		4.26	1.118	-.302	-.415
QM_2		4.11	1.231	-.495	-.180
QM_3		4.85	.930	-.981	1.817
QM_4		4.74	.946	-.668	.593
QM_5		4.72	.922	-.772	.978
Suspension of judgement	SOJ				
SOJ_1		4.83	.948	-1.080	2.132
SOJ_2		4.73	.983	-.726	.361
SOJ_3		3.86	1.421	-.277	-.821
SOJ_4		4.89	.963	-.945	1.064
SOJ_5		4.97	.810	-.628	.323
Search for knowledge	SFK				
SFK_1		5.08	1.043	-1.582	3.273
SFK_2		5.16	.849	-1.396	3.909
SFK_3		5.09	.959	-1.316	2.384
SFK_4		5.01	.860	-.898	1.656
SFK_5		4.82	1.067	-1.068	1.413
Interpersonal understanding	IU				
IU_1		4.95	1.044	-.936	.547
IU_2		4.60	1.149	-.723	-.025
IU_3		4.83	1.026	-.725	.091
IU_4		4.41	1.173	-.864	.463
IU_5		4.77	1.009	-.616	-.050
Self-determining	SD				
SD_1		4.73	1.183	-.724	-.388
SD_2		4.62	1.108	-.532	-.550
SD_3		4.28	1.228	-.437	-.370
SD_4		3.82	1.109	.042	-.536
SD_5		4.12	1.111	-.289	-.400
Self-confidence	SC				
SC_1		4.85	.921	-1.015	1.295
SC_2		5.07	.863	-1.262	2.690

Construct	Code	Mean (M)	Standard deviation	Skewness	Kurtosis
SC_3		4.77	.839	-.705	.907
SC_4		4.72	1.163	-.879	.226
SC_5		4.96	.939	-1.276	2.711

*The HPSS consisted of Likert-response items rated on a scale ranging from 1 = strongly disagree, to 6 = strongly agree.

Source: Own compilation

Skewness and kurtosis values need to range between +2.0 and -2.0 for skewness, and +10.0 and -10.0 for kurtosis to accept a normal univariate distribution (Collier, 2020, p. 166). Based on the results above, the skewness and kurtosis values all fell within the given ranges for a normal distribution.

5.3.2 Results for the constructs of personality traits

The five constructs of personality traits, where each construct measures its own trait, were measured by using the Ten-Item Personality Inventory (TIPI) scale adopted from Gosling et al. (2003). For each of the five personality traits there were two questions. The participants had to rate items using a Likert-response with a rating ranging from 1 (strongly disagree) to 7 (strongly agree). Table 5.6 shows the constructs, abbreviations, and number of items for each construct. Note that there were five reverse-coded questions in the 10-question scale – one for each personality trait.

Table 5.6: Personality traits – constructs

Research construct	Abbreviation	Number of items
Personality trait		**10**
Extraversion	E	2
Agreeableness	A	2
Conscientiousness	C	2
Openness to new experience	O	2
Neuroticism	N	2

Source: Own compilation

The results obtained for each construct of personality traits is presented in Figures 5.8 to 5.12 respectively. Only three categories are presented in the figures, namely “Agree”, “Neither agree or disagree” and “Disagree”. All items indicating agreement with the statement, such as “agree a little”, “moderately agree” and “strongly agree”, were grouped

together for presentation purposes. The same was done for all items indicating disagreement with the statement, such as “disagree a little”, “moderately disagree” and “strongly agree”, which were grouped together.

The responses for reverse-coded questions are reported in their original format, but recoding was done for the descriptive statistics discussion, as reported in Section 5.3.2.6.

5.3.2.1 Extraversion

The two questions making up this personality trait were E 1, “*Extraverted, enthusiastic*” and E 2, “*Reserved, quiet*”. E 2 was a reverse-coded question, which is presented in its original format. Based on the results displayed in Figure 5.8, there was overwhelming agreement with this statement, at 74%. By contrast, for E 2, total disagreement of 49% was reported. For both statements, the participants that neither agreed nor disagreed ranged between 5% and 7%.

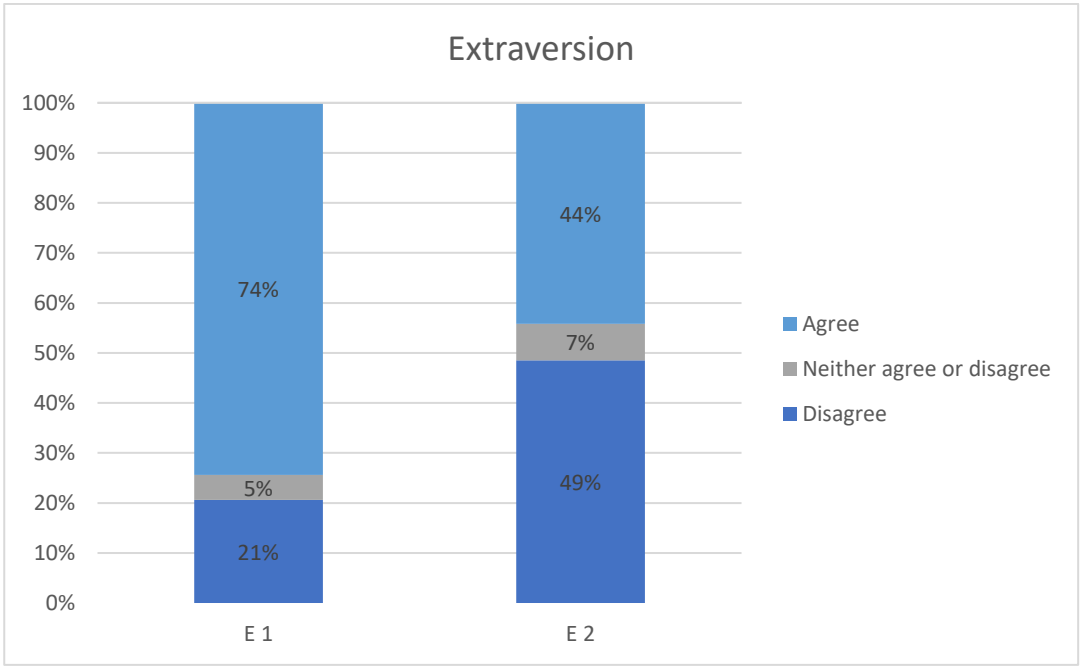


Figure 5.8: Extraversion

Source: Own compilation

5.3.2.2 Agreeableness

The two questions making up this personality trait were A 1, "*Critical, quarrelsome*", and A 2, "*Sympathetic, warm*". A 1 was a reverse-coded question, which is presented in its original format. As the results displayed in Figure 5.9 show, A 1 had a large disagreement percentage, as 35% of the sample indicated some disagreement, and only 56% of the sample agreed. For A 2, overwhelming agreement of 89% was reported. For both statements, the participants that neither agreed nor disagreed ranged between 5% and 9%.

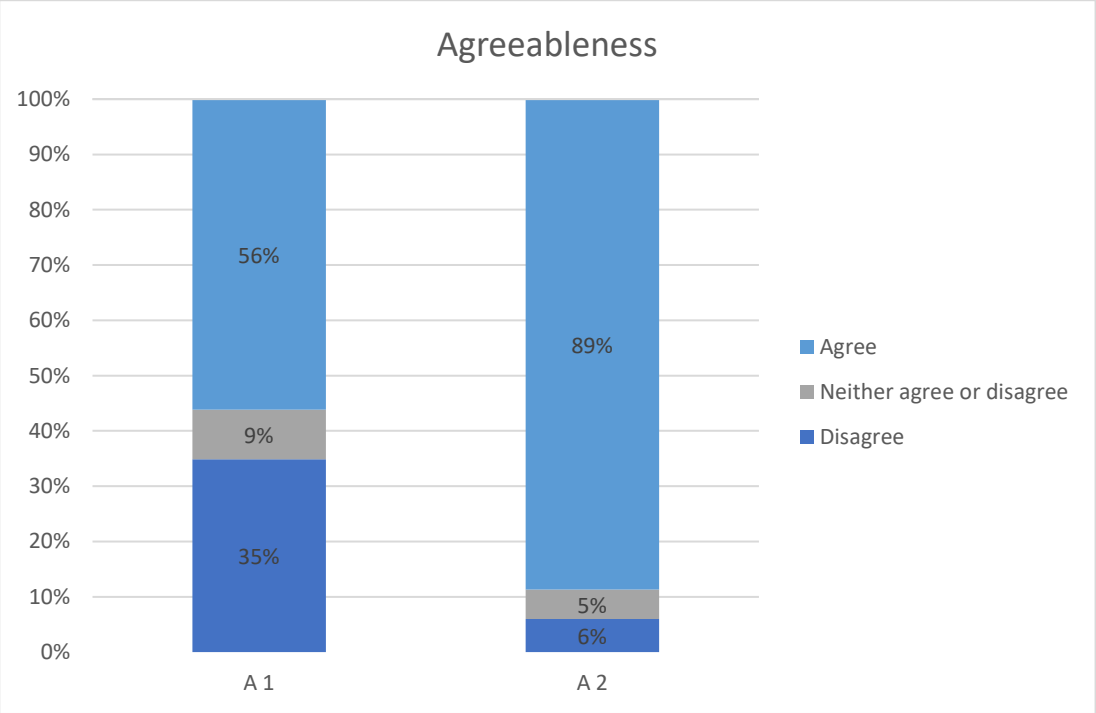


Figure 5.9: Agreeableness

Source: Own compilation

5.3.2.3 Conscientiousness

The two questions making up this personality trait were C 1, "*Dependable, self-disciplined*", and C 2, "*Disorganised, careless*". C 2 was a reverse-coded question, which is presented in its original format. As the results displayed in Figure 5.10 show, 97% of participants reported some level of agreement with the statement in C 1. This contrasts with the results for C 2, where 87% of the participants disagreed with the statement. For both statements, the participants that neither agreed nor disagreed ranged between 1% and 6%. This outcome highlights that most participants in the sample displayed conscientiousness as a personality trait.

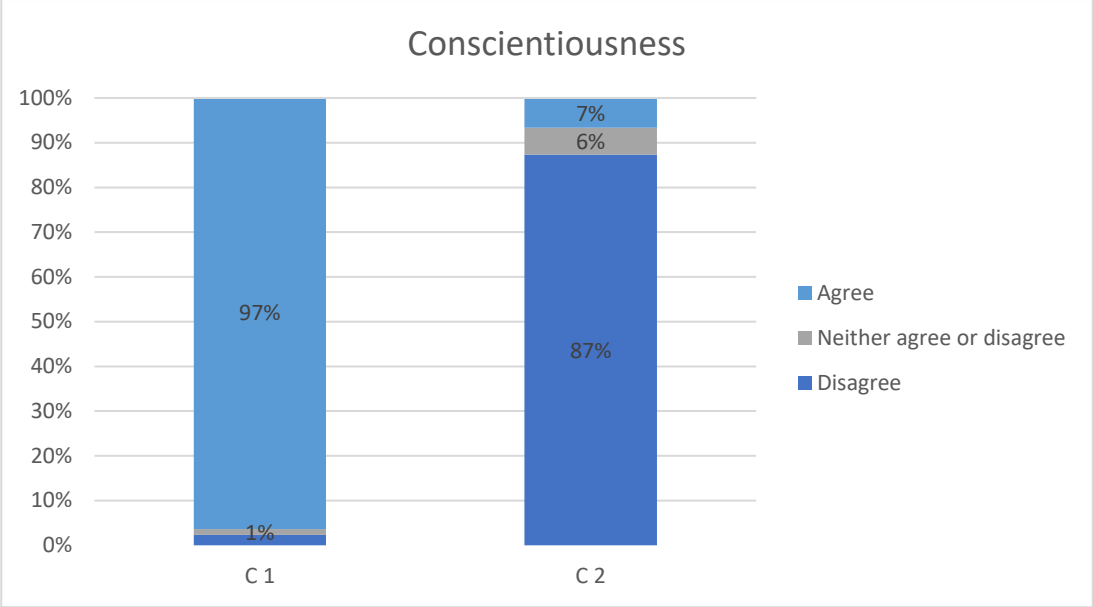


Figure 5.10: Conscientiousness

Source: Own compilation

5.3.2.4 Openness to new experience

The two questions for this personality trait were O 1, "*Open to new experiences, complex*", and O 2, "*Conventional, uncreative*". O 2 was reverse-coded (presented in its original format). Figure 5.11 shows that 90% of the participants agreed with O 1's statement, compared to 31% for O 2. For O 2, 55% of the participants disagreed with the statement to some degree. For both statements, 4% to 14% of participants neither agreed nor disagreed.

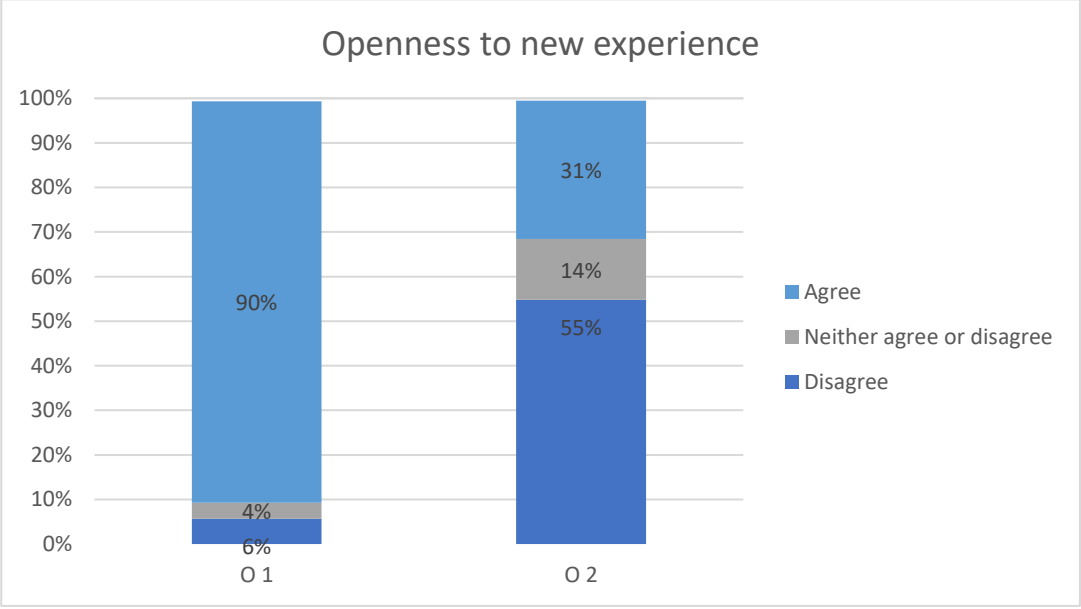


Figure 5.11: Openness to new experience

Source: Own compilation

5.3.2.5 Neuroticism

The two questions making up this personality trait were N 1, "*Anxious, easily upset*" and N 2, "*Calm, emotionally stable*". N 1 was a reverse-coded question, which is presented in its original format. From the results displayed in Figure 5.12, it is clear that for N 1, 56% of the participants were in some form of disagreement with the statement, and that only 36% were in overall agreement. For N 2, there was overwhelming agreement, at 91%. For both statements, the participants that neither agreed nor disagreed ranged from 5% to 8%.

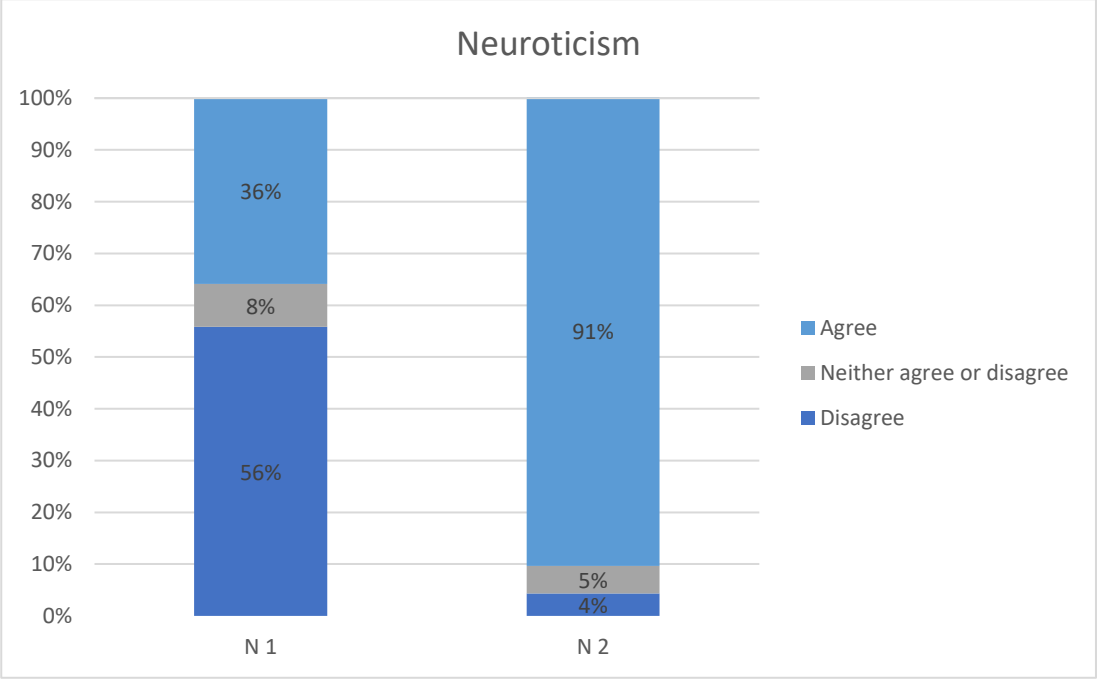


Figure 5.12: Neuroticism

Source: Own compilation

From the review of the personality trait constructs, it is noteworthy that for at least one question for each trait, the participants were largely in agreement. However, for the remaining question, there was a wide range of answers across all levels, from agreement to disagreement. This shows that all participants are not in full agreement with each of the respective traits. Each trait was analysed further, in the additional descriptive statistics (discussed in the next section) to determine the details of the responses gathered from this sample of participants. As with the constructs of professional scepticism as a trait, these statistics are only reported for further exploratory purposes, to gain insight into the data collected.

5.3.2.6 Descriptive statistics for the personality trait constructs

The descriptive statistics for each item of the five personality traits were used to determine the distribution of the items in terms of skewness and kurtosis. These descriptive statistics are based on the recoded dataset, which takes into consideration the reverse-coded questions. These results are presented in Table 5.7.

Table 5.7: Descriptive statistics for the six constructs representing personality traits

Construct	Code	Mean	Std. deviation	Skewness	Kurtosis
Extraversion	E				
E_1		5.08	1.648	-.867	-.120
E_2		4.29	1.876	.018	-1.377
Agreeableness	A				
A_1		3.70	1.854	.336	-1.118
A_2		5.66	1.196	-1.155	1.811
Conscientiousness	C				
C_1		6.35	1.055	-2.920	11.395
C_2		6.05	1.243	-1.473	1.678
Openness to new experience	O				
O_1		5.80	1.155	-1.448	2.781
O_2		4.53	1.582	-.165	-.959
Neuroticism	N				
N_1		4.60	1.740	-.217	-1.193
N_2		5.82	1.035	-1.201	1.770

*The TIPI scale consisted of Likert-response items rated on a scale ranging from 1 = strongly disagree to 7 = strongly agree.

Source: Own compilation

Skewness and kurtosis values need to range between +2.0 to -2.0 for skewness and +10.0 to -10.0 for kurtosis to accept a normal univariate distribution (Collier, 2020, p. 166). Based on the results above, the skewness and kurtosis values on average for each trait and the individual indicators all fell within the given ranges of a normal distribution, except for C 1 of the conscientiousness personality trait, where a kurtosis value of 11.395 and a skewness value of -2.920 were noted. Given that the conscientiousness personality trait displayed a deviation outside the acceptable range, more consideration was given to this trait as part of the factor analysis to assess the correlation analysis of this trait in Section 5.4.1.

The next section discusses the validity and reliability of the latent constructs which relate to professional scepticism as a trait and the five personality traits.

5.4 VALIDITY AND RELIABILITY OF THE CONSTRUCTS

The quality and rigour of the research design is demonstrated by assessing the validity and reliability of the constructs of interest, namely professional scepticism as a trait and personality traits, via the observed variables, in line with Collier (2020, p. 18). In the present study, the observed variables refer to the respective items or questions that make up each construct. This section elaborates on the assessment done in the study to confirm the quality of the chosen research design. A summary of the results obtained for the analyses is presented outlined below.

5.4.1 Results of the factor analysis – professional scepticism as a trait

The present study conducted a measurement model (CFA) using maximum likelihood estimates method for the professional scepticism as a trait constructs. The CFA for professional scepticism as a trait assesses six constructs: questioning mind, suspension of judgement, search for knowledge, interpersonal understanding, self-determining, and self-confidence. In Section 4.6.4, clarity was provided with regard to determining the measurement model's validity. Firstly, the model fit of the measurement model was assessed, after which construct validity was considered. The construct validity of the measurement model was assessed by considering convergent validity and discriminant validity.

5.4.1.1 Model fit

To assess model fit, the present study used goodness-of-fit measures, as required to assess the compliance of the model with the data collected (Civelek, 2018, p. 17; Collier, 2020, p. 65; Kumar, 2015, p. 26). This section reports on the goodness-of-fit measures used to assess the HPSS to determine whether the data collected fitted the model.

Preference was given to the following indices, as outlined in Section 4.6.4: the normed Chi-square (Chi-square statistic to the Degrees of Freedom (CMIN/DF)), the Root Mean Square Error of Approximation Index (RMSEA), the Comparative Fit Index (CFI), the Incremental Fit Index (IFI), and the Standardised Root Square Mean Residual (SRMR). These fit indices were run on the measurement model. Table 5.8 shows the ranges that are required for the

HPSS to be considered a good fit (also see Section 4.6.4). The actual results obtained from the fit indices are also set out in Table 5.8.

Table 5.8: Model fit indices – professional scepticism as a trait

Model	CMIN/DF	RMSEA	CFI	IFI	SRMR
PS model	**1.709**	**0.049**	**0.931**	**0.932**	**0.062**
Good fit	Lower than 3	Less than or equal to 0.05	Above 0.95	Above 0.95	Less than or equal to 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	

Source: Own compilation

Based on the results presented in the table above, the model fit statistics indicated good fit indices, with the CMIN/DF (1.709) below 3, the RMSEA (0.049) below 0.05, and the SRMR (0.062) less than 0.08. The results for the CFI (0.931) and the IFI (0.932) were within an acceptable fit range.

5.4.1.2 Convergent validity

The present study used three measures for convergent validity, namely standardised factor loadings, the average variance extracted (AVE) and reliability measures (Hair et al., 2009, p. 686). The results generated from these three measures are discussed below.

- *Factor loadings*

The measurement model was tested for consistency with the observed data, using an SEM approach, employing the analysis of moment structures (AMOS) package in IBM SPSS, version 28. The standardised regression weights (factor loadings) were assessed by means of the respective indicator factors. Table 5.9 shows the factor loadings for each indicator on its respective construct. Minimum factor loadings of 0.7 per indicator are required (Collier, 2020, p. 81), but if the scale used in the study is an existing, validated scale, factor loadings between 0.4 and 0.7 can be justified, provided that the internal consistency and other reliability and validity measures are within acceptable ranges (Hair et al., 2009). The original study that developed the HPSS (Hurtt, 2010) and subsequent studies (Koch et al., 2016) have used a similar threshold of 0.4 for factor loadings.

Table 5.9: Factor loadings – professional scepticism as a trait

Constructs	Standardised factor loadings
Questioning mind (QM)	
I often reject statements unless I have proof that they are true. (QM_1)	0.426*
My friends tell me that I usually question things that I see or hear. (QM_2)	0.606
I usually notice inconsistencies in explanations. (QM_3)	0.408*
I frequently question things that I see or hear. (QM_4)	0.805
I enjoy trying to determine if what I read or hear is true. (QM_5)	0.695
Suspension of judgement (SOJ)	
I wait to decide on issues until I can get more information. (SOJ_1)	0.677
I take my time when making decisions. (SOJ_2)	0.699
I dislike having to make decisions quickly. (SOJ_3)	0.508
I do not like to decide until I have looked at all of the readily available information. (SOJ_4)	0.812
I like to ensure that I have considered most available information before making a decision. (SOJ_5)	0.657
Search for knowledge (SFK)	
The prospect of learning excites me. (SFK_1)	0.825
Discovering new information is fun. (SFK_2)	0.710
I think that learning is exciting. (SFK_3)	0.913
I like searching for knowledge. (SFK_4)	0.743
I relish learning. (SFK_5)	0.811
Interpersonal understanding (IU)	
I am interested in what causes people to behave the way they do. (IU_1)	0.831
Other people's behaviour does not interest me. (IU_2)	0.432*
I like to understand the reason for other people's behaviour. (IU_3)	0.849
I seldom consider why people behave in a certain way. (IU_4)	0.408*
The actions people take and the reasons for those actions are fascinating. (IU_5)	0.860
Self-determining (SD)	
I often accept other people's explanations without thinking about it further. (SD_1)	0.756
I tend to immediately accept what other people tell me. (SD_2)	0.613
I usually accept things I see, read, or hear at face value. (SD_3)	0.866
Most often I agree with what the others in my group think (SD_4)	0.414*
It is easy for other people to convince me. (SD_5)	0.610
Self-confidence (SC)	
I feel good about myself. (SC_1)	0.766

Constructs	Standardised factor loadings
I am confident of my abilities. (SC_2)	0.705
I am self-assured. (SC_3)	0.791
I do not feel sure of myself. (SC_4)	0.771
I have confidence in myself. (SC_5)	0.861

* Item had low factor loading, but still met the 0.4 threshold.

Source: Own compilation

Based on the results presented in Table 5.9, all factor loadings included ranged above the required threshold of 0.4. The present study was therefore satisfied to include all 30 factors in the SEM, if all the other reliability and validity measures met the required thresholds. The following indicators did, however, display low factor loadings (just above 0.4): QM 1, QM 3, SOJ 3, IU 2, IU 4, and SD 4. For indicators such as QM 1 and QM 3, similar results were obtained by Koch et al. (2016). In their study, QM 1 did not meet the 0.4 factor loading threshold, and for QM 3, the factor loaded strongly on other factors as well. Similarly, in the study conducted by Hurtt (2010), factor QM 3 had a low factor loading and also loaded strongly on other constructs.

Although all the items presented in the table above met the minimum requirement for inclusion in the measurement model, further inspection was conducted with regard to the combined SEM before a final decision was made to keep all the observed variables (see Chapter 7).

- *Average Variance Extracted*

In assessing convergent validity using AVE, the guidance of Fornell and Larcker (1981) was used. A minimum AVE value of 0.5 is required to show that the indicators converge to measure a single concept (Collier, 2020, p. 83). However, some studies have supported an AVE value lower than 0.5, if a minimum composite reliability of 0.6 is achieved (Hair et al., 2009; Psailla & Wagner, 2007). Table 5.10 sets out the AVE for the various constructs in professional scepticism as a trait.

Table 5.10: Average Variance Explained – professional scepticism as a trait

	AVE
Questioning mind (QM)	**0.369**
Suspension of judgement (SOJ)	**0.459**
Search for knowledge (SFK)	0.645

Interpersonal understanding (IU)	0.504
Self-determining (SD)	0.608
Self-confidence (SC)	**0.448**

Source: Own compilation

The AVE value for three constructs was above 0.5: search for knowledge (0.645), interpersonal understanding (0.504), and self-confidence (0.608). Convergent validity was confirmed for all three constructs. The AVE values for questioning mind (0.369), suspension of judgement (0.459), and self-determining (0.448) did not meet the required threshold of 0.5. Malhotra and Dash (2011) argue that the AVE threshold is often too strict, and that reliability can be established through composite reliability alone. Composite reliability is considered below.

- *Reliability tests*

Collier (2020) notes two reliability measures that need to be applied to assess the reliability of a model: internal consistency (the Cronbach's alpha) and composite reliability. The Cronbach's alpha was determined using the Statistical Package for Social Sciences (SPSS) whereas the composite reliability measure was calculated using the guidance of Fornell and Larcker (1981). The required Cronbach's alpha coefficient needs to be above a minimum of 0.7 (Bagozzi & Yi, 2012, p. 14; DeVellis, 1991); the composite reliability coefficient needs to be above a minimum of 0.6 (Hair et al., 2009, p. 687). These thresholds have been stated and discussed in Section 4.6.4. The results of the reliability measures are displayed in Table 5.11.

Table 5.11: Reliability – professional scepticism as a trait

	Cronbach's alpha	Composite reliability
Professional scepticism	0.866	
Questioning mind (QM)	0.709	0.733
Suspension of judgement (SOJ)	0.779	0.806
Search for knowledge (SFK)	0.899	0.900
Interpersonal understanding (IU)	0.796	0.821
Self-determining (SD)	0.879	0.886
Self-confidence (SC)	0.788	0.794

Source: Own compilation

As the results above show, all the constructs for the Cronbach's alpha reliability measure had coefficients above 0.7 and those for the composite reliability measure had coefficients

above 0.6. Because the QM (0.733), SOJ (0.806) and SD (0.794) constructs had a composite reliability coefficient above 0.6, no factors needed to be removed from this construct, as the convergent validity was confirmed for this construct, based on the reliability measure, even though the AVE values were lower than 0.5 (Fornell & Larcker, 1981; Hair et al., 2009, p. 687; Malhotra & Dash, 2011; Psailla & Wagner, 2007).

The study from which the HPSS was adopted obtained a Cronbach alpha coefficient of 0.86 (Hurtt, 2010), similar to the result of 0.866 in the present study. This finding indicates good internal consistency. These results have been supported by more recent studies that also adopted the HPSS (Hurtt, 2010). Using samples of undergraduates studying for a financial degree, a Cronbach's alpha coefficient of 0.84 was obtained by Janssen et al. (2020) and one of 0.90 was reported by Khan and Harding (2020). Eutsler et al. (2018) considered a sample of practising auditors, and obtained a Cronbach's alpha coefficient of 0.87. Quadackers et al. (2014) used only auditors in their sample and reported a Cronbach's alpha coefficient of 0.83. These four studies did not perform a composite reliability test on the professional scepticism as a trait scale, so that the results cannot be compared.

A limited number of studies have looked at the six sub-constructs in the HPSS. In the original study conducted by Hurtt (2010), the six constructs displayed the following Cronbach's alpha coefficients: questioning mind (0.67), search for knowledge (0.88), suspension of judgement (0.83), interpersonal understanding (0.90), self-determining (0.76), and self-confidence (0.91). All the coefficients were above 0.7 except questioning mind. The results of the present study are similar to those of Hurtt (2010), as the Cronbach's alpha coefficients range between 0.7 and 0.8, which is regarded as an acceptable level of coefficient validity. Questioning mind, although above 0.7, displayed the lowest coefficient of all constructs in the present study, in line with Hurtt's (2010) result. These results are also in line with those of Koch et al. (2016), who reported that five of the six constructs had Cronbach's alpha coefficients between 0.75 and 0.88, except for questioning mind, which had a coefficient of 0.62. Hurtt (2010) and Koch et al. (2016) did not perform a composite reliability test on the constructs in the HPSS, so their results cannot be compared with those of the present study.

5.4.1.3 Discriminant validity

To assess discriminant validity, two measures were used (see Section 4.6.4). This is especially important for scales measuring constructs, as in the present study. Discriminant

validity is confirmed if correlations among constructs are lower than the square root of the AVE value for the respective construct (Fornell & Larcker, 1981). The results are shown in Table 5.12. Discriminant validity was supported, except between QM and SD. A similar argument is made for this measure's being too strict, as its inputs are derived from AVE. Therefore, a second measure for discriminant validity had to be considered, namely HTMT.

Table 5.12: Discriminant validity – professional scepticism as a trait

	AVE	QM	SOJ	SFK	IU	SC	SD
QM	0.369	**0.607***					
SOJ	0.459	0.334	**0.677***				
SFK	0.645	0.513	0.158	**0.803***			
IU	0.504	0.541	0.145	0.489	**0.709***		
SC	0.608	0.219	-0.021	0.305	0.031	**0.779***	
SD	0.448	**0.661**	0.186	0.433	0.294	0.293	**0.669***

*Square root of AVE value.
Source: Own compilation

The second discriminant validity measure used was thus the HTMT ratio, where a value lower than 0.85 indicates discriminant validity between two constructs (Hensler et al., 2015). The results are shown in Table 5.13. Discriminant validity was supported for all pairs of constructs, as all the values were lower than 0.85.

Table 5.13: HTMT analysis – Professional scepticism as a trait

	QM	SOJ	SFK	IU	SD	SC
QM						
SOJ	0.280					
SFK	0.426	0.137				
IU	0.380	0.083	0.423			
SD	0.521	0.130	0.356	0.222		
SC	0.206	0.040	0.276	0.039	0.229	

Source: Own compilation

Based on the above assessment, construct validity was proven for all six constructs of professional scepticism as a trait. All the acceptable thresholds were met to support model fit, convergent validity and discriminant validity. Therefore, the present study concluded that all 30 items from the existing HPSS should be included in the measurement model, and that there was no need to consider model respecification.

Figure 5.13 sets out a simple breakdown of the professional scepticism as a trait CFA results. The measurement model is presented with the six constructs associated with professional scepticism as a trait. The coding used in the figure reflects the following:

- the latent variable QM consists of observable variables QM_1 to QM_5;
- the latent variable SOJ consists of observable variables SOJ_1 to SOJ_5;
- the latent variable SFK consists of observable variables SFK_1 to SFK_5;
- the latent variable IU consists of observable variables IU_1 to IU_5;
- the latent variable SD consists of observable variables SD_1 to SD_5; and
- the latent variable SC consists of observable variables SC_1 to SC_5.

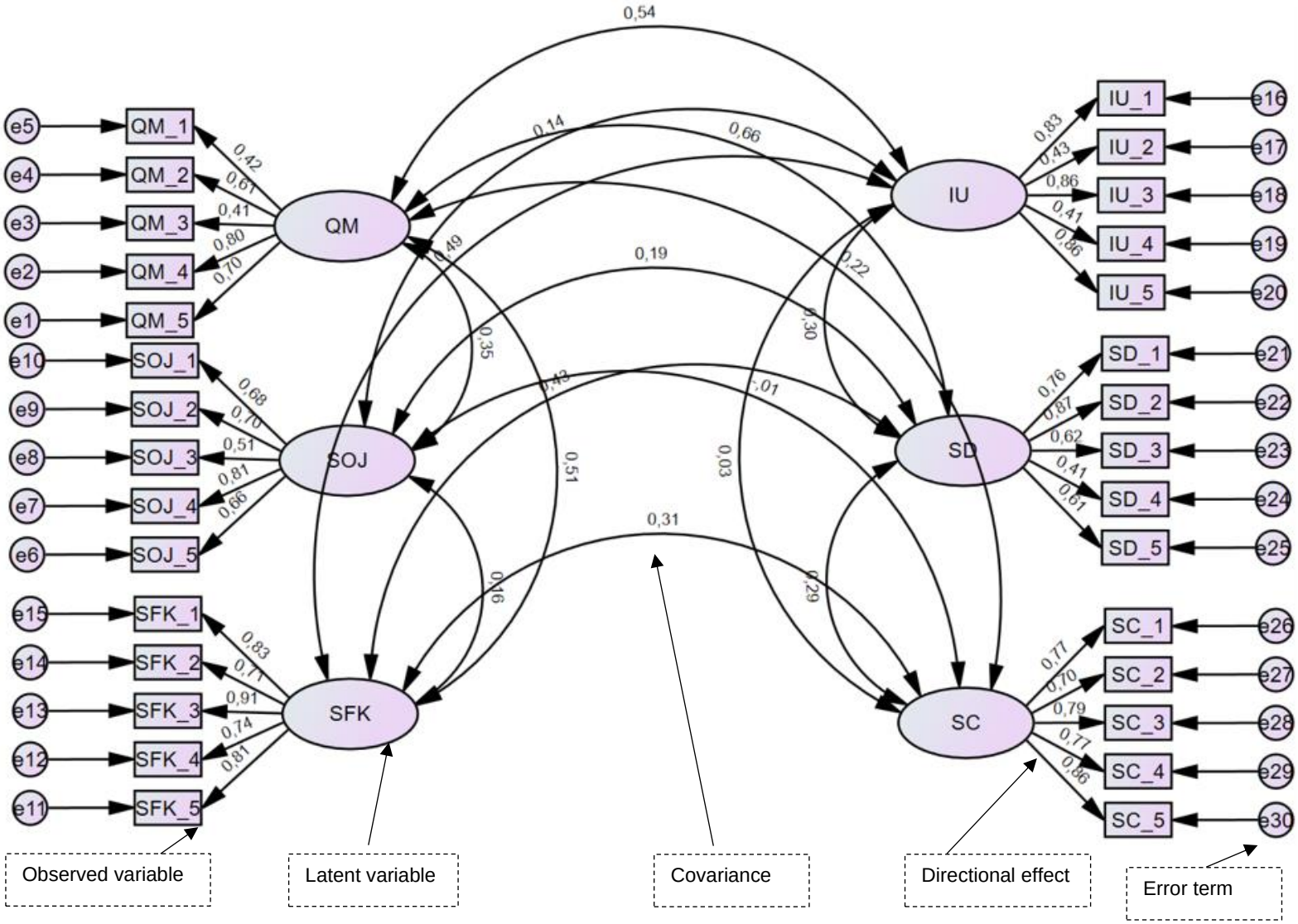


Figure 5.13: Professional scepticism as a trait confirmatory factor analysis

5.4.2 Results of the factor analysis – personality traits

The present study conducted a measurement model (CFA) for the personality trait constructs. 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 factoring (PAF) to determine the dimensions, as this method is appropriate for data that display non-normality. IBM SPSS, version 28, was used to generate the results of the EFA, as presented in Table 5.14.

The *construct validity* of the measurement model was assessed by considering the convergent validity, discriminant validity and possible modification of the model.

5.4.2.1 Convergent validity

Convergent validity was confirmed by conducting an EFA. Thereafter, AVEs for each respective construct, as identified by the EFA, were calculated, together with reliability measures. The results generated from the three measures are presented in the next few paragraphs.

- *Exploratory factor analysis: Personality traits*

To confirm the appropriateness of the EFA for personality traits, the Kaiser-Meyer-Olkin (KMO) test for sampling adequacy and Bartlett's test of sphericity were performed to assess the suitability of the data for factor analysis (Pallant, 2020). For the KMO measure, an index of between 0 and 1 can be obtained, and a minimum threshold of 0.5 is required (Kaiser, 1974; Tabachnick et al., 2007). For Bartlett's test of sphericity, the outcome should be significant ($p < .05$) (Hair et al., 2009, p. 105). In the present study, the KMO value for the personality traits was 0.519, which exceeded the minimum threshold of 0.5. The Bartlett's test of sphericity displayed statistical significance ($p < .001$), supporting the factorability of the correlation matrix.

The PAF method was used to extract the factors, followed by a promax rotation with Kaiser normalisation. The PAF method identified factors with eigenvalues larger than 1 – four of

the five personality traits were dimensionally revealed, cumulatively explaining 36.44% of the variance in the data. Table 5.14 indicates the standard regression weights (factor loadings) and communalities as indicated in the pattern matrix for all five personality traits. Communalities indicate the extent to which individual items correlate with the rest of the items (Hair et al., 2009, p. 92). Item communalities are considered high if they are above 0.8 (Costello & Osborne, 2005, p. 4), and communalities of less than 0.2 might indicate that an item relates to other items and should be considered for deletion (Child, 2006).

Hair et al. (2009, p. 117) provide specific guidance on the required factor loadings that are considered acceptable, which is driven by the sample sizes in the EFA. The sample size of the present study was 301, which falls within the sample size range of 250 to 350. For this sample size range, a minimum factor loading of 0.35 is required. Based on the results presented in Table 5.14, all factor loadings were above 0.5.

Table 5.14: Exploratory factor analysis – personality traits

Constructs	Item	Standardised factor loadings	Variance explained	Communalities
Extraversion (E)	Extraverted, enthusiastic (E_1)	0.731	36.44%	0.568
	Reserved, quiet (E_2)	0.704		0.493
Agreeableness (A)	Critical, quarrelsome (A_1)	0.576		0.258
	Sympathetic, warm (A_2)	0.482		0.327
Conscientiousness (C)	Dependable, self-disciplined (C_1)	0.693		0.480
	Disorganised, careless (C_2)	No loading		**0.162**
Openness to new experience (O)	Open to new experiences, complex (O_1)	No loading		**0.132**
	Conventional, uncreative (O_2)	No loading		**0.132**
Neuroticism (N)	Anxious, easily upset (N_1)	0.836		0.737
	Calm, emotionally stable (N_2)	0.584		0.346

Source: Own compilation

The results in Table 5.14 show that four of the personality trait constructs loaded on their respective personality traits. For the openness to new experiences trait, no items loaded, and for the conscientiousness trait only one item loaded on the trait. A construct requires a minimum of two items (Kline, 2016) and therefore the openness to new experiences trait and the conscientiousness trait were removed. The same two traits also displayed communalities below 0.2. Factor loadings for the remaining three traits (extraversion, agreeableness and neuroticism) all met the required threshold of 0.35.

- *Average Variance Extracted*

To assess convergent validity using AVE, guidance from Fornell and Larcker (1981) was used. A minimum AVE value of 0.5 is required to indicate that the indicators converge to measure a single concept (Collier, 2020, p. 83), but some studies have supported an AVE value lower than 0.5 if minimum construct reliability of 0.6 is achieved (Hair et al., 2009; Psailla & Wagner, 2007). The present study's results, as reported in Table 5.15, show that the required thresholds are met for both extraversion (0.506) and neuroticism (0.522). The AVE for agreeableness (0.273) does not meet the required threshold of 0.5. Nevertheless, Malhotra and Dash (2011) argue that AVE is often a too strict measure, and that reliability can be established through composite reliability alone, so the composite reliability for agreeableness was considered before this personality trait was considered for deletion.

Table 5.15: Average variance extracted – personality traits

Personality traits	AVE
Extraversion (E)	0.506
Agreeableness (A)	**0.273**
Neuroticism (N)	0.522

Source: Own compilation

- *Reliability tests*

The literature has raised concerns around how the reliability of a two-item scale can be measured accurately. Measures such as the Cronbach's alpha estimate reliability under strict assumptions which are not always present in a two-item scale (Eisinga et al., 2013, p. 637). The Spearman-brown coefficient has been suggested as an alternative reliability measure, specifically for two-item scales (Eisinga et al., 2013, p. 641). A coefficient between 0.5 and 0.7 is considered acceptable, whereas a coefficient between 0.7 and 0.9 is considered good and one above 0.9 as excellent (De Vet et al., 2017). The composite

reliability coefficient needs to be above a minimum of 0.6 (Hair et al., 2009, p. 687). These thresholds have been discussed in Section 4.6.4. The results for the reliability measures in the present study are reported in Table 5.16.

Table 5.16: Reliability results – personality traits

Personality traits	Spearman-Brown coefficient	Construct Reliability
Extraversion (E)	0.684	0.672
Agreeableness (A)	**0.427**	**0.428**
Neuroticism (N)	0.636	0.677

Source: Own compilation

According to the results noted in Table 5.16, extraversion (0.684) and neuroticism (0.636) had Spearman-Brown coefficient values above 0.5, which is deemed acceptable, but agreeableness (0.427) had a Spearman-Brown coefficient value below the required threshold of 0.5. For composite reliability, again both extraversion (0.672) and neuroticism (0.677) met the required threshold of 0.6, whereas agreeableness (0.428) did not. For the present study, the agreeableness personality trait could thus not be deemed reliable, based on the low reliability coefficients and AVE value. The agreeableness personality trait was therefore removed from the present study.

The TIPI scale emphasises content validity considerations, which lead in lower inter-item correlations, which in turn result in unusually low internal consistency estimates (Gosling et al., 2003, p. 516). Therefore, low internal consistency estimates were expected, and were found in the results reported in Table 5.16. The results of the present study differed from those of Gosling et al.'s (2003, p. 516) study, which developed the original TIPT scale. Their study used a test-retest reliability measure (the Spearman-Brown coefficient) similar to the present study, and reported coefficients above 0.6 for all five traits. The following coefficients were reported in their study: extraversion (0.77), agreeableness (0.71), conscientiousness (0.76), openness to new experience (0.62) and neuroticism (0.70). In the present study, only two traits, extraversion and neuroticism, had similar coefficients.

The validity measures for the remaining two personality trait constructs are discussed below.

5.4.2.2 Discriminant validity

To assess discriminant validity, two measures were implemented. This is especially important for the use of scales that measure constructs, as in the present study. Discriminant validity for the first measure is proved if the correlations amongst constructs are lower than the square root of the AVE value for the respective construct. Results for the present study are shown in Table 5.17 – discriminant validity is supported.

Table 5.17: Validity – personality traits

	AVE	Extraversion	Neuroticism
Extraversion (E)	0.506	**0.711***	
Neuroticism (N)	0.522	0.132	**0.722***

*Square root of AVE value.

Source: Own compilation

The second measure is HTMT, where a value lower than 0.85 is required per construct. The results are shown in Table 5.18. All values were lower than the 0.85 threshold required.

Table 5.18: HTMT analysis – personality traits

	Neuroticism
Extraversion (E)	0.136

Source: Own compilation

Based on the above assessment, construct validity has been proven for only two personality traits, namely extraversion and neuroticism. For these two traits, all the acceptable thresholds have been met to support convergent validity and discriminant validity, and both traits were considered for inclusion in the combined SEM.

5.5 SUMMARY

This chapter has reported on the descriptive statistics for the demographic information on the participants of the present study, the descriptive statistics for the latent constructs, and the validity and reliability testing of the measurement models for professional scepticism as a trait and personality traits. The research design and statistical methods described in Chapter 4 were useful in analysing and interpreting the data. The main results reported in this chapter are summarised below.

In respect of the participants' demographic information a well-balanced sample between men (51.5%) and women (47.5%) was observed. Most participants were qualified chartered

accountants registered with SAICA (73%), but 24% were trainees gaining experience to register with SAICA. The average age of participants in the sample was 32 years. Participants had an average of nine years' working experience in the general field of finance. The average for key decision-making experience was 4.5 years.

With regard to the latent constructs of professional scepticism as a trait, the average participant was in agreement with all six constructs (questioning mind, suspension of judgement, search for knowledge, interpersonal understanding, self-determining, and self-confidence). The construct with the strongest agreement amongst participants was search for knowledge. The review of the personality trait constructs showed that the sample were in agreement for at least one question per trait. However, for the remaining question, there were a wide dispersion of answers across all levels, from agreement to disagreement.

This chapter has also reported on the measurement model testing for both professional scepticism as a trait and personality traits. For professional scepticism as a trait, information was provided to confirm model fit and construct validity. All the required thresholds for model fit and construct validity were met, which supported inclusion of all 30 factors in the combined SEM for further testing. For personality traits, only two traits (extraversion and neuroticism) met the required criteria for construct validity for inclusion in the combined SEM.

The results for Hypothesis 1 are reported in Chapter 6, and the SEM results generated for the combined statistical models to address Hypotheses 2 to 6 are reported in Chapter 7.

CHAPTER 6:
RESEARCH FINDINGS (PART 2) –
BIAS IN FINANCIAL DECISION-MAKING

6.1 INTRODUCTION

The first research question of the present study is addressed in Chapter 6. This research question relates to *which of the most prevalent heuristic-related and other biases are present in the financial decision-making behaviour of financial professionals.* The study acknowledges that this research question has been addressed in many previous research studies conducted on samples from a finance environment (De Bondt & Thaler, 1985; Einhorn & Hogarth, 1978; Enslin, 2019; Gort, 2009; Joyce & Biddle, 1981; Kida et al., 2001; Lowies, 2012). It is anticipated that the sample of financial professionals used in the present study would be prone to bias in financial decision-making, and the aim with the first research question is to find evidence to support this contention. This research question is therefore a precursor to Research Question 2, as one can only measure a variable's relationship with bias susceptibility if the sample does indeed exhibit bias to some extent. This research question is therefore included in the present study to assist in addressing Research Question 2 (for which the results are the main contribution of the present study).

Questions 1 to 8 of Section 3 of the questionnaire tested for the presence of various biases emanating from heuristics such as the representativeness, and anchoring and adjustment heuristics, as well as overconfidence bias and affect bias in the financial decision-making of financial professionals. The questionnaire is included as Appendix A. For the data analyses for all five biases, the complete sample of 301 responses was used.

The remainder of this chapter addresses Hypothesis 1, which relates to whether *financial professionals are susceptible to a number of heuristic-related and other biases when they make financial decisions*.

6.2 RESULTS FOR BIASES RELATED TO THE USE OF HEURISTICS

In this section, Hypotheses H_{1a} to H_{1c} are addressed. These hypotheses relate to the questions testing confirmation bias and misconception of regression to the mean bias, which stem from the representativeness heuristic, and conjunctive events bias, which stems from the anchoring and adjustment heuristic.

6.2.1 Confirmation bias

Hypothesis H_{1a} states the following: Financial professionals are susceptible to *confirmation bias* related to the representativeness heuristic when they make financial decisions.

Questions 1 and 2 tested confirmation bias, which stems from the representativeness heuristic. Confirmation bias emanates from the tendency to look for confirming evidence when both confirming and disconfirming evidence is available. A rational decision-maker should use both confirming and disconfirming information, or at least disconfirming information, to examine the validity of the statement in the question. The question used in the present study was adopted and adapted from the studies of Einhorn and Hogarth (1978) and Enslin (2019). Participants were considered rational if they chose Option A in Question 1 and Option D in Question 2. The question provided information to the participants which suggested that when a particular share market analyst made a pronouncement, namely that the market would rise, the market always rises in line with the statement made by that analyst. Participants were requested to indicate the minimum evidence that they would need to examine this claim.

Question 1 provided two options. Option A referred to a favourable report by the analyst and Option B referred to an unfavourable report by the analyst. **Question 2** thereafter provided Options C and D, which related to information a participant could look at to examine the claim, in other words, actual rises in the market after the prediction was made by the analyst (Option C) or actual falls (Option D). Questions 1 and 2 had to be completed by participants to determine their susceptibility to bias. Participants could select only one option per question. A rational response would therefore be to choose the favourable report (Option A) and look for disconfirming evidence which examines the report chosen (Option D). Confirmation bias was therefore exhibited when participants chose Options A and C, as this would present a scenario where participants selected a favourable report and searched for a favourable outcome, thus looking for confirming evidence. For combinations such as Options B and C, or B and D, no bias could be assigned. Table 6.1 reports the results obtained from the present study.

Table 6.1: Selection comparison – confirmation bias

Bias variable	Options selected	Frequency (n) N = 301	Percentage (%)
Confirmation bias	A & C	173	57.5%
	B & C	26	8.6%
	B & D	40	13.3%
	A & D	62	**20.6%**

Source: Own compilation

According to the results reported in Table 6.1, only 20.6% of the sample chose Options A and D, which were the options that a rational decision-maker would choose, as they would represent the minimum amount of evidence needed to examine the claim. Most of the participants were susceptible to confirmation bias, as they chose only confirmatory evidence (57.5%), in other words, the favourable report (Option A) and evidence to support the favourable report (Option C). For the remaining 21.9% of the participants, who selected Options B and C, or B and D, no specific bias could be assigned. Overall, the results for confirmation bias in the present study were anticipated, but still concerning. The sample of the present study consisted of highly educated individuals, most of whom have undergone training in a training institution accredited by the South African Institute of Chartered Accountants (SAICA). SAICA's Code of Conduct specifically refers to confirmation bias as a particular form of bias their members needs to take cognizance of (SAICA, 2022). Therefore, the expectation was that the training that the participants in the present study had received would support them in looking for disconfirming evidence, and not only confirming evidence, to support a financial decision they made. The finding in the present study is similar to that of Enslin (2019), who also reported the significant presence of confirmation bias in his sample of management accountants. Enslin (2019) made a similar argument for his sample of management accountants, regarding the training they had undergone to gain their qualification, which needs to assist in mitigating this particular bias. Despite the expectation in both studies that the sample's training would be adequate to decrease confirmation bias, this expectation was not met in either of the studies' results.

These results were anticipated, based on the literature review in the present study. The results reported in the present study support the findings of both Einhorn and Hogarth (1978) and Enslin (2019). In Einhorn and Hogarth's (1978, p. 400) study, only 21.7% of the professional statisticians in their sample requested the correct combination of evidence, similar to the 20.6% in the present sample. Enslin (2019, p. 215) reported even lower results,

as only 8.5% of his sample selected the appropriate minimum amount of evidence. The study by Enslin (2019) allowed participants to choose both confirming and disconfirming evidence and only when at least one piece of disconfirming evidence was selected could a participant be considered rational. Therefore, different results could be expected when comparing the present study's results to that of Enslin (2019), based on how Enslin (2019) structured the questions to his participants. This results that the proportion of Enslin's (2019) sample that displayed bias was considered to be 91.5% of the participants (those who chose only confirmatory evidence).

Einhorn and Hogarth (1978) also reported that 43.5% of their total population chose some form of disconfirming evidence, even though it was not the correct combination. This percentage was much lower, at 14.9%, in the study conducted by Enslin (2019, p. 215). In the present study, a total of 29.2% of the participants selected some form of disconfirming evidence (Options B and C, or A and D), as shown in Table 6.1.

The results of the statistical analyses to determine whether a significant portion of financial professionals were susceptible to confirmation bias are presented in Table 6.2. The table shows the 95% Wilson binomial confidence interval level.

Table 6.2: Test for significance – confirmation bias

	Wilson 95% binomial confidence interval if unbiased	Wilson 95% binomial confidence interval – actual proportion	Test for significance
Confirmation bias	Lower bound limit – 98.74%	Lower bound limit – 16.41%	($p < .01$)
	Proportion if no bias – 100%	Sample unbiased proportion – 20.6%	
		Upper bound limit – 25.52%	

Source: Own compilation

The 95% Wilson binomial confidence interval level of a 100% proportion of unbiased participants compared to a 95% Wilson binomial confidence interval level of the actual proportion shows that the actual responses of financial professionals differed statistically significantly from rationality ($p < .01$). This conclusion can be drawn, as there are no overlapping confidence intervals, which in terms of the guideline by Cumming and Finch (2005, p. 180) confirms the conclusion. This result indicates that a significant portion of financial professionals in the sample were susceptible to confirmation bias when they made

a financial decision. Therefore Hypothesis H_{1a} is supported. The results of the present study further confirm the results of prior studies in a tax environment (Wheeler & Arunachalam, 2008), an auditing environment (Cassell et al., 2022; Peterson & Wong-On-Wing, 2000) and an accounting environment (Perera et al., 2020). These studies were also conducted on confirmation bias.

Wheeler and Arunachalam (2008) found that tax practictioners were prone to supporting their tax opinions on bonus pay-out deductions only with tax cases that confirmed their tax position. In an auditing evironment, Peterson and Wong-On-Wing (2000) reported that auditors used a positive testing strategy when making an initial and intermediate hypothesis as to why profits had increased. Similarly, Cassell et al. (2022, p. 89) further found that confirmation bias was still present amongst a group of professional auditors even when stricter audit policies and regulations were introduced to mitigate this bias. Perera et al. (2020) found that accountants' judgements were biased towards the recognition and measurement principles of full International Financial Reporting Standards (IFRS) when they applied IFRS for SMEs. Their study proposed the use of appropriate decision aids, such as creating awareness of one's bias, to help mitigate confirmation bias in judgements. The studies mentioned above in this paragraph support the notion that individuals working in a finance environment are susceptible to confirmation bias originating from the representativeness heuristic.

Based on the finding that a significant proportion of finance professionals are susceptible to confirmation bias, it is included as one of the biases tested for Hypothesis 2.

6.2.2 Misconception of regression to the mean bias

Hypothesis H_{1b} states the following***:*** Financial professionals are susceptible to ***misconception of regression to the mean bias*** related to the representativeness heuristic when they make financial decisions.

Question 3 investigated misconception of regression to the mean bias, which also stems from the representativeness heuristic. This question was an expansion of an existing question used by both Lowies (2012) and Enslin (2019). Participants were given two scenarios, where they had to make a choice and select the scenario they preferred. Both options related to an investment that the participant needed to choose. Option A's investment had the characteristics of outperforming, on average, other investments in the

recent past, and was therefore priced slightly higher than the average asking price. Option B's investment performed slightly worse, on average, against other investments, and was therefore priced slightly lower than the average asking price.

The rational choice would be to choose Option B, as this investment would, on average, outperform the investment made in Option A, based on the phenomenon identified by De Bondt and Thaler (1985, p. 797), in their study, where the performance regresses back to the mean. This phenomenon describes the naturally occurring regression back to the mean of investments that deviated from the mean. Therefore, the investment in Option B would, most probably, outperform the investment in Option A as the investments regress back to the mean in terms of their performance, making Option B the rational choice.

Table 6.3: Selection comparison – misconception of regression to the mean bias

Bias variable	Option selected	Frequency (n) N = 301	Percentage (%)
Misconception of regression to the mean bias	Option A	189	62.8%
	Option B	112	**37.2%**

Source: Own compilation

Table 6.3 shows that 62.8% of the sample were prone to misconception of regression to the mean bias, and only 37.2% were rational. These results are similar to those of the studies by De Bondt and Thaler (1985) and Lowies (2012). De Bondt and Thaler (1985) suggested a higher than 50% base rate for this bias, a finding which was supported by Lowies (2012, p. 124), who found that 76.4% of listed property fund investment managers in South Africa were prone to misconception of regression to the mean bias. The findings of the present study support the results of De Bondt and Thaler (1985) and Lowies (2012), as more than 50% of the sample displayed this bias. The present study's figures are, however higher, than those of Enslin (2019, p. 216), who reported that 50% of his sample of management accountants were prone to the misconception of regression to the mean bias. Overall, the findings of the present study support the argument that financial professionals tend to emphasise recent past performance, in line with the theory of De Bondt and Thaler (1985).

The statistical analyses to determine whether a significant portion of financial professionals were susceptible to misconception of regression to the mean bias is presented in Table 6.4, using the 95% Wilson binomial confidence interval level.

Table 6.4: Test for significance – misconception of regression to the mean bias

	Wilson 95% binomial confidence interval, if unbiased	Wilson 95% binomial confidence interval – actual proportion	Test for significance
Misconception of regression to the mean bias	Lower bound limit – 98.74%	Lower bound limit – 31.94%	($p < .01$)
	Proportion if no bias – 100%	Sample unbiased proportion – 37.21%	
		Upper bound limit – 42.80%	

Source: Own compilation

A comparison of the 95% Wilson binomial confidence interval level of a 100% unbiased proportion to a 95% Wilson binomial confidence interval level of the actual proportion showed that the actual responses of financial professionals differed statistically significantly from rationality ($p < .01$). This conclusion can be drawn, as there are no overlapping confidence intervals, which, according to the guidance of Cumming and Finch (2005, p. 180), supports the conclusion. This result indicates that a significant portion of financial professionals in the sample were susceptible to misconception of regression to the mean bias when they made a financial decision. Therefore Hypothesis H_{1b} is supported.

The present study's results further support research studies conducted amongst a group of accounting professionals (Lucena et al., 2021) and individual investors (Baker et al., 2019) specifically on misconception of regression to the mean bias. Lucena et al. (2021, p. 193) found that accounting professionals and graduating accounting students were susceptible to misconception of regression to the mean bias. They provided their participants with general decision-making questions related to the respective bias, where the participants' susceptibility to the respective bias was established. Baker et al. (2019, p. 132) reported similar results amongst a sample of individual investors. They found that participants in their sample tended to extrapolate the performance of recent past investments they had purchased. The finding of the present study that financial professionals are susceptible to misconception of regression to the mean bias originating from the representativeness heuristic is thus in line with the findings of Lucena et al. (2021) and Baker et al. (2019).

Based on the finding that a significant proportion of finance professionals displayed misconception of regression to the mean bias, this bias was included as one of the biases to be tested for Hypothesis 2.

6.2.3 Conjunctive events bias

Hypothesis H_{1c} states the following: Financial professionals are susceptible to ***conjunctive events bias*** related to the anchoring and adjustment heuristic when they make financial decisions.

Question 4 tested conjunctive events bias, which stems from the anchoring and adjustment heuristic. This heuristic relates to whether financial professionals tend to anchor their thought process on an initial value and thereafter proceed to make overly conservative adjustments from the initial value. The question used in the present study was adopted from the study conducted by Joyce and Biddle (1981). Question 4 provided a scenario to the participants in which a company wanted to invest in another company based on the successful introduction of a new product. Five steps were needed for successful introduction of the new product. Information on each step was given to the participants, starting with the probability of the successful introduction of the first step, at 95%. Probabilities for Steps 2 to 5 were 90%, 80%, 90% and 90% respectively. Participants were required to make a final probability estimate of the successful introduction of the new product, based on the estimates given. A sliding scale from 0% to 100% was given to the participants, on which they could choose a percentage.

The correct response would have been 55.4% (0.95 x 0.9 x 0.8 x 0.9 x 0.9), where participants adjusted the probability estimate downward sufficiently, based on the new information presented. If participants anchored on the initial given value of 95% and made overly conservative downward adjustments, a percentage higher than 55.4% would be recorded. In the present study, a range between 50% to 60% was accepted as rational. This range was chosen to accommodate for rounding differences and slight error which could come into play when the participants used a sliding scale to select a percentage. If a participant chose a percentage above 60%, then their downward adjustment was too conservative, which meant they were prone to conjunctive events bias. If a participant chose a percentage below 50%, no specific bias could be assigned.

The responses of the participants are summarised in Table 6.5. The sample mean, not presented in Table 6.5, was 72.75 (M = 72.75%), with a standard deviation of 16.293 (SD = 16.29%), which is based on the raw data for how individuals selected their percentage response. For further analysis purposes, the responses from the participants were

categorised into ten categories, where Category 6 (50% to 60%) represented the correct range that a rational financial professional should have chosen.

Table 6.5: Selection comparison – conjunctive events bias

Categories	0-10% (1)	11-20% (2)	21-30% (3)	31-40% (4)	41-49% (5)	50-60% (6)	61-70% (7)	71-80% (8)	81-90% (9)	91-100% (10)
Number	2	0	2	2	3	79	33	67	96	17
Percentage	0.7%	0%	0.7%	0.7%	1%	**26.2%**	11%	22.3%	31.8%	5.6%

Source: Own compilation

The responses show that only 26.2% of participants made an appropriate adjustment from the anchor provided, whereas approximately 70.7% of participants made an overly conservative downward adjustment (they selected a percentage above 60%). This is supported by the high mean of 72.75%. Only 3% of the responses could not be assigned to any bias (they selected a percentage below 50%). This is similar to the results of Enslin (2019, p. 227), who reported that 4% of his sample opted for a percentage below 50%, where no bias could be assigned.

Overall, the results generated by the present study support those of Joyce and Biddle (1981), Enslin (2019) and Kang and Park (2019). Joyce and Biddle's (1981, p. 135) pioneering study revealed that 64.4% of their sample of professional auditors were subject to conjunctive events bias. In the study by Enslin (2019, p. 227), 71.6% of the sample of management accountants were susceptible to conjunctive events bias, whereas in Kang and Park's (2019, p. 393) study, the results were more in line with those of the original study by Joyce and Biddle (1981). Kang and Park (2019) indicated that 64% of their sample of banking employees overestimated the probability of the conjunctive event. The present study's findings of 70.7% are thus considered comparable to those of the reviewed research studies, as their findings were either similar (for example to Enslin's, 2019) or differed only slightly, being about seven percentage points lower than those of the present study.

Joyce and Biddle (1981) did call for caution in the interpretation of their results, given the level of independence between the steps in the scenario (Joyce & Biddle, 1981). Therefore, one can expect slightly higher probabilities, if the statistically correct response is regarded as the minimum. As in the research conducted by Enslin (2019, p. 227), the same view is

adopted in the present study that the steps in the scenario are relatively independent, and no interdependence was noted.

The statistical analyses to determine whether a significant portion of the participating financial professionals were susceptible to conjunctive events bias are presented in Table 6.6. These results were generated based on the ten-category grouping presented in Table 6.5, where Category 6 represented the rational response category.

Table 6.6: Test for significance – conjunctive events bias

	Mean (M)	Std. deviation (SD)	t	Df	Bootstrapped significance
Conjunctive events bias	7.64	1.540	29.760	300	$p < .001$

Source: Own compilation

Table 6.6 indicates that the one-sample t-test results show that this sample of financial professionals was too conservative in the downward adjustment from the anchor (M = 7.64, SD = 1.540). The choice made by the financial professionals in the present study differed statistically significantly from Category 6 ($t(300) = 29.760$, $p < .001$). The present study therefore notes that financial professionals are prone to conjunctive events bias, which stems from the anchoring and adjustment heuristic, providing support for Hypothesis H_{1c}.

Previous studies have also shown the susceptibility of decision-makers in a finance environment to other biases stemming from the anchoring and adjustment heuristic, albeit not the same bias tested in the present study. Kudryavtsev and Cohen (2010, p. 164) found that MBA graduates were more susceptible to biases stemming from the anchoring and adjustment heuristic when they were faced with difficult questions than when faced with easy questions. Cen et al. (2013, p. 73) found that for a sample of market analysts the anchoring heuristic was present, where analysts made earnings forecasts on companies anchored on the industry norm. For a sample of listed property fund investment managers, Lowies et al. (2016, p. 59) found that 84.6% of the participants displayed conservatism bias. More recently, Henrizi et al. (2021) found results that supported anchoring bias. Henrizi et al. (2021) used a question from Joyce and Biddle (1981) which related to an audit risk assessment made on a client's internal control environment. Their study was conducted on a sample of auditors and used a control and experimental group to test biases stemming from the anchoring and adjustment heuristic. They reported statistically significant differences, based on the judgements made and ratings given by both groups regarding the

client's control environment. The studies of Kudryavtsev and Cohen (2010), Cen et al. (2013) and Henrizi et al. (2021) support the argument that people working in a finance environment are susceptible to biases originating from the anchoring and adjustment heuristic.

Based on the finding that a significant proportion of finance professionals were biased by conjunctive events bias, it was included as one of the biases to be tested for Hypothesis 2.

6.3 RESULTS FOR OVERCONFIDENCE BIAS

The present study investigated the presence of overconfidence bias in financial professionals. Hypothesis H_{1d} stated the following: financial professionals are susceptible to bias related to *overconfidence* when they make financial decisions.

All the overconfidence questions used in the present study refer to the financial professional's own abilities, as compared to those of other financial professionals. Therefore, the present study specifically focused on the overplacement aspect of overconfidence, as identified by Moore and Healy (2008, p. 502). Prior research studies conducted on overconfidence bias did not necessarily distinguish between the different overconfidence classifications, and therefore some references to prior research results do not refer specifically to overplacement.

The present study employed three questions to test for the presence of overconfidence bias, namely *Questions 5, 6 and 7*. The questions address two sides of overconfidence: overplacement in general terms, and overplacement in an unfamiliar context. *Question 5* was initially developed by Gort (2009). Thereafter it was adapted and adopted by studies such as those of Lowies (2012) and Enslin (2022), who used it amongst a sample of property fund investment managers and management accountants respectively.

Question 5 related to general overplacement, where the participants had to choose, based on a sliding scale of 0% to 100%, how confident they were in their general financial decision-making ability, compared to other financial professionals. Table 6.7 displays the selection comparison made by participants for Question 5, which measured general overplacement.

Table 6.7: Selection comparison – General overconfidence bias

Category	0-10% (1)	11-20% (2)	21-30% (3)	31-40% (4)	41-49% (5)	50% (6)	51-60% (7)	61-70% (8)	71-80% (9)	81-90% (10)	91-100% (11)
Question 5											
Number	0	1	3	11	3	**33**	25	68	86	44	27
Percentage	0%	0.3%	1%	3.7%	1%	**11%**	8.3%	22.6%	28.6%	14.6%	8.9%

Source: Own compilation

The responses from participants were categorised into 11 categories. The mean confidence of the sample, not presented in Table 6.7, was 70.75%, and the median was 71%.

The literature has supported the view that a rational population should not overplace itself (Benoît & Dubra, 2011, p. 1605). A rational population should display both high placement and low placement, and therefore in any population there should be individuals that are in fact better than others regarding their ability. The contrary should also be true, namely that there are individuals who have below-average abilities. Question 5 can therefore not provide an indication of overconfidence *per individual*. Question 5 can only indicate whether the whole sample is balanced (averages (mean) to 50%), or whether there seems to be an overall tendency to overplace or underplace (if the sample does not average to 50%).

Based on the mean of 70.75%, which exceeds the 50% expectation, the findings of the present study suggest that the sample has a systematic tendency to overplace themselves when comparing their own ability to that of others. The proportion of participants who rated their own decision-making abilities higher than the average (50%) was 83% (250 participants), compared to only 11% (33 participants) who rated themselves as average when comparing their abilities to others. The proportion of participants who rated their own decision-making ability higher than the mean confidence of 70.7% for this sample was 52.2% (157 participants). The 52.2% was skewed toward higher placement, when compared to the normal distribution, which suggests overplacement in the sample.

The studies from which this question was adopted and adapted all used Likert scales. In order to compare the results of the present study to these studies, the Likert ratings were converted to percentages. Gort (2009) used a 7-point Likert scale and reported a mean level of 4.57 (65%) on a sample of pension fund managers. Lowies (2012) used a 5-point Likert

scale, similar to that of Enslin (2022). The results revealed 58.8% of the sample of property fund investment managers (Lowies, 2012) and 52.1% of management accountants (Enslin, 2022) rated themselves as above the average. The overarching trend from the present study's, as well as those in the literature, is that individuals tend to overplace themselves when they compare their own abilities against those of other individuals with similar backgrounds. However, the bias noted in the present study's results is higher than that in other studies conducted on participants that form part of the larger finance environment, as discussed above.

The statistical analyses to determine whether a significant portion of financial professionals were susceptible to overplacement in respect of their general ability compared to that of other financial professionals is presented in Table 6.8. A mean response of 50% for the sample would support the null hypothesis for statistical analysis purposes, as the present study aims to determine whether the average placement of the group differs significantly from 50%. Similar to the studies of both Gort (2009) and Enslin (2022), a one-sample t-test, bootstrapped to ensure robustness, was conducted.

Table 6.8: One-sample t-test – general overconfidence bias

Overconfidence bias	Mean (M)	Std. deviation (SD)	t	Df	Bootstrapped significance
Average (50%)	70.75	15.224	23.645	300	$p < .001$

Source: Own compilation

The sample mean of 70.75% was above the average (50%), together with a large standard deviation of 15.224, which indicates that large variance is present in the confidence placement level of participants. The one-sample t-test results also confirmed that the choices made by financial professionals (M = 70.75, SD = 15.224) differed statistically significantly from 50% ($t(300) = 23.645$, $p < .001$).

A second t-test was performed, based on criticism by Norman (2010), who argued that it is more appropriate to use a statistical test that compares medians, rather than means. Accordingly, the present study performed a one-sample Wilcoxon signed-rank test to address this critique, similar to studies such as those by Benoît and Dubra (2011, p. 315); Enslin (2022, p. 834), and Merkle and Weber (2011, p. 263).

Table 6.9: One-sample Wilcoxon signed-rank test – general overconfidence bias

Overconfidence bias	Expected median	Observed median	z	Significance
Sample median	50	71	13.468	$p < .001$

Source: Own compilation

The results of the one-sample Wilcoxon signed-rank test for these data reveal that when participants judged their decision-making abilities in comparison to those of other financial professionals, the observed median placement (71%) by participants was statistically significantly higher ($z = 13.468$, $p < .001$) than the expected median (50%). Enslin (2022) reported similar results; he found that the observed median of 4 (on a 5-point Likert scale) for the management accountants used in his sample was significantly higher than the expected median of 3, which in his sample indicated average ability. The results generated by the one-sample t-test and the one-sample Wilcoxon signed-rank test, confirmed the presence of overplacement in the present sample of financial professionals and therefore H_{1d} is supported.

In respect of the design of Question 5, two key areas of criticism arise from the literature. Firstly, comparing the observed *mean* responses to the expected *mean* responses or the observed *median* response to the expected *median* responses provides only the placement made by the entire group. These measures do not truly consider whether individuals in the sample are in fact better than the average (Benoît et al., 2015; Moore & Schatz, 2017). Secondly, referring to general abilities to measure the "better-than-average effect" may be unreliable, as individuals tend to think of themselves as better than the average when they refer to their general abilities (Benoît & Dubra, 2011; Moore & Healy, 2008). In the present study, the sample may include more above average decision-makers, so this question cannot be an absolute measure for overconfidence.

Questions 6 and 7 were included in the present study to address the concerns raised in the literature in two ways. Firstly, by measuring individuals' overplacement against their actual performance, the true confidence placement of each individual can be assessed. Secondly, by including tasks in an unfamiliar context, the present study deviates from comparing oneself on general ability only, as was done in prior research studies.

Questions 6 and 7 provided the participants with a general knowledge quiz, which was adopted from the study of Benoît et al. (2015). This quiz is regarded as easy but relates to a decision-making domain that may not be that familiar. A familiar decision-making domain

brings more information to participants, which makes it easier for them to determine their performance (Moore & Healy, 2008, p. 507), similar to what was expected from participants in Question 5. Questions 6 and 7 differ from Question 5 in that the participants need to place themselves in an unfamiliar context, compared to a familiar context as provided in Question 5. Therefore, although the general knowledge quiz is seen as easy, the fact that it is in an unfamiliar context means that it can be regarded as more difficult when participants compared themselves to their own's general ability, as in Question 5.

Before the participants started the quiz, they had to choose how confident they were that their score on the general knowledge quiz would be better than that of other financial professionals who were also taking the quiz (Question 6). To aid in this determination, two example questions were provided to assist participants in assessing the quiz's level of difficulty, and their potential performance relative to that of other financial professionals. The quiz itself consisted of ten general knowledge questions (Questions 7.1 to 7.10 in Section 3 of the questionnaire). Following the quiz, Question 7.11 prompted participants to reassess their confidence in their outperforming other financial professionals who had also taken the quiz. Table 6.10 provides the descriptive statistics for Questions 6 and 7.

Table 6.10: Descriptive statistics – overconfidence bias in an unfamiliar context

Overconfidence bias	Mean (M)	Median (m)	Std. deviation (SD)
Question 6	66.28	70	13.22
Question 7.11	62.26	61	16.29

Source: Own compilation

The descriptive statistics reported a clear decrease in the mean from Question 6 (66.28%) to Question 7.11 (62.26%), revealing a decrease in overplacement in the sample. The means reported in Table 6.10 were lower than the reported mean of 70.75% in Question 5. When the medians were investigated, a clear decrease from 71% in Question 5 to 70% in Question 6 and 61% in Question 7.11 was noted, further confirming a decrease in overplacement in the group of participants.

Table 6.11 provides a breakdown of the selection made by the participants in the present sample for both Questions 6 and 7, which provides further insight into the placement made by individuals. The responses from participants were categorised into 11 categories for presentation purposes only, as for Question 5.

Table 6.11: Selection comparison – overconfidence bias in an unfamiliar context

Category	0-10% (1)	11-20% (2)	21-30% (3)	31-40% (4)	41-49% (5)	50% (6)	51-60% (7)	61-70% (8)	71-80% (9)	81-90% (10)	91-100% (11)
Question 6 – Before quiz											
Number	0	0	1	7	4	54	51	72	76	28	7
Percentage	0%	0%	0%	2%	1%	18%	17%	24%	26%	10%	2%
Question 7 – After quiz											
Number	0	3	8	18	17	60	40	69	48	27	11
Percentage	0%	1%	3%	6%	5%	20%	13%	23%	16%	9%	4%

Source: Own compilation

The percentages displayed in Table 6.11 are also illustrated in Figure 6.1.

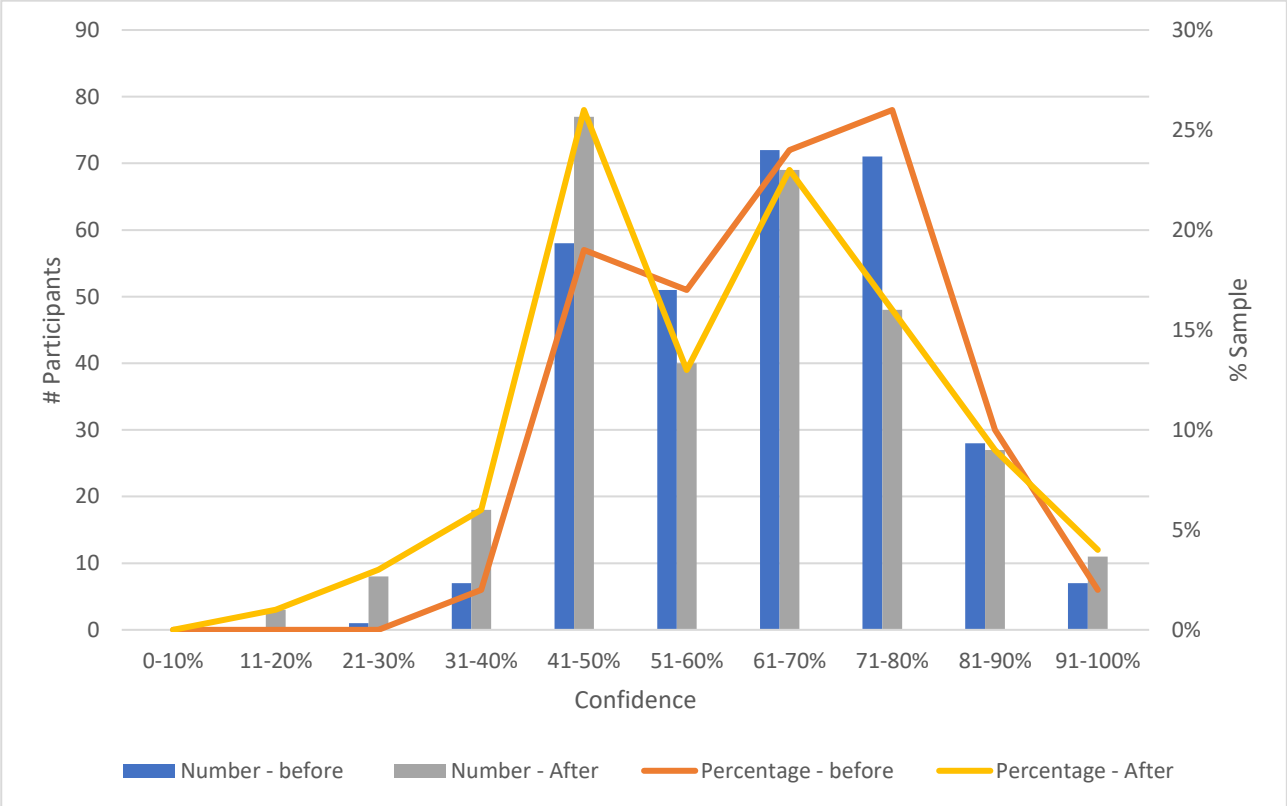


Figure 6.1: Breakdown – overconfidence in an unfamiliar context

Source: Own compilation

Question 6 relates to the placement made by participants before the general knowledge quiz was taken. The responses reveal that 79% (235 participants) were confident that their score on the general knowledge quiz would be higher than the average (50%), compared to the

score of other financial professionals participating in the present study. When Question 6 is compared to Question 5, the sample's overplacement was much lower than the 83% (250 participants) recorded for Question 5. These findings suggest lower confidence levels from the group of financial professionals when they compared their general abilities in a familiar context (the financial environment) to their abilities in the easy general knowledge quiz. For the participants who placed themselves at 50% (average), Question 6 revealed that 18% (54 participants) placed themselves at the average, in contrast to 11% (33 participants) for Question 5. For Question 7.11, the confidence levels of the sample of financial professionals decreased even more after the general knowledge quiz was taken. Findings reveal lower confidence levels for the group, as only 65% (195 participants) were confident that their score on the general knowledge quiz were higher than the average (50%). Similarly, among participants who placed themselves at 50% (average), Question 7.11 revealed a bigger percentage in this category with 20% (60 participants) of the group placing themselves at 50% (average). Moore and Healy (2008, p. 508) argue that people tend to overestimate others' performance on difficult tasks, resulting in underplacement of their own abilities. The quiz adopted in the present study, although it was easy, was conducted in an unfamiliar context. Although the overall placement of the group was high, a decrease in the group's overplacement compared to Question 5 (83%) was still evident. The unfamiliar context of the quiz appears to have made this placement decision more difficult than in Question 5, where participants had to compare themselves to their own general ability in a familiar context. Notwithstanding, the overall results still reveal overplacement in the group for Questions 6 and 7 and therefore supports the findings of Moore and Healy (2008, p. 506), who argued, based on the findings, that people tend to overplace themselves on easy quizzes.

When the results for Questions 6 and 7 are considered, one remaining concern is that neither question considers whether those who placed themselves high (above average) or who placed themselves low (or below average) might be correct in terms of how they performed on the quiz. Moore and Schatz (2017) suggest comparing the placements of participants with their actual performance on the task performed, as participants that overplaced themselves may outperform the other participants, or vice versa. Table 6.12 sets out the actual performance of the financial professionals in the present sample, whose scores ranged between 30% to 100%, with an average score of 80%. To be able to determine whether the participants placed themselves too high or too low regarding their

actual performance-based placement on the general knowledge quiz, a comparison was done between their estimated placement before and after the quiz, compared to where their actual score placed them on the quiz.

Table 6.12: Actual performance on the general knowledge quiz

Actual performance	Number scoring in category (n)	Percentage scoring in category	Cumulative percentage of sample	Category
30%	1	0%	0%	**1**
40%	2	1%	1%	
50%	9	3%	4%	
60%	23	8%	12%	
70%	48	16%	28%	**2**
80%	76	25%	53%	**3**
90%	86	29%	81%	**4**
100%	56	19%	**100%**	**5**
Grand total	**301**	**100%**		

Source: Own compilation

In the last column of Table 6.12, the actual performance per category level (30% to 100%) was categorised to enable better interpretation of the actual performance compared to where participants placed themselves. In the present sample, participants who scored 30% to 60% were grouped together, because of the low number of participants falling into these categories, with the rest of the participants in their own category.

For each participant's classification as underplaced, rational or overplaced, the placements were determined by comparing the pre- and post-quiz placements with the actual performance among financial professionals in the sample on the general knowledge quiz. The way each category's placements was coded is summarised in Appendix 2. Table 6.13 displays a summary of the findings for Questions 6 and 7 after the coding was completed.

Table 6.13: Overconfidence coding – Questions 6 and 7

Category	Question 6	Question 7
Underplacement	70 (23%)	72 (24%)
Rational	76 (25%)	84 (28%)
Overplacement	155 (52%)	145 (48%)
Total (n)	**301**	**301**

Source: Own compilation

The findings in Table 6.13 present the placement of individuals both before and after the quiz. The participants still overplaced themselves, with 52% of participants overplacing themselves before the quiz compared to 48% of participants overplacing themselves after the quiz. The general knowledge quiz in the present study was easy, as was evident from the 80% average score achieved by the group. The fact that the quiz was easy supports the overall high percentage of individuals that overplaced themselves (Moore & Healy, 2008, p. 506).

The decrease in overplacement between Questions 6 and 7 was inspected further to determine the reason behind the lower percentage of overplacement (on an individual level more participants underplaced themselves in Question 7.11 than in Question 6). Pulford and Colman (1997) argue that the presence of more social pressure may reduce confidence during more difficult tasks, so that individuals can preserve their dignity in the event of failure. Moore and Schatz (2017) also argue that individuals tend to underplace themselves in situations where they are uncertain about their performance. In the present study, more certainty was obtained by participants regarding the questions asked after the quiz was completed. However, some uncertainty may still arise in respect of their performance (Moore & Schatz, 2017), given that the participants' scores on the quiz remained undisclosed. After the quiz was completed, participants were able to assess its true difficulty, potentially leading to uncertainty regarding their placement in the sample. The findings from the present study suggest that the consequence of this uncertainty caused participants to place themselves lower than in Question 6, but the end result still revealed overplacement amongst financial professionals.

Overall, most of the participants in the present study still overplaced themselves on both Questions 6 and 7 and therefore H_{1d} is supported. This result supports the findings of Burks et al. (2013) and Benoît et al. (2015) that individuals tend to overplace themselves on easy quizzes. In summary, based on the findings from Question 5, the average placement suggests that the sample collectively judged themselves to be above average. Additionally, based on findings from Questions 6 and 7, financial professionals are prone to overplacement if asked to compare their abilities against those of others in an easy, unfamiliar task. Therefore, as the findings indicate, substantial deviation from rationality in the form of overconfidence occurs, and therefore overconfidence was included as one of the biases to be tested for Hypothesis 2.

In summary, based on the findings from Question 5, the average placement suggests that the sample collectively seem to judge themselves as above average. Additionally, based on the findings from Questions 6 and 7, financial professionals are prone to overplacement when they are asked to compare their abilities against those of others in an easy unfamiliar task. Therefore, because the findings indicated substantial deviation from rationality, overconfidence was included as one of the biases to be tested for Hypothesis 2.

6.4 RESULTS FOR AFFECT BIAS

The final questionnaire question investigated possible susceptibility by financial professionals to affect bias when they make financial decisions. Hypothesis H_{1e} stated the following: Financial professionals are susceptible to bias related to the use of *affect (emotion)* when they make financial decisions.

Question 8 was originally developed by Kida et al. (2001). The adapted version used by Enslin (2019) was used in the present study. Participants were given a short scenario in which two investment options were presented. Option A related to an investment with a possible return of R5 500 000 (55% probability), or R4 500 000 (45% probability). By contrast, Option B related to an investment with a possible return of R5 500 000 (45% probability), or R4 500 000 (55% probability). For both investments, participants were instructed that they might be collaborating with a manager of another division for whom they had previously worked, although this was not guaranteed. Specific triggers were included to evoke negative affect reactions towards the manager that they needed to work with for Option A, whereas for Option B, neutral to slightly positive affect was evoked. Based on the information on the two options, Option A was the superior option, as the expected return value of R5 050 000 exceeded the expected return of R4 950 000 for Option B. The inclusion of the negative affect trigger could, however, persuade participants to choose Option B. Table 6.14 shows the option selection comparison between Option A and Option B.

Table 6.14: Selection comparison – affect bias

Bias variable	Categories	Frequency (n) N = 301	Percentage (%)
Affect bias	Option A	166	**55.1%**
	Option B	135	44.9%

Source: Own compilation

From the results displayed in Table 6.14, more than half of the participants (55.1%) were not susceptible to affect bias, as they chose Option A. These results were much lower than those in the study by Kida et al. (2001, p. 488), who found that 77.8% of the business managers in their sample were susceptible to affect bias. Kida et al. (2001) used a sample which included various participants with business experience, ranging from project and production managers to chief operation officers. Their sample displayed much higher susceptibility to affect bias than the present sample. In the studies of both Enslin (2019) and Fehrenbacher et al. (2020), the results revealed similar susceptibility to affect bias as in the present sample. Enslin (2019, p. 229) elicited only negative affect in his study, similar to the present study, and found that only 38.4% of the management accountants in his sample were susceptible to affect bias. Fehrenbacher et al. (2020, p. 8) reported results for when both positive and negative affect was elicited. Their results revealed that 58% of the group were prone to affect bias when positive affect was elicited, compared to only 45% when negative affect was elicited (Fehrenbacher et al., 2020, p. 9). The results of the present study are therefore in line with those of Enslin (2019) and Fehrenbacher et al. (2020). In the context of the results from the present study, financial professional are individuals qualified or gaining experience to be qualified by a professional body, with some similarities to that the management accounting professionals used in the study conducted by Enslin (2019) and Fehrenbacher et al. (2020).

The statistical analyses to determine whether a significant portion of financial professionals were susceptible to affect bias are presented in Table 6.15, using the 95% Wilson binomial confidence interval level.

Table 6.15: Test for significance – affect bias

	Wilson 95% binomial confidence interval, if unbiased – Options	Wilson 95% binomial confidence interval – actual proportion of options	Test for significance
Affect bias	Lower bound limit – 98.74%	Lower bound limit – 49.50%	($p < .01$)
	Proportion if no bias – 100%	Sample unbiased proportion – 55.15%	
		Upper bound limit – 60.67%	

Source: Own compilation

The comparison of the 95% Wilson binomial confidence interval level of a proportion of 100% unbiased participants, compared to a 95% Wilson binomial confidence interval level of the actual proportion, shows that the actual responses of the financial professionals differed statistically significantly from rationality ($p < .01$). This conclusion can be drawn, as there were no overlapping confidence intervals, which, in terms of the guidance provided by Cumming and Finch (2005, p. 180), supports the conclusion made. This result shows that a significant portion of financial professionals in the sample were susceptible to affect bias when they make a financial decision. The finding supports Hypothesis H_{1e}.

The results of significance obtained in the present study further support the studies conducted amongst a sample of fund managers (Moreno et al., 2002) and one of professional auditors (Bhattacharjee & Moreno, 2002; Bhattacharjee et al., 2012). Moreno et al. (2002) found that for negative affect and decision-making scenarios in their study posing a loss alternative, more than half of their participants were prone to affect bias, choosing the loss alternative. For the three scenarios included in their study that dealt with a loss alternative, the portions of fund managers prone to affect bias were 64%, 71% and 93% of their sample respectively. They concluded that fund managers chose the investment with the lower economic value when negative affect reactions were present, leading to suboptimal decision-making (Moreno et al., 2002, p. 1342). Bhattacharjee and Moreno (2002, p. 371) reported that less experienced auditors who received the negative information provided a higher risk assessment than the auditors who received no information. Bhattacharjee et al. (2012, pp. 1094-1095) confirmed these results with their finding that the level of competence perceived in the client's management evoked either positive, negative, or neutral affect toward the client's management. Their results suggested that higher inventory obsolescence ratings were awarded in a scenario where auditors perceived a negative affect from management as indicative of lower competence. The studies cited in this paragraph support the claim that people working in a finance environment are susceptible to affect bias.

Given that a significant proportion of finance professionals in the present study were prone to affect bias, it was included as one of the biases to be tested for Hypothesis 2.

6.5 SUMMARY

The possible presence of heuristic-related and other biases in the financial decision-making behaviour of financial professionals was investigated in Chapter 6. The main findings relating to Hypothesis 1 and its related sub-hypotheses are summarised in the following paragraphs. Table 6.16 summarises these findings.

Table 6.16 presents the specific findings for Sections 6.2 to 6.4. At the start of Chapter 6, it was indicated that it was anticipated that the population of financial professionals used in the present study were expected to be prone to bias in financial decision-making, based on the literature review. The finance professionals in the present sample displayed all five heuristic-related and other biases tested in Hypothesis 1. The results of the present study were also compared to the results for other professional populations on which similar studies have been conducted. It should be noted that the literature includes studies conducted on auditors, management accountants, fund managers, etc. However, the present study's population was not as restricted as that of other studies, consisting of a combined group of financial professionals, which can include any of the populations used in the prior studies.

Lower levels of confirmation bias were found, as the participating financial professionals displayed lower levels of bias than prior samples restricted to auditors and management accountants. For misconception of regression to the mean bias, the present study's sample displayed lower levels of bias than a sample of fund managers, but higher levels than a sample of management accountants. Regarding conjunctive events bias, the present sample of financial professionals had similar levels of this bias to management accountants, and only slightly higher levels than auditors and banking employees. For general overplacement, the present study reported results higher than those for property fund investment managers and management accountants. For overplacement within an unfamiliar context, a decrease in overplacement was revealed, although the sample as a whole still displayed overplacement. This finding held true when participants' placements before and after the quiz were compared with their actual performance on the quiz. Finally, for affect bias, results indicated similar levels of bias to those of management accountants, and lower levels of bias to fund managers and business managers.

Even though the population targeted in the present study has a professional certification from a professional body such as the International Auditing and Assurance Standards Board (IAASB) and/ or the Association of Chartered Certified Accountants (ACCA), bias in financial

decision-making was still evident. An interesting finding is that for conjunctive events bias and affect bias, the percentage of the sample prone to these biases was similar to that for management accountants. Exactly the same survey question was used for conjunctive events bias (Enslin, 2019) and affect bias (Enslin, 2019; Fehrenbacher et al., 2020) in both prior studies. These results are supported by the fact that most management accountants also have a professional certification and similar experience to that of the financial professionals in the present sample.

Table 6.16: Summary of findings – Hypothesis 1

Section and bias	Hypothesis number	Proportion of biased respondents	Significance of portion	Comparison of portion to previous studies
Section 6.2.1 *Confirmation bias*	Hypothesis H_{1a}	57.5%	Significant	Lower than other professional populations: • Statisticians: 78.3% (Einhorn & Hogarth, 1978) • Management accountants: 91.5% (Enslin, 2019)
Section 6.2.2 *Misconception of regression to the mean bias*	Hypothesis H_{1b}	62.8%	Significant	Lower than other professional populations: • Property fund investment managers: 76.4% (Lowies, 2012) Higher than other professional populations: • Management accountants: 50% (Enslin, 2019)
Section 6.2.3 *Conjunctive events bias*	Hypothesis H_{1c}	70.7%	Significant	Similar to other professional populations: • Management accountants: 71.6% (Enslin, 2019) Higher than other professional populations: • Banking employees: 64% (Kang & Park, 2019) • Auditors: 64.4% (Joyce & Biddle, 1981)
Section 6.3 *Overconfidence bias*	Hypothesis H_{1d}	General context 83% (overplacement)	Significant	Higher than other professional populations: • Property fund investment managers: 58.8% (Lowies, 2012), 65% (Gort, 2009) • Management accountants: 52.1% (Enslin, 2019)
Section 6.3 *Overconfidence bias*	Hypothesis H_{1d}	Unfamiliar easy context (overplacement) • Before quiz: 78% • After quiz: 65% Conjunctive bias with actual performance (overplacement) • Before quiz: 52% • After quiz: 44%	Significant	Supporting results found compared to overplacement trend in an easy, unfamiliar context: • General public (Benoît et al., 2015) • Truck drivers (Burks et al., 2013) • University students (Moore & Healy, 2008)
Section 6.4 *Affect bias*	Hypothesis H_{1e}	44.9%	Significant	Similar to other professional populations:

				• Management accountants: 45% (Fehrenbacher et al., 2020), 38.4% (Enslin, 2019), Lower than other professional populations: • Business managers: 77.8% (Kida et al., 2001) • Fund managers: between 64%, 71% to 93% (Moreno et al., 2002)

Source: Own compilation

CHAPTER 7:
RESEARCH FINDINGS (PART 3) – PROFESSIONAL SCEPTICISM AND BIAS IN FINANCIAL DECISION-MAKING

7.1 INTRODUCTION

The second research question of the present study is addressed in Chapter 7. This research question relates to *determining the relationship between the trait of professional scepticism and the identified heuristics-related and other biases in the financial decision-making behaviour of financial professionals.* The results reported in Chapter 6 were in line with the results anticipated on the basis of the literature review. The results in the present study revealed that financial professionals were prone to the five identified heuristic-related and other biases tested. These biases were confirmation bias, misconception of regression to the mean bias, conjunctive events bias, overconfidence bias and affect bias. These results were an important finding, as Research Question 2 aims to establish whether professional scepticism as a trait has a relationship with these identified biases.

A structural equation modelling (SEM) statistical approach was adopted in the present study to address Research Question 2 and the supporting hypotheses, namely Hypotheses 2 to 6. This advanced statistical technique was adopted because of the presence of latent variables such as professional scepticism as a trait and personality traits, which are an integral part of the theories underpinning the hypotheses. Testing of the measurement model, also referred to as confirmatory factor analyses (CFA) testing, was conducted in Chapter 5, where each of these latent variables was tested to confirm the relationship of the observed variables to their respective latent variables. The results for the measurement model for professional scepticism as a trait indicated that all 30 observed variables included in the six constructs met the required model fit, reliability criteria and validity criteria. All 30 items were therefore retained for use in the SEM. However, the results for the measurement model and subsequent exploratory factor analysis (EFA) of the personality traits revealed that only two of the five personality traits, namely extraversion and neuroticism, met the required reliability and validity criteria.

The remainder of this chapter addresses three key areas. Firstly, Section 7.2 addresses whether a higher order model (second order model) is applicable to the professional

scepticism as a trait construct in the present study. Secondly, Section 7.3 outlines how the data were compiled and bias categories were created. Section 7.4 discusses the results of the goodness-of-fit testing performed on the respective SEM statistical models used to test Hypotheses 2 to 6. Finally, Sections 7.5 to 7.6 report the SEM results generated for Hypotheses 2 to 6 for each of the respective biases tested in the present study.

7.2 HIGHER ORDER FACTOR STRUCTURE

Based on the theoretical foundation and layout of how the trait of professional scepticism as a latent variable and its six related constructs were measured, the present study tested whether a higher order model, also referred to as a second order model, was applicable. Figure 7.1 displays a first order model with 15 unique covariances between six latent factors, namely questioning mind (QM), suspension of judgement (SOJ), search for knowledge (SFK), interpersonal understanding (IU), self-determining (SD) and self-confidence (SC).

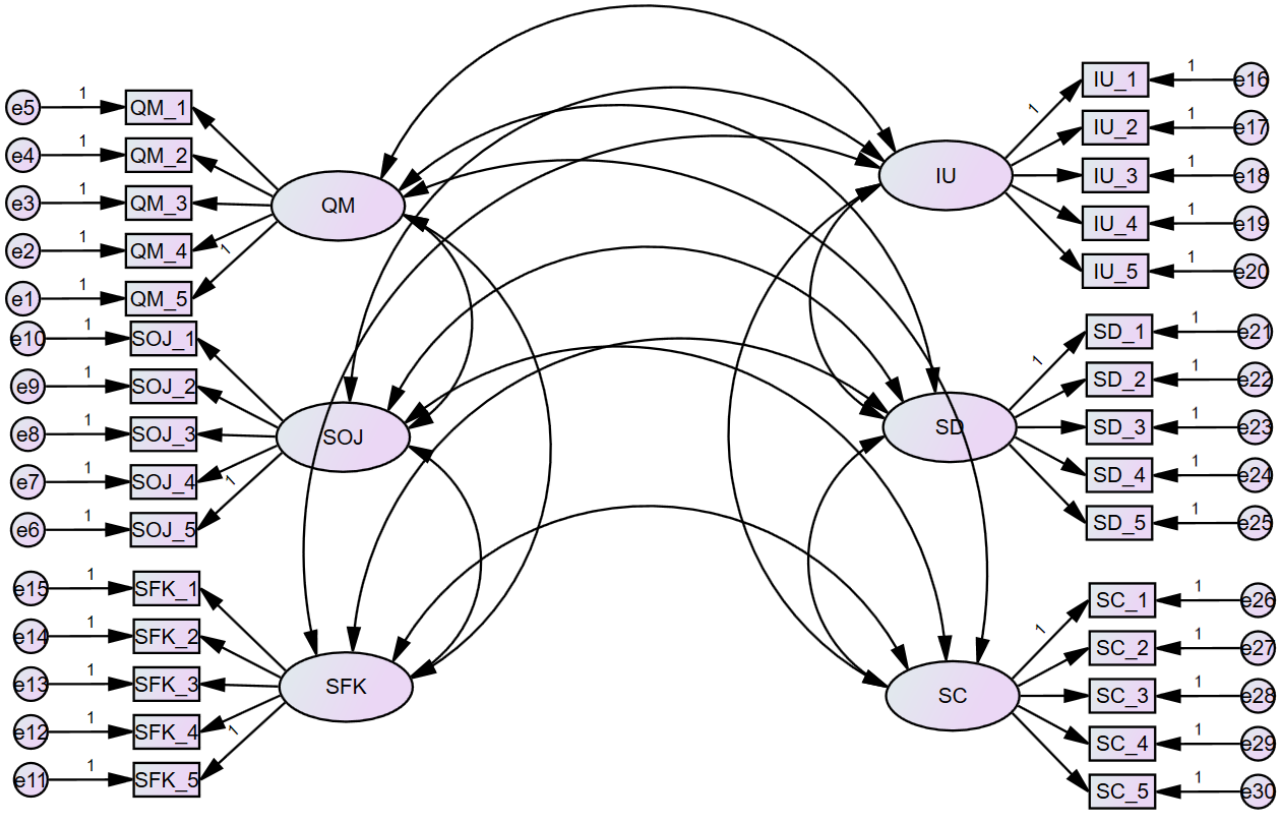


Figure 7.1: First order model

Source: Own compilation

Figure 7.2 shows the second order model that indicates the relationship of the six individual sub-constructs with the second order professional scepticism (PS) construct. In a second order model, the first order factors act as indicators of the second order model (Hair et al., 2009, p. 740).

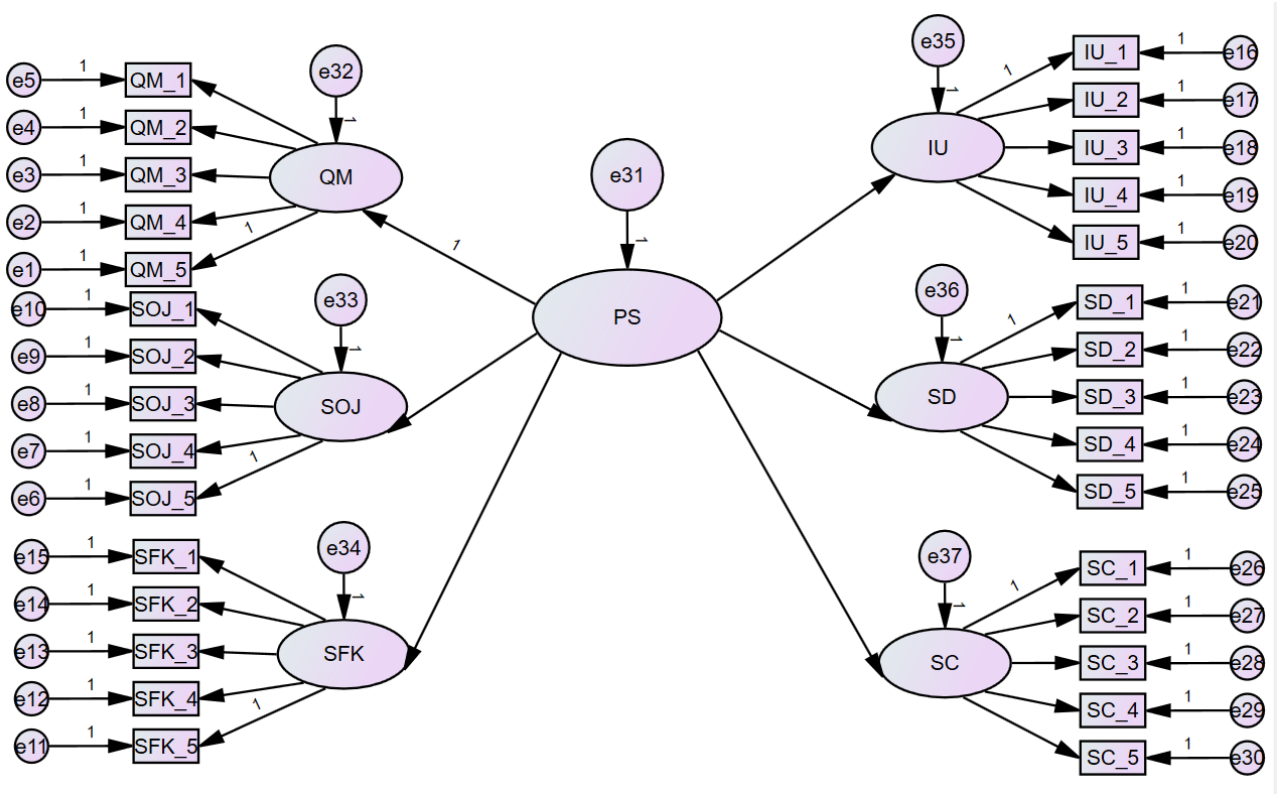


Figure 7.2: Second order model

Source: Own compilation

Before SEM testing is conducted, two areas of consideration are suggested by the literature to support the use of higher order models (Hair et al., 2009, p. 743). This guidance is stipulated in Section 4.6.4.

Firstly, a target coefficient ratio needs to be calculated to determine whether the second order model provides a good explanation for the correlations between the first order constructs. If the target coefficient ratio is above 0.9, it suggests that the second order model provides a good explanation for the correlations between the first order constructs (Hong & Thong, 2013). The target coefficient CMIN (x^2) ratio of 93.6% (661.3/706.0 as stipulated in Table 7.1) was determined. This met the required threshold of 0.9. Therefore, a second order measurement model could be conducted for the professional scepticism construct.

Table 7.1: Second order measurement model – professional scepticism as a trait

Model	CMIN (x^2)
Model (second order)	706.0
Model (first order)	661.3

Source: Own compilation

Secondly, the second order model needs to exhibit model fit according to the set of fit indices considered in the present study. The first order model fit indices have been reported in Section 5.4.1. Next, Table 7.2 reports the results of the second order model fit indices, together with the first order model fit indices to show the model fit.

Table 7.2: Model fit indices – first and second order models

Model	CMIN/DF	RMSEA	CFI	IFI	SRMR
First order model	**1.709**	**0.049**	**0.931**	**0.932**	**0.062**
Second order model	**1.770**	**0.050**	**0.923**	**0.923**	**0.073**
Good fit	Lower than 3	Less and equal to 0.05	Above 0.95	Above 0.95	Less and equal to 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	

Source: Own compilation

As the results presented in the table demonstrate, the model fit statistics for the second order model indicate good fit indices with CMIN/DF (1.770) below 3, RMSEA (0.050) equals 0.05 and SRMR (0.073) less than 0.08, as well as acceptable fit for CFI (0.923) and IFI (0.923) between 0.90 and 0.95.

Table 7.3 further confirms why a second order model representation is valid in the present study. The standardised regression weights that each construct contributes to professional scepticism as a trait are displayed in Table 7.3. The questioning mind construct (0.906) contributes the most towards professional scepticism as a trait, whereas the self-confidence construct (0.284) contributes the least towards professional scepticism as a trait. Although not all six constructs contribute equally towards professional scepticism as a trait as a whole, all the constructs do contribute to professional scepticism as a trait, which supports the validity of using a second order model.

Table 7.3: Standardised regression weights – second order model

Constructs	Estimate
PS <—QM	0.906
PS <—SOJ	0.316
PS <—SFK	0.628
PS <—IU	0.577
PS <—SD	0.695
PS <—SC	0.284

Source: Own compilation

Based on the results reported in the paragraphs above, the present study meets the requirement to conduct both first order model and second order model testing. A separate SEM model was generated for each bias, for both first order models and second order models. Table 7.4 sets out the final summary of the conceptual SEM models which were conducted in the present study. These conceptual SEM models included all variables of interest, namely professional scepticism as a trait, gender, age, experience, and personality traits. The diagrammatic representation is also illustrated in Figure 4.7 and Figure 4.8 in Chapter 4.

Table 7.4: Summary of conceptual SEM models

Model	Model number	Bias	Professional scepticism	Other
Second order model	Model 1.1	Confirmation bias (CB)	PS	Gender, Age, Experience, Personality traits
	Model 1.2	Misconception of regressions to the mean bias (MRB)		
	Model 1.3	Conjunctive events bias (CEB)		
	Model 1.4	Overconfidence bias (OB)		
	Model 1.5	Affect bias (AB)		
First order model	Model 2.1	Confirmation bias (CB)	QM, SOJ, SFK, IU, SD, SC	Gender, Age, Experience, Personality traits
	Model 2.2	Misconception of regressions to the mean bias (MRB)		
	Model 2.3	Conjunctive events bias (CEB)		
	Model 2.4	Overconfidence bias (OB)		
	Model 2.5	Affect bias (AB)		

Source: Own compilation

The next section considers how the bias data were compiled for the use in the statistical testing of Hypotheses 2 to 6.

7.3 COMPILATION OF BIAS DATA

The present study collected 460 responses, of which only 301 (65%) were complete, in the sense that the participants completed every section of the questionnaire. These 301 responses were used to test Hypothesis 1 (see Chapter 6). When the data were screened further for SEM testing purposes, the information collected on each of the determinants was considered in more detail. It was noted that for the gender variable, three participants chose the option “prefer not to say”. As this category contained too few responses, these three responses were removed from the data set. For testing Hypotheses 2 to 6, a sample of 298 was considered further for each respective bias. Further adjustments were made to the sample sizes of the various biases, depending on how the participants answered the bias-related questions.

7.3.1 Confirmation bias

Regarding the options selected for the two questions pertaining to confirmation bias, 66 participants (20.6%) of the original 298 participants selected a combination for which no bias could be assigned. Their responses were excluded, as no relationship could be tested if no bias could be assigned to the answers given. The categorisation of the remaining answers obtained from the confirmation bias questions is presented in Table 7.5 where 0 denotes a rational answer, and 1 denotes a biased answer.

Table 7.5: Confirmation bias – bias categorisation

Bias variable	Category	Option selected	Frequency (n) N = 232	Percentage (%)
Confirmation bias	0	A & D	60	25.8%
	1	A & C	172	74.2%

Source: Own compilation

7.3.2 Misconception of regression to the mean bias

Regarding the options selected for the question pertaining to misconception of regression to the mean bias, of the remaining 298 responses, 110 (37.2%) participants selected the rational response (Category 0), whereas 188 (62.8%) selected a biased response (Category 1).

Table 7.6: Misconception of regression to the mean bias – bias categorisation

Bias variable	Category	Option selected	Frequency (n) N = 298	Percentage (%)
Misconception of regression to the mean bias	0	Option B	110	37.2%
	1	Option A	188	62.8%

Source: Own compilation

7.3.3 Conjunctive events bias

In the present study, a range between 50% to 60% was accepted as rational for conjunctive events bias. Category 0 represents the rational response, where participants answered within the 50% to 60% range. Category 1 represents the biased option, where participants did not adjust the estimate downward sufficiently (range above 60%). Nine participants chose a range between 0% and 49%, and for this answer, no specific bias could be assigned. These nine answers were removed from the data set. The final categorisation of the remaining answers obtained for conjunctive events bias are presented in Table 7.7.

Table 7.7: Conjunctive event bias – bias categorisation

Bias variable	Category	Percentage category	Frequency (n) N = 289	Percentage (%)
Conjunctive events bias	0	50% - 60%	79	27.4%
	1	61% - 100%	210	72.6%

Source: Own compilation

7.3.4 Overconfidence bias

For overconfidence bias, the present study used two measures, each measuring different aspects of overconfidence. The first measure aimed to assess the “better-than-average effect” amongst financial professionals comparing their general ability to those of other financial professionals. High placement (which could suggest overplacement) for the first measure was determined from the responses derived from Question 5 in Section 3 of the questionnaire. The second measure specifically considered how overplacement is affected when a person is in an unfamiliar context. Overplacement for the second measure was determined from the responses derived from Questions 6 and 7 in Section 3 of the questionnaire.

For the purposes of measuring overconfidence for the SEM, the placement recorded by the participants for Question 7 was considered. The following rationale was applied for the final placement of each participant, based on Question 7:

- Question 5 cannot serve as an absolute measure for overconfidence, since it assesses the placement of the group in its entirety, lacking the ability to discern individual overplacement.
- Questions 6 and 7 measure placement by comparing the individual participant's self-placement against actual performance. These questions were deemed more accurate measures of overplacement for the present study. Question 7 was chosen for the final placement determination, as it captured participants' placements after completing the quiz, presumably providing them with a clearer understanding of their performance.
- To ensure consistency in how each individual is placed, the placement responses for Questions 6 and 7 were compared for each participant. Only in instances where the placement shifted from 0 (underplacement) to 2 (overplacement) or vice versa, between Questions 6 and 7 was further examination prompted. The further examination included consideration to the answer given by the participant in Question 5 to ascertain the final placement. Following data inspection, no such discrepancies were observed.

Table 7.8: Overconfidence measure – bias categorisation

Bias variables	Percentage range	Categories	Frequency (n) N = 298	Percentage (%)
Overconfidence bias: Final	Underplacement	0	71	24%
	Rational	1	83	28%
	Overplacement	2	144	48%

Source: Own compilation

7.3.5 Affect bias

Based on the options selected for the questions pertaining to affect bias, of the 298 responses, 163 (54.7%) participants selected the rational response, whereas 135 (45.3%) selected a biased response.

Table 7.9: Affect bias – bias categorisation

Bias variables	Category	Option selected	Frequency (n) N = 298	Percentage (%)
Affect bias	0	Option A	163	54.7%
	1	Option B	135	45.3%

Source: Own compilation

The next section reports the model fit of the conceptual structural equation models which were used in the present study.

7.4 FIT OF STRUCTURAL EQUATION MODELS

As part of the SEM process discussion in Section 4.6.4, Step 6 outlined that structural validity needs to be assessed. This last step in the SEM process tests the validity of the proposed SEM model by studying the structural model fit and examining the model diagnostics (Hair et al., 2009, p. 718). To assess model fit, the present study used goodness-of-fit measures, as set out in Section 4.6.4, which reveal whether the conceptual SEM model provides an appropriate means of data representation. The following goodness-of-fit indices were considered: the Chi-square statistic to the Degrees of Freedom (CMIN/DF), the Root Mean Square Error of Approximation Index (RMSEA), the Comparative Fit Index (CFI), the Incremental Fit Index (IFI), and the Standardised Root Square Mean Residual (SRMR) (Kline, 2016, p. 266).

The goodness-of-fit results obtained for each conceptual model, including both first order models and second order models, are presented in the Table 7.10. The goodness-of-fit tests were performed on the sample size for each respective bias, as specified in Section 7.3. For the remainder of the sections, the respective biases are referred to by the following abbreviations: confirmation bias (CB), misconception of regression to the mean bias (MRB), conjunctive events bias (CEB), overconfidence bias (OB), and affect bias (AB).

Table 7.10: Model fit indices – SEM model with 30 indicators for professional scepticism as a trait

Model	Bias	CMIN/DF	RMSEA	CFI	IFI	SRMR
Second order model						
Model 1.1	CB	1.581	0.050	**0.765**	**0.748**	**0.126**
Model 1.2	MRB	1.772	0.051	**0.760**	**0.743**	**0.122**
Model 1.3	CEB	1.708	0.050	**0.769**	**0.752**	**0.114**
Model 1.4	OB	**Refer to Section 7.4.1***				
Model 1.5	AB	1.774	0.051	**0.760**	**0.743**	**0.112**
First order model						
Model 2.1	CB	1.427	0.043	0.834	0.820	**0.119**
Model 2.2	MRB	1.537	0.042	0.815	0.839	**0.103**
Model 2.3	CEB	1.492	0.041	0.845	0.828	**0.106**
Model 2.4	OB	**Refer to Section 7.4.1***				
Model 2.5	AB	1.538	0.042	0.839	0.821	**0.103**
Good fit		Lower than 3	Less and equal to 0.05	Above 0.95	Above 0.95	Less and equal to 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	

*Model non-convergence for the overconfidence model using diagonally weighted least squares (DWLS) estimation approach within Mplus. Refer to Section 7.4.1.

Source: Own compilation

All the thresholds marked in red above point to the fact that the model fit was not acceptable, as the estimates did not fall within the range of either a good fit, an acceptable fit or a marginal fit. For SRMR, all estimates were above 1, which indicates poor fit. For both CFI and IFI, within the second order models only, the estimates were below 0.8, which also show poor fit. Consideration of model respecification was therefore required.

Support needs to be provided for any respecification of the conceptual SEM model (Hair et al., 2009, p. 728). The model output was therefore inspected with reference to standardised model results, and residual error variances with a high modification index. Two areas for respecification were identified. Firstly, variables with high factor loadings were identified from the review of the standardised model results. Chin (1998) argues that variables with loading values lower than 0.5 should be dropped. The following five indicators had factor loadings below 0.5: QM_1, QM_3, SD_1, SD_4, and SOJ_3. It was decided to remove these five indicators to improve model fit. The constructs for QM, SOJ and SD still contain the minimum

number of three indicators (Kline, 2016, p. 201) to support the theoretical framework sufficiently, and therefore the removal of these five indicators was deemed theoretically sound. Secondly, a review of the model modification indices was performed to identify residual covariances with a high modification index. The literature provides various thresholds for determining what value is considered high. It was therefore decided to start with the identified residual covariances with the highest modification indices. The two residual covariances with the highest modification indices were identified between Extraversion (E) and SC, and Neuroticism (N) and SC, exceeding a modification index value of 75 for the second order models only. These covariances were not unexpected, as Cheng and Furnham (2002) have previously found that traits such as extraversion and neuroticism are direct predictors of self-confidence (Cheng & Furnham, 2002). To improve model fit, these covariances were added in each of the second order models.

After the conceptual SEM models had been respecified, using the assumptions discussed above, goodness-of-fit was tested in line with the guidance provided in Section 4.6.4.

7.4.1 Model fit

To assess model fit, the present study used goodness-of-fit measures such as the CMIN/DF, RMSEA, CFI, IFI and SRMR. The goodness-of-fit results for each respective conceptual model after model respecification had been performed and are presented in Table 7.11.

Table 7.11: Model fit indices – SEM model with 25 indicators for professional scepticism as a trait

Model	Bias	CMIN/DF	RMSEA	CFI	IFI	SRMR
Second order model						
Model 1.1	CB	1.310	0.037	0.897	0.887	**0.117**
Model 1.2	MRB	1.441	0.039	0.888	0.878	0.099
Model 1.3	CEB	1.401	0.037	0.894	0.894	0.100
Model 1.4	OB	**Refer to Section 7.4.1***				
Model 1.5	AB	1.426	0.038	0.892	0.883	0.099
First order model						
Model 2.1	CB	1.325	0.037	0.893	0.877	**0.112**
Model 2.2	MRB	1.367	0.035	0.911	0.899	0.095
Model 2.3	CEB	1.337	0.034	0.914	0.902	0.100
Model 2.4	OB	**Refer to Section 7.4.1***				
Model 2.5	AB	1.362	0.035	0.913	0.900	0.095

Model	Bias	CMIN/DF	RMSEA	CFI	IFI	SRMR
Good fit		Lower than 3	Less and equal to 0.05	Above 0.95	Above 0.95	Less and equal to 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	

*Model non-convergence for the overconfidence model using a DWLS estimation approach within Mplus. Refer to Section 7.4.1.

Source: Own compilation

Based on the results presented in Table 7.11, the CFI and IFI measures improved to meet the marginal fit thresholds, which range between 0.8 and 0.9 for all second order models. Even though the RMSEA estimates were originally already within an acceptable fit range, these estimates also improved to fall within a good fit range of less than 0.05 after the model respecification. The SRMR estimates all improved to meet an acceptable fit threshold, which ranged between 0.08 and 0.1, except for Model 1.1 and 2.1. Hu and Bentler (1999, p. 27) argue that if the SRMR thresholds are not met, but all other goodness-of-fit thresholds are met, model fit can be accepted.

It was concluded that, based on the goodness-of-fit measures, the model fit for all the second order models (Models 1.1, 1.2, 1.3 and 1.5) and all the first order models (Models 2.1, 2.2, 2.3 and 2.5) improved, using the respecification suggested, and are now within marginal to good fit ranges.

7.4.2 Overconfidence – multinomial regression analysis

Section 4.6.4 outlined the statistical techniques for Hypotheses 2 to 6. The statistical technique suggested was SEM, with specific reference to conducting structural path models using a DWLS estimation approach. This method was chosen because the dependent variable was a dichotomous variable. For the overconfidence variable, three categories were created to denote individuals that underplaced or overplaced themselves, or were rational regarding their placement. Given the number of continuous independent variables, together with the three categories denoting the dependent variable, the solutions had convergence problems in Mplus. This challenge arises when continuous independent variables are

measured on different scales. Sample variances regarding the observed continuous variables that fall outside the range of 1 to 10 give rise to convergence problems (Muthén & Muthén, 2017, p. 524). Rather than changing the continuous variables into categorical variables, it was decided to use multinomial logistic regression as an alternative to SEM to offer similar analyses.

The multinomial logistic regression was conducted using the Statistical Package for the Social Sciences (SPSS) on the composite, factor-based variables for professional scepticism as a trait and personality traits. For Model 2.4, the composite score for the combined professional scepticism trait was used for measurement purposes, whereas, for Model 1.4, the composite scores of the six sub-constructs of professional scepticism as a trait are used. The multinomial logistic regression models measures the relationship between the predictor variables and a categorical outcome variable, and estimates the probability of belonging to each category of the outcome variable, based on the predictor variables. It should be noted that this approach differs from that of the DWLS estimation, which estimates parameters in an SEM with reference to latent variables and observed variables.

A multinomial logistic regression is an extension of the binary logistic regression and is used in instances where the dependent variable has more than two categories (Chan, 2005, p. 259). In the multinomial logistic regression framework, distinct sub-populations are formed for every combination of variable values. The multinomial regression model reports on the adjusted odds ratios, with 95% confidence intervals (Chan, 2005). The results of the multinomial logistic regression need to be inspected for model fit to determine whether the results can be interpreted. Two measures of model fit needed to be examined, namely the model fit information and the goodness-of-fit. The SPSS multinomial outputs of the present study revealed sub-populations containing zero frequencies, because of the large number of continuous variables containing many different values. Given the many cells with zero frequencies, both the model fit information and goodness-of-fit results were not considered relevant to report, in line with the recommendations from Chan (2005, p. 262). This outcome does not influence the statistical significance testing performed on the parameter estimates of the individual independent variables in the context of the regression.

The classification table which forms part of the multinomial logistic regression outputs is also not reported on in the present study. The purpose of a classification table is to provide a

detailed breakdown of how well the model performs in classifying observations into different categories or classes. The aim of the present study was to determine the statistical significance of a specific relationship, not to make a prediction or classification. Therefore, the results generated by the classification table were not relevant for the present study.

The remainder of the chapter reports the SEM results, starting with the relationship between the main dependent and independent variables of the present study, namely bias in financial decision-making and professional scepticism as a trait. Thereafter the rest of the determinants (gender, age, experience, and personality traits) and their relationship with bias in financial decision-making are presented.

7.5 RESULTS: PROFESSIONAL SCEPTICISM AS A TRAIT

The main independent variable of interest in the present study is professional scepticism as a trait, and the question of whether this trait is related to bias in financial decision-making has to be answered. The SEM and multinomial regression results aimed to confirm whether professional scepticism as a trait and its sub-constructs are related to bias in financial decision-making. Support for the use of both the first order model and second order model was driven by the literature. Several prior studies have considered professional scepticism as a trait as a whole and its association with other variables (Eutsler et al., 2018; Glover & Prawitt, 2013; Harding & Trotman, 2017; Popova, 2013; Quadackers et al., 2014). However, only a limited number have studied professional scepticism as a trait together with its sub-constructs, and its association with other variables (Koch et al., 2016; Teye, 2023). This gap in the literature is addressed through the first order model testing conducted by the present study.

The hypotheses related to testing the relationship between professional scepticism as a trait, related sub-constructs and biases are outlined in Table 7.12.

Table 7.12: Hypothesis 2 summary

Hypothesis	Main hypothesis	Test
Confirmation bias		
$H2_a$	A relationship exists between professional scepticism as a trait and *confirmation bias* in the financial decision-making of financial professionals.	Two-tailed
$H_{2.1a}$ to $H_{2.6a}$	A relationship exists between questioning mind ($H_{2.1}$), search for knowledge ($H_{2.2}$), suspension of judgement ($H_{2.3}$), interpersonal understanding ($H_{2.4}$), self-determining ($H_{2.5}$) and self-confidence	Two-tailed

	($H_{2.6}$) and *confirmation bias* in the financial decision-making of financial professionals.	
Misconception of regression to the mean bias		
$H2_b$	A relationship exists between professional scepticism as a trait and *misconception of regression to the mean bias* in the financial decision-making of financial professionals.	Two-tailed
$H_{2.1b}$ to $H_{2.6b}$	A relationship exists between questioning mind ($H_{2.1}$), search for knowledge ($H_{2.2}$), suspension of judgement ($H_{2.3}$), interpersonal understanding ($H_{2.4}$), self-determining ($H_{2.5}$), and self-confidence ($H_{2.6}$) and *misconception of regression to the mean bias* in the financial decision-making of financial professionals.	Two-tailed
Conjunctive events bias		
$H2_c$	A relationship exists between professional scepticism as a trait and *conjunctive events bias* in the financial decision-making of financial professionals.	Two-tailed
$H_{2.1c}$ to $H_{2.6c}$	A relationship exists between questioning mind ($H_{2.1}$), search for knowledge ($H_{2.2}$), suspension of judgement ($H_{2.3}$), interpersonal understanding ($H_{2.4}$), self-determining ($H_{2.5}$), and self-confidence ($H_{2.6}$) and *conjunctive events bias* in the financial decision-making of financial professionals.	Two-tailed
Overconfidence bias		
$H2_d$	A relationship exists between professional scepticism as a trait and *overconfidence bias* in the financial decision-making of financial professionals.	Two-tailed
$H_{2.1d}$ to $H_{2.6d}$	A relationship exists between questioning mind ($H_{2.1}$), search for knowledge ($H_{2.2}$), suspension of judgement ($H_{2.3}$), interpersonal understanding ($H_{2.4}$), self-determining ($H_{2.5}$), and self-confidence ($H_{2.6}$) and *overconfidence bias* in the financial decision-making of financial professionals.	Two-tailed
Affect bias		
$H2_e$	A relationship exists between professional scepticism as a trait and *affect bias* in the financial decision-making of financial professionals.	Two-tailed
$H_{2.1e}$ to $H_{2.6e}$	A relationship exists between questioning mind ($H_{2.1}$), search for knowledge ($H_{2.2}$), suspension of judgement ($H_{2.3}$), interpersonal understanding ($H_{2.4}$), self-determining ($H_{2.5}$), and self-confidence ($H_{2.6}$) and *affect bias* in the financial decision-making of financial professionals.	Two-tailed

Source: Own compilation

Table 7.13 sets out the results for confirmation bias, misconception of regression to the mean bias, conjunctive events bias and affect bias. The results are given for each of the relationships showing its associated hypotheses. Information is further disclosed on the path coefficients, standard errors, and p-values. The detailed breakdown of the SEM results for confirmation bias, misconception of regression to the mean bias, conjunctive events bias

and affect bias is reported in Appendix 3. Table 7.14 reveals the multinomial logistic regression results for overconfidence bias. The results are given for each of the relationships showing its associated hypotheses, coefficient estimates (β), standard errors, p-values and odds ratios (Exp(β)). The p-values in Table 7.13 and Table 7.14 indicate whether the structural path or multinomial regression outputs are statistically significant at a .001, .01, .05, or .1 level (two-tailed).

Table 7.13: Professional scepticism as a trait – standardised model results for SEM

		Hypothesis	CB		MRB		CEB		AB	
			Path Coeff	Std error	Path Coeff	Std error	Path Coeff	Std error	Path Coeff	Std error
PS <— QM	Second order model		**0.816*** **	0.044	**0.800*** **	0.044	**0.803*** **	0.044	**0.835*** **	0.044
PS <— SOJ			**0.444*** **	0.064	**0.382*** **	0.062	**0.381*** **	0.062	**0.360*** **	0.063
PS <— SFK			**0.707*** **	0.047	**0.749*** **	0.044	**0.740*** **	0.045	**0.697*** **	0.043
PS <— IU			**0.618*** **	0.051	**0.610*** **	0.045	**0.615*** **	0.046	**0.618*** **	0.047
PS <— SD			**0.692*** **	0.054	**0.608*** **	0.052	**0.624*** **	0.051	**0.657*** **	0.050
PS <— SC			**0.401*** **	0.060	**0.366*** **	0.057	**0.363*** **	0.058	**0.396*** **	0.056
PS		$H2_{a, b, c \& e}$	-0.034	0.107	-0.050	0.088	-0.107	0.098	-0.121	0.093
QM	First order model	$H2.1_{a, b, c \& e}$	0.301	0.386	-0.146	0.177	**-0.396*[a]**	0.202	0.171	0.307
SOJ		$H2.2_{a, b, c \& e}$	0.140	0.147	0.138	0.098	-0.146	0.103	0.103	0.312
SFK		$H2.3_{a, b, c \& e}$	-0.097	0.121	**0.281**[a]**	0.105	0.055	0.119	0.103	0.233
IU		$H2.4_{a, b, c \& e}$	0.185	0.159	-0.001	0.115	0.118	0.106	0.108	0.708
SD		$H2.5_{a, b, c \& e}$	-0.246	0.273	-0.042	0.134	**0.402**[a]**	0.156	0.132	0.232
SC		$H2.6_{a, b, c \& e}$	0.198	0.163	0.171	0.128	0.118	0.137	0.132	0.298

"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 ($p < .01$)
***Significance at a 0.1% level of significance ($p < .001$)
[a] Two-tailed test
[b] One-tailed test

Source: Own compilation

Table 7.14: Professional scepticism as a trait – overconfidence multinomial regression results

Category	Variable	Hypothesis	β	Std error	Significance	Exp(β)
Model 2.4						
0	PS	$H2_d$	0.007	0.012	0.544	1.007
1	PS	$H2_d$	0.001	0.010	0.942	1.001
Model 1.4						
0	QM	$H2.1_d$	-0.028	0.058	0.635	0.973
	SOJ	$H2.2_d$	0.131	0.048	**0.006**[a]**	1.140
	SFK	$H2.3_d$	0.022	0.049	0.650	1.022
	IU	$H2.4_d$	-0.026	0.046	0.578	0.974
	SD	$H2.5_d$	0.006	0.045	0.891	1.006
	SC	$H2.6_d$	-0.039	0.048	0.417	0.962
1	QM	$H2.1_d$	0.071	0.056	0.203	1.073
	SOJ	$H2.2_d$	-0.017	0.041	0.669	0.983
	SFK	$H2.3_d$	-0.057	0.043	0.192	0.945
	IU	$H2.4_d$	-0.060	0.042	0.159	0.942
	SD	$H2.5_d$	0.073	0.043	**0.090[Aa]**	1.076
	SC	$H2.6_d$	-0.029	0.045	0.528	0.972

"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 ($p < .01$)
***Significance at a 0.1% level of significance ($p < .001$)
[a] Two-tailed test
[b] One-tailed test

Source: Own compilation

7.5.1 Professional scepticism as a trait

For the second order model testing conducted on confirmation bias, misconception of regression to the mean bias, conjunctive events bias and affect bias, the SEM results displayed in Table 7.13 reveal that all six constructs were significantly correlated with the bigger professional scepticism as a trait construct ($p < .001$). These results provide evidence that the respective constructs of professional scepticism as a trait contribute to the overall understanding of professional scepticism as a trait. These results do not support any hypotheses, but provide support towards the validity of the conceptual framework used to measure professional scepticism as a trait.

Table 7.13 and Table 7.14 reveal no statistically significant results for the relationship between the overall professional scepticism as a trait construct and any of the five biases. This implies that having either lower or elevated levels of professional scepticism as a trait has no relationship with decision-making biases. Based on the findings, H_{2a} to H_{2e} are *not*

supported. A recent study conducted by Teye (2023, p. 36) amongst a group of professional auditors established an association between bias and professional scepticism as a trait. That study found that framing bias and optimism bias reduced professional scepticism. However, the present study differed from this prior research study's approach. Unlike Teye (2023), who examined the influence of bias on professional scepticism, the present study investigated the opposite direction, in other words, the relationship between professional scepticism as a trait and bias. The divergent results need to be explored further by future studies to determine whether the relationship is bidirectional, or influenced by other factors.

The sub-constructs were thus considered further to assess whether there is a relationship between the sub-constructs of professional scepticism as a trait and bias in decision-making.

7.5.2 Questioning mind

For the relationship between the questioning mind construct and five respective biases ($H_{2.1a}$ to $H_{2.1e}$), only the negative relationship with conjunctive events bias was statistically significant ($\beta = -0.396$, $p = .050$), as shown in Table 7.13. These results reveal that a person with a higher *(lower)* questioning mindset has a lower *(higher)* predicted probability of displaying susceptibility to conjunctive events bias. Based on these results, only $H_{2.1c}$ was supported for the questioning mind construct, while $H_{2.1a}$, $H_{2.1b}$, $H_{2.1d}$ and $H_{2.1e}$ were *not* supported.

When this significant relationship was explored further, a deeper examination was undertaken to clarify and understand the concept of the questioning mind trait. The trait of possessing a questioning mind is characterised as the ability to interrogate information and evidence until comfort is obtained (Hurtt, 2010, p. 152), as well as being willing to challenge and critically evaluate assumptions (Cheng, 2023). This could imply that individuals with a questioning mind actively seek underlying factors contributing to an event, rather than accept information at face value. Furthermore, having this critical mindset could help to distinguish between events that are independent of each other, which in turn can help mitigate conjunctive events bias.

Koch et al. (2016) were some of the first researchers to investigate how scepticism as a trait influenced bias amongst a sample of professional auditors. Their study considered only recency bias, and focused only on the evidence-related construct (questioning mind,

suspension of judgement and search for knowledge) in an auditing task presented to their participants. Their results revealed that scepticism as a trait, measured through the evidence-related construct, mitigated recency bias. The present study analysed the respective constructs individually and confirmed the results, for questioning mind only, for conjunctive events bias.

The recency bias tested by Koch et al. (2016) stems from the availability heuristic, whereas conjunctive events bias stems from the anchoring and adjustment heuristic. Comparing the results of the present study and Koch et al.'s (2016) study, we note that the respective constructs within scepticism as a trait may influence biases stemming from different heuristics differently. Additionally, in certain decision-making environments, it may be better to group some traits together, rather than to measure them as a single trait, similarly to how Koch et al. (2016) conducted their study. In an auditing environment, it would be sensible to make use of the evidence-related construct in its entirety, as an auditing environment is information- and evidence-focused (Cushing & Ahlawat, 2000). The present study, however, is exploratory in nature, as it is the first to analyse the six constructs individually, and their association with bias in a broader finance environment. Future studies may consider addressing the findings raised and grouping constructs within the different decision-making environments together.

7.5.3 Suspension of judgement

For the relationship between the suspension of judgement construct and five respective biases ($H_{2.2a}$ to $H_{2.2e}$), only the relationship with overconfidence bias was statistically significant, with a positive relationship ($\beta = 0.131$, $p = .006$ and $Exp(\beta) = 1.140$) as shown in Table 7.14. These results reveal that participants were 1.140 more likely to underplace themselves rather than to overplace themselves if their suspension of judgement trait increased by one unit. Based on these results, only $H_{2.2d}$ a was supported for the suspension of judgement construct, while $H_{2.2a}$, $H_{2.2b}$, $H_{2.2c}$ and $H_{2.2e}$ were *not* supported.

When this significant relationship was explored further, a deeper examination was undertaken to clarify and understand the concept of the suspension of judgement trait. A person with this trait tends to gather more information before making decisions (Hurtt, 2010, p. 153). This process may enable such participants to consider multiple alternatives and allows them time to reflect on their own experience and biases. Suspension of judgement

may therefore lead to people being more realistic about their abilities, which may lead to underplacement rather than overplacement These results are similar to those of Moore and Schatz (2017), who argue that people tend to underplace themselves in situations where they are uncertain about their performance.

As noted for the questioning mind construct, Koch et al. (2016) were among the first to test the evidence-related construct. They also found that this construct mitigated recency bias amongst a sample of professional auditors. The present study analysed the constructs individually and found evidence to support the results (for suspension of judgement only) for overconfidence bias. This finding is interesting when one takes into account the use of System 1 and System 2 thinking strategies in decision-making. Kahneman (2011) has argued in his book *Thinking, fast and slow* that in thinking slower, a person thinks more deliberately and logically, which may assist decision-makers in avoiding mistakes. This deliberate and logical thinking process may therefore lead to people's gathering more evidence before making a judgement and may thereby possibly mitigate bias. However, the present study's results suggest that thinking slowly is not the same as suspending judgement, because suspending judgement influenced only overconfidence bias in the present study. The findings in the present study suggest that thinking more slowly would imply thinking differently, whereas suspending judgement indicates taking time to gather more evidence before making a judgement or decision, which does not mitigate most biases.

7.5.4 Search for knowledge

For the relationship between search for knowledge and the respective five biases ($H_{2.3a}$ to $H_{2.3e}$), only the positive relationship with misconception of regression to the mean bias was statistically significant ($\beta = 0.281$, $p = .007$) as displayed in Table 7.13. These results reveal that a financial professional with a higher *(lower)* search for knowledge trait has a higher *(lower)* predicted probability of displaying proneness to misconception of regression to the mean bias when making financial decisions. Results of the present study support only $H_{2.3b.}$ However, $H_{2.3a}$, $H_{2.3c}$, $H_{2.3d}$ and $H_{2.3e}$ are *not* supported.

The results of the present study differ to those of Koch et al. (2016), who assessed this trait in aggregate with questioning mind and suspension of judgement to mitigate recency bias in an auditing environment amongst a group of professional auditors. The recency bias tested by Koch et al. (2016) stems from the availability heuristic, whereas misconception of

regression to the mean bias stems from the representativeness heuristic. When comparing the results, a plausible explanation for the differences is that the respective constructs within scepticism as a trait may influence biases stemming from different heuristics in different ways. However, a second consideration is whether traits within the evidence-related construct may have opposing effects on biases. This argument can be supported when one looks at Table 7.3 and the standardised regression weights for each of the constructs. When questioning mind, suspension of judgement and search for knowledge are inspected, one can see that the questioning mind construct (0.906) contributes the most to the overall professional scepticism as a trait construct, compared to the suspension of judgement construct (0.316) and the search for knowledge construct (0.628). This finding in the present study confirms the need to drill down into the composing sub-constructs of the evidence-related aspects of scepticism as a trait, as they may have different relationships with bias.

In light of the present study's findings, the search for knowledge trait was further unpacked to determine a plausible reason for the findings. The literature associates the search for knowledge trait with having a curious mind to go beyond the information that is given (Hurtt, 2010, p. 153). In actively seeking information, statistical phenomena such as regression back to the mean may be overlooked, as people try to overinterpret information, and in doing so, fail to consider the natural outcome. The natural result in this case is that outcomes regress back to the mean. These findings support a similar argument made by Tversky and Kahneman (1974, p. 1124) regarding the representativeness heuristic, where individuals neglect the base rate frequency and rely more on the new information received. These results represent a new contribution to the literature, particularly as they challenge the notion that increased scepticism leads to reduced bias, which in turn should lead to improved decision-making (Teye, 2023, p. 27).

7.5.5 Interpersonal understanding

The interpersonal understanding construct revealed no statistically significant relationship with any of the five biases. Therefore, $H_{2.4a}$ to $H_{2.4e}$ were *not* supported. These findings suggest that having more interpersonal understanding does not elevate or mitigate confirmation bias, misconception of regression to the mean bias, conjunctive events bias, overconfidence bias or affect bias. Upon closer analysis, when the interpersonal trait was analysed in more detail, the findings of the present study became clearer. The interpersonal understanding trait relates to a person's being able to understand the motivations and

assumptions of whoever presents them with information, which puts them in a position to be able to challenge the information appropriately (Hurtt, 2010, p. 154). From the way the questions and scenarios were presented to the participants in the present study, the participants were not able to get an understanding of the person presenting the information. The only question which provided some sort of background on the person presenting the information was confirmation bias. Therefore, the findings revealed in the present study are understandable.

Prior studies have not yet considered the relationship between the interpersonal understanding construct of professional scepticism as a trait and bias in decision-making. The present study is therefore exploratory, and is the first of its kind to establish whether this relationship exists. Based on the results, no relationship could be established for this sample of financial professionals in a financial environment. Future research studies should explore this trait, using more appropriate questions and scenarios to grasp the impact, if any, of this trait on bias in decision-making.

7.5.6 Self-determining

For the relationship between self-determining and the respective five biases ($H_{2.5a}$ to $H_{2.5e}$), two statistically significant relationships were found. A positive relationship with conjunctive events bias was identified (β = 0.401, *p* = .010), as displayed in Table 7.13, and a positive relationship with overconfidence bias was noted (β = 0.073, *p* = .090 and Exp(β) = 1.076), as shown in Table 7.14. These results revealed for conjunctive events bias that a financial professional with higher *(lower)* self-determination had a higher *(lower)* predicted probability of displaying susceptibility to conjunctive events bias in making financial decisions. Conversely, for overconfidence bias, the results show that people with an increase in one unit of self-determination is 1.076 more likely to be rational than to overplace themselves. The results of the present study therefore supported $H_{2.5c}$ and $H_{2.5d}$, but $H_{2.5a}$, $H_{2.5b}$, and $H_{2.5e}$ were *not* supported.

The self-determination trait fosters attributes such as autonomy, and independence so as not to be persuaded by other people (Hurtt, 2010, p. 155). A plausible explanation for the findings in the present study on conjunctive events bias may be related to the characteristics of the heuristic from which the bias is derived, namely the anchoring and adjustment heuristic. In respect of 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 & Kahneman, 1974, p. 1128). They might therefore consider the anchor to be more important, as they regard it as their own initial determination of the outcome. People might therefore not be persuaded to adjust for the new information presented. This may lead to elevation of biases such as conjunctive events bias where a person underestimates the probability of outcomes that depend on a single event, but do not respond correctly to new information presented, which leads the person to anchor more heavily in their initial judgements (Bar-Hillel, 1973).

For the findings in relation to overconfidence, aspects of the self-determining trait, such as not being easily persuaded, may lead to greater ability to resist social pressures. The literature has reported evidence that being overconfident is sometimes driven by the status and influence of individuals in social settings (Moore & Swift, 2011, p. 173). If people are able to avoid this social pressure, they are able to take a more realistic perspective regarding their own abilities. Future research needs to explore the underlying factors of the self-determining trait and its relationship with overconfidence bias.

The findings of the present study contribute to the literature in showing that there is a relationship between self-determining and two biases, namely conjunctive events bias and overconfidence bias, amongst a group of financial professionals in a financial environment. The findings further reveal that the self-determining trait can lower or elevate various biases. Future research studies should therefore explore the possible relationship between self-determining and other biases.

7.5.7 Self-confidence

The self-confidence construct revealed no statistically significant relationship with any of the five biases. Hence, $H_{2.6a}$ to $H_{2.6e}$ were *not* supported. Prior studies have not yet considered the relationship between the self-confidence construct of professional scepticism as a trait and bias in decision-making. Based on the results of the present study, no relationship could be established for this sample of financial professionals in a financial environment.

The self-confidence trait relates to people's *self-esteem*, which enables them to place as much value on their own opinions as they do on others' opinions, thereby empowering them to challenge conclusions made by other individuals (Hurtt, 2010, p. 155). The findings of the present study reveal that having more self-confidence does not play a significant role in

elevating or mitigating confirmation bias, misconception of regression to the mean bias, conjunctive events bias, overconfidence bias or affect bias in decision-making. It might be assumed that self-confidence and overconfidence are related concepts, as they sound similar. However, when the underlying behavioural manifestations of these concepts are considered, differences can be noted. Self-confidence relates to an expression of personal self-estimation (Liu et al., 2019, p. 245), whereas overconfidence relates to the tendency to overestimate one's own ability or performance (Moore & Healy, 2008). A distinct difference between self-confidence and overconfidence may be the impact this trait has on performance. Prior studies have found that self-confidence is positively related to increased performance. However, self-confidence may lead to overconfidence, which in turn can reduce performance over time (Moores & Chang, 2009). The impact of overconfidence on company performance amongst chief financial officers has been reported in the literature. Arend et al. (2016, p. 1161) found that overconfidence led to more risk-taking behaviour amongst chief financial officers, which led to poorer financial results. Similarly, Meikle et al. (2016, p. 129) found that overconfident financial executives pursued higher risk investment projects, which put companies under pressure in the long term. The studies mentioned in this paragraph help to differentiate between the two traits, making the lack of findings in the present study to distinguish between self-confidence and overconfidence understandable.

Overall, these results contribute significantly to the literature, given that only a limited number of studies have considered professional scepticism 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 scepticism leads to a reduction of certain biases and improved decision-making (Teye, 2023). However, contrary to expectation, the results for the search for knowledge and self-determining trait provided insights suggesting that some sceptical traits may elevate certain biases. This finding highlights the importance of considering not only the entire construct of professional scepticism as a trait, but also the underlying traits that comprise it, as these can exert both positive and negative influences on bias decision-making.

7.6 RESULTS: DETERMINANTS

The main independent variable of interest of the present study is professional scepticism as a trait, but in the literature reviewed, other determinants have been identified as having a relationship with bias in financial decision-making. The other determinants also considered

in the present study were gender, age, experience, decision-making experience and personality traits. This section provides the SEM results for confirmation bias, misconception of regression to the mean bias, conjunctive events bias, and affect bias, as well as the multinomial regression results for overconfidence bias, using both the first and second order representation of professional scepticism. This section also provides evidence of the relationship of the determinants with bias in financial decision-making.

The hypotheses related to testing the relationship between the respective determinants and biases are outlined in Table 7.15. However, note should be taken of the findings revealed by the measurement model testing conducted on the five personality traits. Based on the validity and reliability testing performed on personality traits in Chapter 5, only extraversion and neuroticism met the required criteria for validity and reliability to be included for testing. Therefore, with reference to the personality traits determinant, only hypotheses related to extraversion and neuroticism were considered.

Table 7.15: Summary – Hypotheses 3 to 6

Hypothesis	Main hypothesis	Test
Gender		
H_{3a}	A relationship exists between gender and *confirmation bias* related to the representativeness heuristic when they make financial decisions.	Two-tailed
H_{3b}	A relationship exists between gender and *misconception of regression to the mean bias* related to the representativeness heuristic when they make financial decisions.	Two-tailed
H_{3c}	Financial professionals who are wo*men* are more susceptible than financial professionals who are *men* to *conjunctive events bias* related to the anchoring and adjustment heuristic when making financial decisions.	One-tailed
H_{3d}	Financial professionals who are *women* are less susceptible than financial professionals who are *men* to bias related to *overconfidence* when making financial decisions.	One tailed
H_{3e}	Financial professionals who are *women* are more susceptible than financial professionals who are *men* to bias related to the use of *affect (emotion)* when making financial decisions.	One tailed
Age		
H_{4a}	A relationship exists between age and *confirmation bias* related to the representativeness heuristic when they make financial decisions.	Two-tailed
H_{4b}	A relationship exists between age and *misconception of regression to the mean bias* related to the representativeness heuristic when they make financial decisions.	Two-tailed

Hypothesis	Main hypothesis	Test
H_{4c}	A relationship exists between age and *conjunctive events bias* related to the anchoring and adjustment heuristic when they make financial decisions.	Two-tailed
H_{4d}	A relationship exists between age and *overconfidence bias* when they make financial decisions.	Two-tailed
H_{4e}	Financial professionals who are *relatively older* are less susceptible to bias related to the use of *affect (emotion)* when making financial decisions, compared to *younger* financial professionals.	One-tailed
Experience		
$H_{5.1a}$	A relationship exists between the level of experience and *confirmation bias* related to the representativeness heuristic in the financial decisions of financial professionals.	Two-tailed
$H_{5.2a}$	A relationship exists between when they make decision-making experience and *confirmation bias* related to the representativeness heuristic in the financial decisions of financial professionals.	Two-tailed
$H_{5.1b}$	A relationship exists between when they make experience and *misconception of regression to the mean bias* related to the representativeness heuristic in the financial decisions of financial professionals.	Two-tailed
$H_{5.2b}$	A relationship exists between when they make decision-making experience and *misconception of regression to the mean bias* related to the representativeness heuristic in the financial decisions of financial professionals.	Two-tailed
$H_{5.1c}$	Financial professionals with *more experience* are less susceptible to *conjunctive events bias* related to the anchoring and adjustment heuristic when making financial decisions, compared to financial professionals with *less experience*.	One-tailed
$H_{5.2c}$	Financial professionals with *more decision-making experience* are less susceptible to *conjunctive events bias* related to the anchoring and adjustment heuristic when making financial decisions, compared to financial professionals with *less decision-making experience*.	One-tailed
$H_{5.1d}$	Financial professionals with *more experience* are more susceptible to bias related to *overconfidence* when making financial decisions, compared to financial professionals with *less experience*.	One-tailed
$H_{5.2d}$	Financial professionals with *more decision-making experience* are more susceptible to bias related to *overconfidence* when making financial decisions, compared to financial professionals with *less decision-making experience*.	One-tailed
$H_{5.1e}$	Financial professionals with *more experience* are less susceptible to bias related to the use of *affect (emotion)* when making financial	One-tailed

Hypothesis	Main hypothesis	Test
	decisions, compared to financial professionals with *less experience*.	
$H_{5.2e}$	Financial professionals with *more decision-making experience* are less susceptible to bias related to the use of *affect (emotion)* when making financial decisions, compared to financial professionals with *less decision-making experience*.	One-tailed
Personality traits		
$H_{6.1a}$	A relationship exists between *extraversion* and *confirmation bias* related to the representativeness heuristic in the financial decision-making of financial professionals.	Two-tailed
$H_{6.5a}$	Financial professionals who exhibit personality traits such as *neuroticism* are more susceptible to *confirmation bias* related to the representativeness heuristic when making financial decisions, compared to financial professionals who do not exhibit these traits.	One-tailed
$H_{6.1b}$	Financial professionals who exhibit personality traits such as *extraversion* are more susceptible to *misconception of regression to the mean bias* related to the representativeness heuristic when making financial decisions, compared to financial professionals who do not exhibit these traits.	One-tailed
$H_{6.5b}$	Financial professionals who exhibit personality traits such as *neuroticism* are more susceptible to *misconception of regression to the mean bias* related to the representativeness heuristic when making financial decisions, compared to financial professionals who do not exhibit these traits.	One-tailed
$H_{6.1c}$	Financial professionals who exhibit personality traits such as *extraversion* are more susceptible to *conjunctive events bias* related to the anchoring and adjustment heuristic when making financial decisions, compared to financial professionals who do not exhibit these traits.	One-tailed
$H_{6.5c}$	Financial professionals who exhibit personality traits such as *neuroticism* are more susceptible to *conjunctive events bias* related to the anchoring and adjustment heuristic when making financial decisions, compared to financial professionals who do not exhibit these traits.	One-tailed
$H_{6.1d}$	Financial professionals who exhibit personality traits such as *extraversion* are more susceptible to *overconfidence bias* when making financial decisions, compared to financial professionals who do not exhibit these traits.	One-tailed
$H_{6.5d}$	A relationship exists between *neuroticism* and *overconfidence bias* in the financial decision-making of financial professionals.	Two-tailed
$H_{6.1e}$	Financial professionals who exhibit personality traits such as *extraversion* are more susceptible to biases related to *affect (emotion)* when making financial decisions, compared to financial professionals who do not exhibit these traits.	One-tailed

Hypothesis	Main hypothesis	Test
$H_{6.5e}$	Financial professionals who exhibit personality traits such as *neuroticism* are more susceptible to biases related to *affect (emotion)* when making financial decisions, compared to financial professionals who do not exhibit these traits.	One-tailed

Source: Own compilation

Table 7.16 reveals the results for confirmation bias, misconception of regression to the mean bias, conjunctive events bias and affect bias. Results are set out for each of the relationships shown and its associated hypotheses. Information is also disclosed on the path coefficients, standard errors, and p-values. A detailed breakdown of the SEM results for confirmation bias, misconception of regression to the mean bias, conjunctive events bias and affect bias is reported in Appendix 3.

Table 7.17 reveals the multinomial regression results for overconfidence bias. For each of the relationships shown, the results indicate its associated hypotheses, coefficient estimates (β), standard errors, p-values and odds ratios (Exp(β)). The p-values set out in both Table 7.16 and Table 7.17 indicate whether the structural path or multinomial regression outputs are statistically significant at a .001, .01, .05 or .1 level (two-tailed) or a .0005, .005, .025 or .05 level (one-tailed).

Table 7.16: Determinants – Standardised model results for SEM

		Hypothesis	CB		MRB		CEB		AB	
			Path Coeff	Std error	Path Coeff	Std error	Path Coeff	Std error	Path Coeff	Std error
Gender	Second order model	$H_{3a, b, c, e}$	0.066	0.087	**0.224**[**a]	0.071	**0.234**[**b]	0.077	0.271	0.149
Age		$H_{4\ a, b, c, e}$	-0.080	0.301	0.156	0.141	0.074	0.295	0.002	0.020
Experience		$H_{5.1\ a, b, c, e}$	-0.064	0.304	0.001	0.152	0.242	0.323	-0.004	0.021
Decision-making experience		$H_{5.2\ a, b, c, e}$	**0.400**[*a]	0.177	-0.229	0.147	-0.135	0.167	-0.004	0.021
Extraversion		$H_{6.1\ a, b, c, e}$	0.053	0.109	-0.002	0.100	0.119	0.137	-0.001	0.096
Neuroticism		$H_{6.5\ a, b, c, e}$	-0.028	0.114	0.023	0.101	0.075	0.122	**-0.298**[**b]	0.097
Gender	First order model	$H_{3a, b, c, e}$	0.138	0.183	**0.224**[**a]	0.071	**0.234**[**b]	0.077	0.134	0.073
Age		$H_{4\ a, b, c, e}$	-0.010	0.038	0.156	0.141	0.074	0.295	0.019	0.167
Experience		$H_{5.1\ a, b, c, e}$	-0.008	0.038	0.001	0.152	0.242	0.323	-0.036	0.175
Decision-making experience		$H_{5.2\ a, b, c, e}$	**0.070**[*a]	0.033	-0.229	0.147	-0.135	0.167	-0.022	0.130
Extraversion		$H_{6.1\ a, b, c, e}$	0.029	0.152	0.081	0.128	**0.194**[Ab]	0.095	0.137	0.131
Neuroticism		$H_{6.5\ a, b, c, e}$	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

Table 7.17: Determinants – overconfidence multinomial regression results

Category	Variable	β	Std error	Significance	Exp(β)
Model 1.4					
0	Gender (=0)	0.188	0.332	0.571	1.207
	Age	-0.004	0.058	0.944	0.996
	Experience	-0.128	0.070	0.066	0.880
	Decision-making experience	0.149	0.063	**0.019**[Ab]	1.160
	Extraversion	0.116	0.104	0.263	1.123
	Neuroticism	-0.142	0.144	0.324	0.868
1	Gender (=0)	-0.127	0.299	0.671	0.881
	Age	-0.03	0.036	0.931	0.997
	Experience	0.004	0.038	0.924	1.004
	Decision-making experience	-0.029	0.047	0.532	0.971
	Extraversion	-0.041	0.092	0.658	0.960
	Neuroticism	0.028	0.130	0.829	1.028
Model 2.4					
0	Gender (=0)	0.260	0.345	0.451	1.297
	Age	0.002	0.059	0.970	1.002
	Experience	-0.123	0.070	0.078	0.884
	Decision-making experience	0.136	0.064	**0.033**[Ab]	1.146
	Extraversion	0.221	0.116	0.057	1.248
	Neuroticism	-0.056	0.158	0.722	0.945
1	Gender (=0)	-0.241	0.311	0.438	0.786
	Age	0.008	0.038	0.841	1.008
	Experience	0.002	0.040	0.962	1.002
	Decision-making experience	-0.042	0.049	0.390	0.959
	Extraversion	-0.015	0.106	0.888	0.985
	Neuroticism	0.036	0.141	0.802	1.036

'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

7.6.1 Gender

The present study's results revealed a positive, statistically significant relationship between gender and misconception of regression to the mean bias, as well as between gender and conjunctive events bias. These results supported H_{3b} and H_{3c}, which state that women, in comparison to men, are more susceptible to these biases. The results further reveal that H_{3a}, H_{3d} and H_{3e} were *not* supported. The findings for each respective bias are considered in the paragraphs below.

7.6.1.1 Confirmation bias and misconception of regression to the mean bias

For the two biases stemming from the representativeness heuristic tested in the present study, differing results were found regarding each bias's relationship with gender. A statistically significant positive relationship was found only for misconception of regression to the mean bias ($\beta = 0.224$, $p = .002$).

Both AlKhars et al. (2019) and Lucena et al. (2021) examined the impact of gender on confirmation bias and misconception of regression to the mean bias. Their findings indicated that gender did not significantly predict or influence either bias. Both studies considered student participants specialising in either business or accounting, but Lucena et al. (2021) also included accounting professionals who had graduated. The results of the present study for confirmation bias corroborates the findings of these two prior studies.

Upon further investigation of the contradictory findings for confirmation bias and misconception of regression to the mean bias in the present study, plausible explanations can be offered for the underlying reasons for the contradictions. Confirmation bias stems from a tendency to look for confirmatory evidence to confirm a person's beliefs, whilst disregarding contradictory evidence (Pompian, 2011, p. 188). This bias relates primarily to the cognitive processes in a person's belief system. Therefore it can be argued that it i not gender specific. By contrast, misconception of regression to the mean bias relates to how statistical phenomena are misinterpreted (Tversky & Kahneman, 1974, p. 1126). Prior studies such as those of AlKhars et al. (2019) were inspected, but no reason was provided in their study for why their study found a positive association between gender and insensitivity to predictability bias, a negative association between gender and insensitivity to prior probability of outcomes,

and no association between the same two biases tested in the present study. Future research should delve deeper into the reasons for this difference, seeing that these biases both stem from the same heuristic. Factors that contribute to these differences should be explored in future research.

7.6.1.2 Conjunctive events bias

For conjunctive events bias, a statistically significant positive relationship with gender was found (β = 0.234, *p* = .002) for models using professional scepticism as a first or second order construct. Conjunctive events bias arises from the anchoring and adjustment heuristic. The present study is one of very few studies considering the influence of gender on this bias. Enslin (2019) conducted a study on management accountants and found similar results to those of the present study, reporting that women were more susceptible to conjunctive events bias than men were. These results were in line with those of other research studies that looked into anchoring bias, which also stems from the anchoring and adjustment heuristic (Kudryavtsev & Cohen, 2011; Rajdev & Raninga, 2016). It can be inferred that for different biases stemming from the anchoring and adjustment heuristic, there is a trend in that research findings have confirmed that women are more prone than men to these biases.

7.6.1.3 Overconfidence bias

For overconfidence bias, an overall trend noted in the literature is that men are more prone to overconfidence bias. However, the present study's findings do not support the results of Barber and Odean (2001), Mishra and Metilda (2015), or Baker et al. (2019) in this regard. Barber and Odean (2001, p. 289) conducted a study on a group of investors working at an investment brokerage. They found that male investors were more overconfident than their female counterparts, and overestimated the accuracy of the information the men processed, which led to lower than expected trading profits. Mishra and Metilda (2015, p. 237) found that men were more confident than women in a study measuring "better-than-average effect" amongst mutual fund investors, whereas Baker et al. (2019, p. 132) found, amongst a group of individual investors, that men were more overconfident than women in respect of their own knowledge of the stock market.

7.6.1.4 Affect bias

For affect bias, the overall trend in the literature suggests that women are more prone than men to affect bias. The psychology literature supports this view, based on the claim that women experience emotions more strongly than men (Harshman & Paivio, 1987). Bacha and Azouzi (2019) and Enslin (2019), conducted their studies among banking employees and management accountants respectively and found gender to play an influencing role on affect bias. Enslin (2019) employed an identical question to that used in the present study, albeit on management accountants. Both studies found that women were more susceptible than men to affect bias. In the present study, susceptibility to affect bias among female financial professionals was not significant at a 0.05 level, but was significant at a 0.10 level for the model using professional scepticism as a first order construct (β = 0.019, p = .066) and the model using professional scepticism as a second order construct (β = 0.134, p = .066). It can be argued that management accountants and financial professionals work in the same financial environment, and that therefore the types of stress level that need to be managed in this decision-making environment are similar. Women who are financial professionals may therefore be prone to heightened stress, thereby increasing their susceptibility to affect bias. It is possible that similar future studies may find more significant results, as the present study's sample size may have imposed a limitation, given the advanced statistical technique used to analyse the data.

The present study highlights the need for future studies to consider interventions tailored to address gender-specific biases to improve decision-making in various environments.

7.6.2 Age

No relationship between age and any of the five biases was found. Hence, H_{4a} to H_{4e} were therefore *not* supported. Mixed results were reported in the literature. Further comparisons of the present study's findings are discussed below for each bias.

7.6.2.1 Confirmation bias and misconception of regression to the mean bias

Prior research studies found mixed results with regard to age and its influence on confirmation bias. Ossareh et al. (2021, p. 16) found age to be a strong predictor of

confirmation bias among a sample of individual investors, whereas Sinha and Shunmugasundaram (2023) found similar results to the present study, where age did not play a role, for a sample of insurance agents working in the insurance industry. For misconception of regression to the mean bias, prior studies reported support for the role that age plays in a person's susceptibility to bias. Tekçe et al. (2016) and Enslin (2019) demonstrated that age led to higher susceptibility to this bias amongst individual investors and management accountants respectively. Overall, these findings highlight the complexity of the relationship between age and biases stemming from the representativeness heuristic. While some studies suggested that age has a significant influence on susceptibility to biases, others have reported contradictory results.

7.6.2.2 Conjunctive events bias

For conjunctive events bias, Enslin (2019), using a sample of management accountants, also considered the influence of age on this respective bias. His study found age not to be significantly associated with conjunctive events bias. Other prior research studies have also considered other biases stemming from the anchoring and adjustment heuristic. For anchoring bias, the research studies retrieved from the literature reported differing results. Kudryavtsev and Cohen (2010) reported that older MBA graduates were more prone than younger MBA graduates to anchoring bias Baker et al. (2019) found the opposite to be true amongst a sample of individual investors, where increasing age decreased anchoring bias in decision-making amongst individual investors. Kudryavtsev and Cohen (2010) and Baker et al. (2019) found a relationship of some significance for a sample of individual investors, whereas the present study found no relationship between age and conjunctive events bias. The present study therefore supports the results of Enslin (2019), who noted no association between age and conjunctive events bias.

7.6.2.3 Overconfidence bias

The present study found no relationship between age and overconfidence bias and therefore could not support prior studies that found any relationship with age. Prosad et al. (2015) noted a positive association between age and susceptibility to overconfidence bias, in that older individual investors were more prone to

overconfidence bias. By contrast, Arend et al. (2016) found younger entrepreneurs to be more prone to overconfidence bias. The results from these two studies suggest that participants' overconfidence may differ when different populations and decision-making environments are compared.

7.6.2.4 Affect bias

For affect bias, the trend emerging from the literature is that older individuals display lower susceptibility to affect bias. These results were generated for various decision-making contexts, which did not include a financial environment. These findings were not confirmed by the present study, which therefore differs from the findings of Eberhardt et al. (2019) and You et al. (2019). Eberhardt et al. (2019, p. 79) conducted a study on a sample of adults who had to make financial decisions. Their study revealed that older persons were less affected by negative emotion when they had to make decisions. You et al. (2019, p. 802) reported similar findings from their examination of a sample of adults investigating age differences in a decision-making scenario in which negative emotion was induced. Results revealed that older individuals regulated their emotions better and were not impacted by the induced negative emotions, compared to younger individuals.

Given the mixed results across the various different studies and decision-making environments, the study highlights the complexity of the relationship between age and bias in decision-making, which therefore needs to be explored further in future studies.

7.6.3 Experience

The present study measured experience in two ways, namely general experience (measured as total years of experience in a finance environment) and decision-making experience (measured as the number of years for which a person made key decisions). Key decisions in the context of the present study were defined as "decisions which can relate to either strategic, financial or operational decisions that may have a noticeable financial impact on business operations". Overall, for general experience, no significant results were found, and therefore $H_{5.1a}$ to $H_{5.1e}$ were *not* supported.

For decision-making experience, two statistically significant relationships were found, for confirmation bias and overconfidence bias. A statistically significant positive relationship was noted for confirmation bias, which supported $H_{5.2a}$. However, for overconfidence, a significant relationship was found where more decision-making experience was related to participants' underplacing themselves, rather than overplacing themselves. $H_{5.2d}$ was thus *not* supported, as it was hypothesised, based on the literature, that financial professionals with *more decision-making experience* would be more susceptible to bias related to overconfidence in making financial decisions. Therefore $H_{5.2b}$ to $H_{5.2e}$ were *not* supported. The findings for each bias are considered in the paragraphs below.

7.6.3.1 Confirmation bias

For confirmation bias, a statistically significant positive relationship was found for the model using professional scepticism as a first order construct and as a second order construct ($\beta = 0.070$, $p = .034$). These findings imply that financial professionals in the present study who reported higher (lower) levels of decision-making experience had a higher (lower) predicted probability of displaying proneness to confirmation bias in financial decision-making. For biases stemming from the representativeness heuristic, a limited number of prior studies have considered the relationship between experience and either confirmation bias and misconception of regression to the mean bias. Park et al. (2010), Ossareh et al. (2021) and Chalissery et al. (2023) conducted their studies amongst samples of individual investors, focusing solely on overall investment experience, without distinguishing between various types or levels of experience. Park et al. (2010) found that investment experience did not influence investors' confirmation bias, whereas Ossareh et al. (2021) observed that less experienced investors displayed higher susceptibility to confirmation bias. By contrast, Chalissery et al. (2023) found that investors with more investment experience were also more prone to confirmation bias. All three of the studies in this paragraph examined the relationship between domain experience and confirmation bias. The way experience was measured in these three studies was therefore a more useful comparison with the present study's general and total years of experience in a financial environment. With reference to the general experience measure used in the present study, the findings support those of Park et al. (2010).

The significant results revealed for confirmation bias and decision-making experience in the present study were surprising, as it was anticipated that more decision-making experience would decrease bias in decision-making. However, these results are in line with those of Chalissery et al. (2023), even though a different experience measure was used in their study. It might be argued that people with more decision-making experience have over time consistently confirmed their existing beliefs in a finance environment, therefore increasing their susceptibility to confirmation bias. Hurtt et al. (2013) argue that auditors with more experience become "captured" by the audit industry, which leads auditors to fail to question assumptions around client explanations.

7.6.3.2 Misconception of regression to the mean bias

Similarly, mixed results have been reported in the literature with regard to the influence of experience on misconception of regression to the mean bias. Tekçe et al. (2016) found investment experience to decrease misconception of regression to the mean bias, whereas Chalissery et al. (2023) found the opposite to be true amongst a sample of individual investors. The present study's findings supported neither of these studies, as neither general experience nor decision-making experience within a financial environment played any role in a sample of financial professionals' susceptibility to misconception of regression to the mean bias. For biases stemming from the representativeness heuristic, the majority of studies in the literature have been done in an investment environment only.

7.6.3.3 Conjunctive events bias

For biases stemming from the anchoring and adjustment heuristic, the overall trend in the recent literature is that more experience has been associated with less susceptibility to these biases. Henrizi et al. (2021, p. 611) found in their study on various biases stemming from the anchoring and adjustment heuristic, including insufficient adjustment from the anchor bias, that their sample of auditors with more experience were less prone to these biases. Chalissery et al. (2023, p. 16) used a sample of individual investors, and tested anchoring and adjustment bias. Their results revealed that increased trading experience made investors less prone to the anchoring and adjustment-related bias. The findings in the present study did not support the

findings of Henrizi et al. (2021) or Chalissery et al. (2023), as no relationship was found with either general experience or decision-making experience and conjunctive events bias.

7.6.3.4 Overconfidence bias

For overconfidence bias, a statistically significant positive relationship was found in the present study for the model using the professional scepticism as a trait composite (β = 0.136, *p* = .033 and Exp(β) = 1.146) and for the model using the scepticism as a trait sub-construct composites (β = 0.149, *p* = .019 and Exp(β) = 1.160). The first set of results reveals that one unit increase in decision-making experience resulted in participants' being 1.146 more likely to underplace themselves than to overplace themselves. Similarly, the second set of results revealed that one unit increase in decision-making experience resulted in participants' being 1.160 more likely to underplace themselves than to overplace themselves.

The findings of the present study regarding the relation between decision-making experience and overconfidence bias were contradictory to those in the literature reviewed. Most prior research studies reported that having more experience led to overconfidence bias in decision-making. This was found to be true among samples of individual investors (Ateş et al., 2016; Beatrice et al., 2021; Deaves et al., 2010; Mishra & Metilda, 2015; Prosad et al., 2015) and business managers (Doukas & Petmezas, 2007). However, although no significance was found for the general experience measure of financial professionals in the present study at a 0.05 significance level, the findings were significant at a 0.10 level. For the model using the professional scepticism as a trait composite (β = -0.123, *p* = .078 and Exp(β) = 0.884) and the model using the scepticism as a trait sub-construct composites (β = -0.128, *p* = .066 and Exp(β) = 0.880), the results reveal a negative relationship, where participants with more general experience were more likely to overplace themselves rather than to underplace themselves. These findings support those in the literature which state that more experience leads to overconfidence bias. This suggests that some behavioural biases are not lowered with more experience, but seem to increase. Future studies should explore the differentiating role of different measures of experience and how different types of experience may mitigate some behavioural biases, as reported in the present study.

7.6.3.5 Affect bias

For affect bias, a limited number of prior research studies have considered how experience may impact affect bias. Bhattacharjee and Moreno (2002) conducted their study in an auditing environment to show that professional auditors with more auditing experience displayed less affect bias. These results were not supported by the present study, which found no evidence for affect bias in a sample of financial professionals.

7.6.3.6 Discussion

Prior research reveals mixed results regarding the influence of experience on biases stemming from different heuristics. The present study could support a significant relationship for only two biases (confirmation bias and overconfidence bias), and decision-making experience. The overall findings when compared to the literature suggests that the relationship between experience and decision-making biases are more complex. The present study highlights the importance of using different measures of experience, as results may be affected by domain experience. This argument is supported by the different results found when considering both general experience and decision-making experience and its association with overconfidence bias in the present study. Secondly, the present study expands the research scope by examining biases in decision-making environments and populations beyond an investment environment and individual investor population where the majority of studies reviewed in the literature have been performed. For the present study, sample size may pose a limitation because of the advanced statistical technique used to analyse the data. More significant results may emerge if larger samples can be obtained and tested, which can help to address the dearth of literature on this specific relationship in a finance environment.

7.6.4 Personality traits

The present study's results revealed two findings of statistical significance for the relationship between personality traits and the set of biases. Firstly, a positive relationship was identified between extraversion and conjunctive events bias, therefore supporting $H_{6.1c}$. Secondly, a negative relationship was found between neuroticism and affect bias. However, $H_{6.5c}$ was *not* supported, because the present study hypothesised a positive relationship, based on the literature. For extraversion,

$H_{6.1a}$, $H_{6.1b}$, $H_{6.1d}$ and $H_{6.1e}$ were *not* supported. For neuroticism, $H_{6.5a}$ to $H_{6.5e}$ were *not* supported. Findings for each bias are considered in the paragraphs below.

7.6.4.1 Confirmation bias and misconception of regression to the mean bias

No statistical significance was found for the relationship between either extraversion or neuroticism as personality traits and biases stemming from the representation heuristic assessed in the present study. A limited number of studies have been conducted on the relationship between personality traits and biases stemming from this heuristic. For confirmation bias, the present study's results differ from those of Chalissery et al. (2023), who found that the neuroticism trait played a positive influencing role amongst a sample of individual investors, where investors who displayed this trait were more prone to confirmation bias. For misconception of regression to the mean bias, Baker et al. (2019) conducted their study amongst a sample of individual investors and found a positive influence between neuroticism, but also with extraversion traits.

7.6.4.2 Conjunctive events bias

A statistically significant positive relationship was revealed between extraversion and conjunctive events bias for the model using professional scepticism as a trait as a first order construct ($\beta = 0.194$, $p = .041$). This finding reveals that being more extroverted is associated with being more prone to conjunctive events bias. For conjunctive event bias prior research studies were conducted mostly on anchoring bias, stemming from the anchoring and adjustment heuristic, and not on the bias assessed by the present study (Baker et al., 2021; Chalissery et al., 2023). When considering findings from these studies, only Baker et al. (2021) reported similar results, noting that extraversion made investors more prone to anchoring bias. Extraversion incorporates aspects such as being energetic, optimistic, sociable and talkative (Baker et al., 2021, p. 357). Characteristics such as being optimistic may lead to people's being more inclined to focus on the benefits associated with a decision. This may lead to an overestimation of the likelihood of favourable outcomes occurring at the same time, which may contribute to conjunctive events bias in decision-making. Conjunctive events bias is a manifestation of anchoring bias and conservatism bias and it therefore may explain

why traits such as extraversion play a similar influencing role as different biases stemming from the anchoring and adjustment heuristic.

7.6.4.3 Overconfidence bias

For the association between personality traits and overconfidence bias, the present study found no significant relationship. These results differ from those of prior studies that supported a positive relationship between extraversion and overconfidence amongst a sample of students (Ahmad, 2020) and a sample of individual investors (Baker et al., 2021). However, like the present study, these two prior studies did not find any relationship between neuroticism and overconfidence bias.

7.6.4.4 Affect bias

A statistically significant negative relationship was found between neuroticism and affect bias for the model using professional scepticism as a trait as a second order construct ($\beta = -0.298$, $p = .017$). Most of the literature noted a positive relationship between neuroticism and affect bias (Baker et al., 2021; Khan & Abid Usman, 2021), which contrasts with the negative influencing role found in the present study. A deeper examination of the neurotic trait explains that a person exhibiting this trait may display impulsivity, anxiety and tension (Baker et al., 2021, p. 357). Descriptions such as impulsivity may suggest that such people are not able to manage their emotions well, and therefore the finding in the present study cannot be supported with a reasonable explanation from the literature. This finding needs to be explored further by future research to determine what factors might drive these different findings, including the negative relationship found in the present study.

In summary, a key observation when comparing the results of the present study to those of prior studies is the different type of decision-makers that were included in the respective studies. Financial professionals, for the present study, were defined as professionals who are accredited by the International Auditing and Assurance Standards Board (IAASB) and/ or the Association of Chartered Certified Accountants (ACCA). This may include decision-makers such as auditors, accountants, financial analysts and tax practitioners. The present study's results are therefore more comparable to the following studies, whose populations included a similar sub-cohort as the present study.

- Gender: The present study only supports the results of AlKhars et al. (2019) and Lucena et al. (2021) for confirmation bias, but for misconception of regression to the mean bias these studies are not supported. A possible reason for this difference is the fact that these studies were conducted on students to proxy for business managers and accountants.
- Age: The present study supports the study of Enslin (2019) regarding conjunctive events bias, but not misconception of regression to the mean bias.
- Experience: The present study does not support the studies conducted by Bhattacharjee and Moreno (2002) and Henrizi et al. (2021) conducted amongst a sample of auditors.

Based on the summary above, determinants such as personality traits and susceptibility to bias in decision-making have not yet been researched extensively amongst financial professional and should be explored by future studies. For determinants such as gender, age and experience, differences in results were revealed when comparing the present study to studies with a sample from other financial populations such as auditors and management accountants. These findings provide an area for future research to determine any underlying factors that may lead to the different results.

The remainder of the studies reviewed, not listed in the bullets above, were mostly conducted on samples of individual investors and asset managers. Therefore, different results can be expected, due to the different decision-making environments in which these studies were conducted.

7.7 SUMMARY

Chapter 7 reported the results addressing the second research question of the present study. This research question focused on examining whether a relationship exists between professional scepticism as a trait and its related constructs, as well as other determinants, such as gender, age, experience and personality, and several biases. The study used an SEM approach and multinomial regression technique to analyse the data. Both first order and second order models were employed, with support drawn from the literature. While prior studies have explored the relationship between professional scepticism as a trait and other variables, fewer studies have considered

the sub-constructs of professional scepticism as a trait and their associations with other variables. The present study addressed this gap by examining the first order model, which considers the individual constructs' relationship with other variables.

The present study found no statistically significant results regarding the relationship between the overall professional scepticism as a trait construct and any of the five biases, suggesting that varying levels of professional scepticism as a trait have no relationship with decision-making biases. The sub-constructs revealed several significant relationships with certain biases tested in the present study. For *questioning mind*, a positive relationship with conjunctive bias was found, suggesting that people with a more (less) questioning mind are less (more) prone to conjunctive events bias. For *suspension of judgement*, a relationship with overconfidence was found to be significant, suggesting that people with this trait are more likely to underplace themselves than to overplace themselves. For *search for knowledge*, a significant positive relationship was found for misconception of regression to the mean bias. This finding suggests that individuals with higher (lower) traits of search for knowledge are more (less) prone to misconception of regression to the mean bias. These findings challenge the anticipated result that higher professional scepticism as a trait mitigates bias in decision-making. For the *self-determining* trait, a significant relationship was found for both conjunctive events bias and overconfidence bias. However, the relationship with conjunctive events bias suggests that people with higher self-determining traits are more prone to this bias, whereas for overconfidence, the opposite was found. Participants displaying higher self-determining traits were more likely to be rational than to overplace themselves. Finally, for *interpersonal understanding* and *self-confidence*, no relationship with any of the biases were revealed, therefore suggesting that these traits did not influence bias in decision-making. Overall, the study's findings highlight the importance of considering individual constructs within scepticism as a trait and their specific effects on bias, and not only the entire professional scepticism as a trait construct.

Although the present study's focus was determining whether there is a relationship between professional scepticism as a trait and bias in decision-making, other determinants, such as gender, age, experience, and personality traits were also examined. For *gender*, a significant relationship was found with misconception of regression to the mean bias and conjunctive events bias, suggesting that women in

the sample were more prone to these biases. For *age*, no significant relationship was found between age and any of the biases considered in the present study. For *experience*, the study examined both general experience and decision-making experience, and susceptibility to bias in decision-making. No significant results were found for general experience, but for decision-making experience, two significant relationships were noted, namely with confirmation bias and overconfidence bias. The findings for confirmation bias suggest that having more decision-making experience made participants more prone to this bias. By contrast, for overconfidence bias, the findings revealed that having more decision-making experience led participants to underplace themselves rather than to overplace themselves. These different findings highlight the complex relationship between experience and bias, so future research is needed to unpack this relationship.

This study finally examined the relationship between *personality traits*, specifically extraversion and neuroticism, and decision-making biases. Two significant relationships were revealed between extraversion and conjunctive events bias, and between neuroticism and affect bias. The relationship between extraversion and conjunctive events bias was positive, suggesting that having this trait leads to being more prone to this bias. The relationship between affect bias and neuroticism was negative, suggesting that being more neurotic makes people less prone to affect bias. The latter finding does not support the literature, so the factors driving this relationship need to be explored in future research. Table 7.18 provides a summary of the results of the supported and unsupported hypotheses.

Table 7.18: Summary of results with supported or unsupported hypotheses

Variable	CB	MRB	CEB	OB	AB
Second order	**Model 2.1**	**Model 2.2**	**Model 2.3**	**Model 2.4**	**Model 2.5**
PS	Hypothesis 2(a) not supported	Hypothesis 2(b) not supported	Hypothesis 2(c) not supported	Hypothesis 2(d) not supported	Hypothesis 2(e) not supported
Gender	Hypothesis 3(a) not supported	Hypothesis 3(b) supported**	Hypothesis 3(c) supported**	Hypothesis 3(d) not supported	Hypothesis 3(e) not supported
Age	Hypothesis 4(a) not supported	Hypothesis 4(b) not supported	Hypothesis 4(c) not supported	Hypothesis 4(d) not supported	Hypothesis 4(e) not supported

Experience	Hypothesis 5.1(a) not supported	Hypothesis 5.1(b) not supported	Hypothesis 5.1(c) not supported	Hypothesis 5.1(d) not supported	Hypothesis 5.1(e) not supported
Decision-making experience	Hypothesis 5.2(a) supported*	Hypothesis 5.2(b) not supported	Hypothesis 5.2(c) not supported	Hypothesis 5.2(d) not supported[A]	Hypothesis 5.2(e) not supported
Extraversion	Hypothesis 6.1(a) not supported	Hypothesis 6.1(b) not supported	Hypothesis 6.1(c) not supported	Hypothesis 6.1(d) not supported	Hypothesis 6.1(e) not supported
Neuroticism	Hypothesis 6.5(a) not supported	Hypothesis 6.5(b) not supported	Hypothesis 6.5(c) not supported	Hypothesis 6.5(d) not supported	Hypothesis 6.5(e) not supported
First order	**Model 1.1**	**Model 1.2**	**Model 1.3**	**Model 1.4**	**Model 1.5**
QM	Hypothesis 2.1(a) not supported	Hypothesis 2.1(b) not supported	Hypothesis 2.1(c) supported*	Hypothesis 2.1(d) not supported	Hypothesis 2.1(e) not supported
SOJ	Hypothesis 2.2(a) not supported	Hypothesis 2.2(b) not supported	Hypothesis 2.2(c) not supported	Hypothesis 2.2(d) supported**	Hypothesis 2.2(e) not supported
SFK	Hypothesis 2.3(a) not supported	Hypothesis 2.3(b) supported**	Hypothesis 2.3(c) not supported	Hypothesis 2.3(d) not supported	Hypothesis 2.3(e) not supported
IU	Hypothesis 2.4(a) not supported	Hypothesis 2.4(b) not supported	Hypothesis 2.4(c) not supported	Hypothesis 2.4(d) not supported	Hypothesis 2.4(e) not supported
SD	Hypothesis 2.5(a) not supported	Hypothesis 2.5(b) not supported	Hypothesis 2.5(c) supported**	Hypothesis 2.5(d) supported[A]	Hypothesis 2.5(e) not supported
SC	Hypothesis 2.6(a) not supported	Hypothesis 2.6(b) not supported	Hypothesis 2.6(c) not supported	Hypothesis 2.6(d) not supported	Hypothesis 2.6(e) not supported
Gender	Hypothesis 3(a) not supported	Hypothesis 3(b) supported**	Hypothesis 3(c) supported**	Hypothesis 3(d) not supported	Hypothesis 3(e) not supported
Age	Hypothesis 4(a) not supported	Hypothesis 4(b) not supported	Hypothesis 4(c) not supported	Hypothesis 4(d) not supported	Hypothesis 4(e) not supported
Experience	Hypothesis 5.1(a) not supported	Hypothesis 5.1(b) not supported	Hypothesis 5.1(c) not supported	Hypothesis 5.1(d) not supported	Hypothesis 5.1(e) not supported
Decision-making Experience	Hypothesis 5.2(a) supported*	Hypothesis 5.2(b) not supported	Hypothesis 5.2(c) not supported	Hypothesis 5.2(d) not supported[A]	Hypothesis 5.2(e) not supported
Extraversion	Hypothesis 6.1(a) not supported	Hypothesis 6.1(b) not supported	Hypothesis 6.1(c) supported[A]	Hypothesis 6.1(d) not supported	Hypothesis 6.1(e) not supported

Neuroticism	Hypothesis 6.5(a) not supported	Hypothesis 6.5(b) not supported	Hypothesis 6.5(c) not supported	Hypothesis 6.5(d) not supported	Hypothesis 6.5(e) not supported

Source: Own compilation

The findings of the present study contribute to the literature in that this research study is one of only a limited number of studies that have explored the relationship between professional scepticism as a trait and its related sub-constructs and bias in decision-making. The present study has also broadened the scope of research beyond individual investor populations when mainly certain biases such as overconfidence were tested.

Chapter 8 provides the conclusion of the present study, highlighting the main findings and key contributions. It further elaborates on the key limitations of the present study, as well as makes recommendations for future research.

CHAPTER 8:
CONCLUSION

8.1 SUMMARY OF CHAPTERS AND FINDINGS

The main research problem that the present study investigated was driven by the fact that financial professionals make use of heuristics and are susceptible to biases arising from those heuristics, which may lead to suboptimal decision-making in certain circumstances. Professional scepticism has been suggested as a trait that could improve decision-making, but so far, there has been limited empirical evidence as to whether professional scepticism will also limit behavioural bias. Professional scepticism has become an increasingly important topic in the financial environment over the last few decades. This attention has been driven by policy-makers, regulators, practitioners and the public, because a lack of professional scepticism by financial professionals globally has damaged the reputation of the finance profession. The global focus on professional scepticism inspired the development of the research question in the present study, which is to determine whether this important trait is related to decision-making biases. The main research question focuses on whether professional scepticism as a trait can improve decision-making in a sample of financial professionals who use heuristic-related and other biases in their decision-making.

The present study adopted an empirical research design, using a quantitative data analysis approach, where data were collected primarily through questionnaires. The sample of financial professionals selected for the present study have a qualification accredited by the International Auditing and Assurance Standards Board (IAASB) and/ or the Association of Chartered Certified Accountants (ACCA). Financial professionals accredited by these professional bodies may face an increasingly complex financial and social environment, and therefore there is an emphasis on the need for them to apply professional scepticism when they make judgements and decisions. It was anticipated that the application of professional scepticism would therefore help to improve decision-making in the context of the present study and to reduce decision-making biases. Advanced statistical techniques, including structural equation modelling (SEM), were used to explore the relationship between professional scepticism as a trait and decision-making biases.

The chapters and main findings of the present study are summarised below. Section 8.1.1 provides an overall conclusion of the present study. Section 8.1.2 addresses *Research Question 1*, which relates to determining the presence of heuristic-related and other biases amongst financial professionals. Section 8.1.3 addresses *Research Question 2,* the main focus and contribution of the present study, summarising the relationship between professional scepticism as a trait and decision-making biases. This section also elaborates on determinants such as gender, age, experience and personality traits, which *were not the main focus* of Research Question 2. However, acknowledgement of these variables is important, as understanding their susceptibility to bias, together with professional scepticism as a trait needed to be considered as well.

8.1.1 Overall conclusion

The problem that this study investigated was driven by the fact that financial professionals use heuristics, but are subject to biases, which may lead to suboptimal decision-making in certain circumstances. Professional scepticism has been suggested to be an aspect that could improve decision-making, but thus far, there is limited empirical evidence as to whether it may also limit behavioural bias.

The findings of the present study firstly indicates that financial professionals do indeed make use of heuristics and were susceptible to each of the biases investigated by the present study. The present study's results further found that professional scepticism as a trait in its entirety played no role in financial professionals' bias in decision-making. When the individual sub-constructs were investigated, four of the six sub-constructs revealed a relationship with some of the biases investigated in the present study. The findings suggest that certain underlying constructs could potentially improve decision-making whereas, conversely, other underlying constructs could potentially exacerbate decision-making biases.

8.1.2 Heuristics and the biases of financial professionals

People use simplifying strategies to help them solve uncertain or complex decision-making problems. These strategies (heuristics) help people to make decisions quickly, with minimal cognitive effort, and can be helpful to navigate complex decision-making scenarios. However, these strategies may also lead to biases in judgement. Chapter

2 presented some of the key heuristic-related and other biases present in the finance environment. From the biases identified in prior research, five biases were identified to be examined in the present study, namely confirmation bias, misconception of regression to the mean bias, conjunctive events bias, overconfidence bias, and affect bias. Although these biases do not present an exhaustive list of the biases that financial professionals may be susceptible to, some of these biases have been singled out by several professional accounting bodies as being important for financial professionals to recognise and address (ACCA, 2017, 2022; SAICA, 2022). Another crucial factor the study had to consider in determining which biases to examine was whether the method of examining the bias could be easily integrated into a survey design environment. This resulted in the exclusion of biases originating from the availability heuristic from the present study. The literature reviewed in Chapter 2 also indicated that heuristics in finance has already been extensively researched, but establishing the presence of these biases in the present study's sample of financial professionals was a precursor to addressing Research Question 2.

The findings presented in Chapter 6 indicate that a significant proportion of the participants in the present study were susceptible to all five biases investigated. The proportion of the sample susceptible to each of the biases was as follows: confirmation bias (57.5%), misconception of regression to the mean bias (62.8%), conjunctive events bias (70.7%) and affect bias (44.9%). For overconfidence bias, the present study focused on overplacement, also referred to as the "better-than-average effect". For overplacement. measured on general abilities, the findings revealed that the group mean placement was 70.8%, which shows that the members of the sample collectively placed themselves as above average. This measure could only determine the group's overplacement and not the individual placement. For overplacement in an easy, unfamiliar quiz, individual participants' placement, before and after the quiz, could be measured by comparing their placement to their actual performance. The findings revealed that 52% of the participants overplaced themselves before the quiz was taken, compared to 48% of them who overplaced themselves after the quiz was taken. On the second overplacement measures, again the findings confirmed that financial professionals in the present study were susceptible to overplacement.

After establishing that the present sample of financial professionals were susceptible to all five biases investigated in the present study, the relationship with the main

independent variable, namely professional scepticism as a trait, together with the other determinants, was investigated to address Research Question 2.

8.1.3 Determinants of heuristics and biases

The present study focused on individual or personal variables that could influence decision-making biases. Professional scepticism as a trait was the main personal variable investigated, but other variables such as gender, age, experience and personality traits have also been identified in the literature as having an influence on decision-making biases. Chapter 3 summarised the literature on all the determinants investigated in the present study. A gap was identified in the literature, as professional scepticism as a trait and its relationship with decision-making biases have not yet been extensively researched, compared to the other determinants researched in finance and other decision-making environments. It is important to understand this relationship, seeing the importance that the ACCA attached to professional scepticism as a potential mitigant against decision-making biases (ACCA, 2017). This gap in the literature was addressed in Chapter 7, by investigating the relationship between professional scepticism as a trait and decision-making biases. The relationship investigated included the considerations of whether the sub-constructs of professional scepticism as a trait, namely questioning mind, suspension of judgement, search for knowledge, interpersonal understanding, self-determining, and self-confidence, also have a relationship with the decision-making biases investigated in the present study.

Regarding professional scepticism as a trait, Chapter 7 revealed no statistically significant relationship between the overall professional scepticism as a trait construct and any of the five biases. These findings imply that having either lower or elevated levels of professional scepticism as a trait does not lead to higher or lower susceptibility to heuristic-related and other biases investigated in the present study. When the individual sub-constructs were investigated, four of the six sub-constructs revealed a statistically significant relationship with some of the biases investigated in the present study. For *questioning mind*, a significant negative relationship was revealed with conjunctive events bias. These findings imply that an individual with a higher (lower) questioning mindset has a lower (higher) predicted probability of displaying proneness to conjunctive events bias. For *suspension of judgement*, a significant positive relationship with overconfidence bias was revealed. These findings

suggest that people who exhibit more of a suspension of judgement trait were more likely to underplace themselves rather than to overplace themselves in relation to others. For *search for knowledge*, a significant positive relationship was revealed with misconception of regression to the mean bias. These findings imply that a person with a higher (lower) search for knowledge trait has a higher (lower) predicted probability of displaying proneness to misconception of regression to the mean bias. Lastly, for *self-determining*, a positive relationship was revealed with conjunctive events bias, as well as a positive relationship with overconfidence bias. For conjunctive events bias, it was found that a person with higher (lower) self-determination has a higher (lower) predicted probability of displaying proneness to conjunctive events bias. For overconfidence bias, it was found that people with more self-determination are more likely to be rational than to overplace themselves. In summary, the findings suggest that certain underlying traits could potentially improve decision-making. Conversely, instances were also identified where certain underlying traits could potentially exacerbate decision-making biases.

Chapter 7 further revealed that for the other determinants, only gender, decision-making experience and personality traits displayed a significant relationship with some biases. For *gender*, a significant positive relationship was found for both misconception of regression to the mean bias and conjunctive events bias. These findings suggest that women were more susceptible than men to these biases. For *decision-making experience*, a significant positive relationship was found for confirmation bias, which implies that having more decision-making experience leads to greater susceptibility to confirmation bias. For overconfidence bias, a significant relationship was found, where more decision-making experience related to individuals underplacing rather than overplacing themselves. Finally, only two personality traits, namely extraversion and neuroticism, could be investigated in the present study. For personality traits such as *extraversion*, those exhibiting more of this trait were revealed to be more susceptible to conjunctive events bias. For *neuroticism,* those who exhibited more of this trait were less susceptible to affect bias, contrary to the findings suggested by prior studies.

The remainder of this chapter reports the conclusions for each hypothesis and sets out the limitations of the present study. Thereafter, the contribution of the study is

outlined, and the practical implications derived from the present study's findings are reported. The chapter ends with recommendations for future research.

8.2 CONCLUSIONS

8.2.1 Heuristics and biases of financial professionals

Research Question 1 was investigated by means of five hypotheses. These five hypotheses identified each of the heuristic-related and other biases that the present study considered, namely 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}). Each hypothesis is discussed along with the findings of the present study with reference to the hypothesis (see Table 6.16 at the end of Section 6.5 for a summary of the results of the supported and unsupported hypotheses).

Hypothesis H_{1a}: Financial professionals are susceptible to *confirmation bias* related to the representativeness heuristic when they make financial decisions

The presence of confirmation bias stemming from the representativeness heuristic became evident from the results of the present study, where 57.5% of the sample of financial professionals decided not to consider any form of disconfirming evidence in examining the validity of information given. The failure to incorporate disconfirming evidence when assessing information exposes the sample's predisposition towards confirmation bias. A Wilson 95% binomial confidence interval further confirmed that the responses for this sample of financial professionals differed significantly from rationality. These findings support those of similar studies conducted in a finance environment, which found that professional tax practitioners (Wheeler & Arunachalam, 2008), professional auditors (Cassell et al., 2022; Peterson & Wong-On-Wing, 2000), professional accountants (Perera et al., 2020) and management accountants (Enslin, 2019) were susceptible to confirmation bias in decision-making.

Hypothesis H_{1b}: Financial professionals are susceptible to *misconception of regression to the mean bias* related to the representativeness heuristic when they make financial decisions

Misconception of regression to the mean bias, like confirmation bias, stems from the representativeness heuristic. A proportion of 62.8% of the financial professionals

revealed susceptibility to this bias by placing too much emphasis on recent past performance when they were asked to make an investment decision and, by doing so, chose the incorrect investment option. These results show the tendency of financial professionals to believe that extreme outcomes will be followed by less extreme outcomes, whereas in reality the extreme outcomes are more likely to regress back to the mean. As with confirmation bias, a Wilson 95% binomial confidence interval further confirmed that the responses from the financial professionals differed significantly from rationality. These findings support the findings of similar studies conducted in a finance environment, which found that accounting professionals (Lucena et al., 2021), management accountants (Enslin, 2019), property fund investment managers (Lowies, 2012) and individual investors (Baker et al., 2019) were susceptible to misconception of regression to the mean bias when they made decisions.

Hypothesis H_{1c}: Financial professionals are susceptible to *conjunctive events bias* related to the anchoring and adjustment heuristic when they make financial decisions

Conjunctive events bias stems from the anchoring and adjustment heuristic and is a further manifestation of similar biases such as anchoring bias and conservatism bias, which also stem from this heuristic. For conjunctive events, 70.7% of the financial professionals revealed their predisposition towards this bias by making too conservative a downward adjustment, based on the conjunctive event probability information provided. Biases stemming from the anchoring and adjustment heuristic function on the basis that when an estimate on a starting probability value is formed, people tend to make an insufficient adjustment to the starting value, based on the subsequent information received. A one-sample t-test further confirmed that the choice made by the financial professionals differed statistically significantly from the correct (rational) answer. These findings support those of similar studies conducted in a finance environment that found that professional auditors (Joyce & Biddle, 1981), management accountants (Enslin, 2019) and banking employees (Kang & Park, 2019) were susceptible to conjunctive events bias. Other studies also confirmed the susceptibility of professionals in the finance environment to similar biases which manifested from the anchoring and adjustment heuristic, such as anchoring bias (Cen et al., 2013; Kudryavtsev & Cohen, 2010) and conservatism bias (Lowies et al., 2016).

Hypothesis H_{1d}: Financial professionals are susceptible to bias related to *overconfidence* when they make financial decisions.

The present study measured both overplacement in participants' general abilities compared to others, and in easy, unfamiliar tasks. The sample of financial professionals overplaced themselves when they were comparing their own general ability to the general ability of other financial professionals. The premise of these results is that decision-makers neglect to compare themselves against the reference group (against individuals with similar skills) and therefore tend to overplace themselves. For general overplacement, only the sample's placement could be measured. A one-sample t-test confirmed that the average placement for the sample differed significantly from 50% (average). The findings of the present study support those of similar studies conducted on professionals in the finance environment, such as management accountants (Enslin, 2022), property fund investment managers (Lowies, 2012) and pension fund managers (Gort, 2009).

Overplacement in easy, unfamiliar tasks was measured by asking participants to complete a general knowledge quiz. The present study compared the individual participant's placement before and after the quiz against their actual performance in the quiz to determine the accuracy of the placement made. This measure of overplacement contributed to the literature by addressing some of the criticism directed towards using a metric that compares an individual's general ability to that of others without any proof that the individual may indeed be better than others. For the participants' placement before the quiz, the results reveal that they overplaced themselves, compared to their actual performance. Individuals therefore exhibit overconfidence when they compare their abilities to those of other financial professionals in easy tasks. These results support the argument made by Moore and Healy (2008) that people tend to overplace themselves on easy tasks. However, with regard to the individual participant's placement after the quiz, a decrease in overplacement was noted. This decrease suggests that amidst uncertainty about their performance, particularly once they were aware of the difficulty level of the quiz, fewer individuals tend to overplace their abilities, when compared to those of other financial professionals (Moore & Schatz, 2017). Overall, regarding the placement made by participants, both before and after the quiz, there was still a big portion of the sample that overplaced themselves. These findings support those of similar studies conducted

using easy quizzes, which revealed that people tend to overplace themselves on easy tasks (Benoît et al., 2015; Burks et al., 2013).

Hypothesis H_{1e}: Financial professionals are susceptible to bias related to the use of *affect (emotion)* when they make financial decisions

Finally, regarding affect bias, the present study found that 44.9% of financial professionals exhibited susceptibility to this bias. This was apparent in their choice of a project with lower returns over another project with higher returns, but where there was a low probability of having to work with a manager who had evoked negative affect in them. A Wilson 95% binomial confidence interval confirmed that the responses of the financial professionals differed significantly from rationality. The present study's findings support those of similar studies conducted in a finance environment, which found that management accountants (Enslin, 2019; Fehrenbacher et al., 2020), professional auditors (Bhattacharjee & Moreno, 2002; Bhattacharjee et al., 2012), business managers (Kida et al., 2001), and investment fund managers (Moreno et al., 2002) were susceptible to affect bias.

The findings of the present study reveal that financial professionals use heuristics and are subject to biases, which may lead to suboptimal decision-making in certain circumstances. These findings are alarming, as almost the entire sample of financial professionals are either chartered accountants registered with the South African Institute of Chartered Accountants (SAICA) or are working at a SAICA-accredited training office to become a chartered accountant. These financial professionals are expected to "exercise professional judgement without being compromised by bias" (SAICA, 2022, p. 26). The SAICA Code of Professional Conduct outlines several biases which chartered accountants need to take cognizance of when applying professional judgement (SAICA, 2022, p. 40). These biases include confirmation bias, anchoring bias and overconfidence bias. The expectation would have been that the individuals in question received training as part of their educational background or at SAICA-accredited training institutions to equip them with awareness of these biases. However, the findings from the present study suggest that the awareness that was created was not enough to limit financial professionals' bias susceptibility.

8.2.2 Professional scepticism as a trait and bias in decision-making

Research Question 2 was investigated by means of seven hypotheses. The first hypothesis related to professional scepticism as a trait (H_2) and the other six related to the sub-constructs of professional scepticism as a trait, namely questioning mind ($H_{2.1}$), suspension of judgement ($H_{2.2}$), search for knowledge ($H_{2.3}$), interpersonal understanding ($H_{2.4}$), self-determining ($H_{2.5}$), and self-confidence ($H_{2.6}$). Each hypothesis is discussed with reference to the findings of the present study relating to the hypothesis (see Table 7.18 at the end of Section 7.7 for a summary of the results for the supported and unsupported hypotheses).

Hypothesis H_2: A relationship exists between *professional scepticism as a trait* 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

The present study contributes to the literature by being one of the first studies to show that no relationship exists between professional scepticism as a trait and the decision-making biases investigated in the present study. To the best knowledge of the author of the present study, no comparable studies have explored this relationship previously. Teye (2023) recently conducted a study on the same key variables, namely professional scepticism and bias, but that study analysed the opposite direction, in other words, the influence of bias on professional scepticism. Teye's (2023) findings suggest that optimism bias and framing bias reduce professional scepticism. These results differ from those of the present study, which raises the question of whether the relationship between professional scepticism and bias is bidirectional or there are other factors contributing to these differences.

The reason that no relationship was found in the present study might be ascribed to the sub-constructs in the scepticism trait having varying degrees of influence on the decision-making biases. The present study therefore delved deeper into the relationship between professional scepticism as a trait and decision-making biases by investigating the constructs comprising the scepticism trait and assessing whether these constructs have a relationship with decision-making biases.

Hypothesis $H_{2.1}$: A relationship exists between *questioning mind* and confirmation bias ($H_{2.1a}$), misconception of regression to the mean bias ($H_{2.1b}$), conjunctive events bias ($H_{2.1c}$), overconfidence bias ($H_{2.1d}$), and affect bias ($H_{2.1e}$) in the financial decision-making of financial professionals

The present study's findings revealed a negative relationship between having a questioning mindset and conjunctive events bias. These findings suggest that when an individual has more (less) of a questioning mindset, the predictive probability would be that they display lower (higher) susceptibility towards conjunctive events bias. These results support the study of Koch et al. (2016), who found that the evidence-related construct (measured by questioning mind, suspension of judgement and search for knowledge) decreased recency bias amongst a sample of professional auditors. Recency bias stems from the availability heuristic. These results support the importance of a questioning mind, which involves actively seeking underlying factors contributing to an event before accepting information, and its potential to reduce conjunctive events bias. However, this was only found to be important for one of the five biases investigated in the present study.

Hypothesis $H_{2.2}$: A relationship exists between *suspension of judgement* and confirmation bias ($H_{2.1a}$), misconception of regression to the mean bias ($H_{2.1b}$), conjunctive events bias ($H_{2.1c}$), overconfidence bias ($H_{2.1d}$), and affect bias ($H_{2.1e}$) in the financial decision-making of financial professionals

For suspension of judgement, the only significant relationship revealed was with overconfidence bias. The findings show that participants exhibiting this trait were more likely to underplace themselves than to overplace themselves. These findings suggest that people who allow themselves to gather more information before making decisions are more realistic regarding their abilities. This leads to underplacement rather than overplacememt. Again, the present study's findings support those of Koch et al. (2016), who showed that the evidence-related construct decreased recency bias amongst a group of professional auditors. As with questioning mind, this trait was only found to be important for one of the five biases investigated in the present study.

Hypothesis $H_{2.3}$: A relationship exists between *search for knowledge* and confirmation bias ($H_{2.1a}$), misconception of regression to the mean bias ($H_{2.1b}$),

conjunctive events bias ($H_{2.1c}$), overconfidence bias ($H_{2.1d}$), and affect bias ($H_{2.1e}$) in the financial decision-making of financial professionals

The findings for search for knowledge reveal a significant positive relationship with misconception of regression to the mean bias. These findings suggest that when people display higher (lower) levels of the search for knowledge trait, the predictive probability would be that they will also display higher (lower) susceptibility towards misconception of regression to the mean bias. These results differ from the findings reported by Koch et al. (2016), as the present study's findings suggest that having more of this trait made participants more susceptible to this particular bias. These results are the opposite of the expectation set by the literature, namely that applying higher levels of scepticism should improve the quality of judgements, and therefore mitigate bias in decision-making (Cruz et al., 2020; Hurtt et al., 2013). Neither Hurtt et al. (2013) nor Cruz et al. (2020) empirically tested this relationship.

A plausible explanation for these differences may be that the underlying constructs of scepticism as a trait influence biases stemming from various heuristics differently. These differing findings confirm the need emphasised by the present study to investigate the underlying constructs individually, as each of these constructs may have different relationships with decision-making biases.

Hypothesis $H_{2.4}$: A relationship exists between *interpersonal understanding* and confirmation bias ($H_{2.1a}$), misconception of regression to the mean bias ($H_{2.1b}$), conjunctive events bias ($H_{2.1c}$), overconfidence bias ($H_{2.1d}$), and affect bias ($H_{2.1e}$) in the financial decision-making of financial professionals

The present study revealed no significant relationship between interpersonal understanding and any of the biases investigated. These findings suggest that having more of an interpersonal understanding does not increase or mitigate decision-making biases. However, the manner in which the present study's questions were asked posed a limitation for the participants to be truly able to understand the motivations and assumptions of the "person" providing them with information. Therefore, as the present study did not specifically include an interpersonal aspect in the questionnaire, the lack of results is understandable.

Hypothesis $H_{2.5}$: A relationship exists between *self-determining* and confirmation bias ($H_{2.1a}$), misconception of regression to the mean bias ($H_{2.1b}$), conjunctive events bias ($H_{2.1c}$), overconfidence bias ($H_{2.1d}$), and affect bias ($H_{2.1e}$) in the financial decision-making of financial professionals

For self-determining, two significant relationships were found in the present study. Firstly, a positive relationship was identified with conjunctive events bias. These findings suggest that when people exhibit higher (lower) levels of the self-determining trait, the predictive probability would be that they would also display higher (lower) susceptibility to conjunctive events bias. These results are similar to those for the misconception of regression to the mean bias, where having the search for knowledge trait increased the bias in decision-making. Again, these findings are the opposite to what was anticipated, which yet again suggests that underlying constructs of scepticism as a trait influence biases stemming from various heuristics differently. The second relationship was found for overconfidence bias. These findings suggest that people with more self-determination are more likely to be rational, rather than to overplace themselves. These results indicate a different relationship compared to that with conjunctive events bias, with reference to the same trait (self-determining).

The differing results can be ascribed to the characteristics of the self-determining trait and how it may affect biases differently. This trait relates to being autonomous and independent, so as not to be persuaded by other people. The characteristics of the anchoring and adjustment heuristic from which conjunctive events bias stems may lead people to place too much importance on the anchor, as it is regarded as their own initial determination of the outcome. This may then elevate biases such as conjunctive events bias, where people anchor more heavily on their initial judgements and therefore underestimate new information that is presented and which is supposed to lead to new judgements (Bar-Hillel, 1973). For overconfidence, characteristics such as not being easily persuaded may allow people to resist social pressures, which in turn could make them less prone to overplacement. The literature has provided some evidence that being overconfident is sometimes driven by the people's status and influence in social settings (Moore & Swift, 2011, p. 173). If people are able to avoid this social pressure, they are able to take a more realistic perspective regarding their own abilities. In summary, the findings reveal that the self-determining trait can

potentially reduce the effects of some biases, but also increases susceptibility to others.

Hypothesis $H_{2.6}$: A relationship exists between *self-confidence* and confirmation bias ($H_{2.1a}$), misconception of regression to the mean bias ($H_{2.1b}$), conjunctive events bias ($H_{2.1c}$), overconfidence bias ($H_{2.1d}$), and affect bias ($H_{2.1e}$) in the financial decision-making of financial professionals

Lastly, the present study found no significant relationship between self-confidence with any of the biases investigated. This trait entails having the confidence to place value on one's own opinions. Findings from the present study suggest that having more or less of this trait does not mitigate or elevate bias. These findings support the argument that not all constructs in scepticism as a trait contribute to mitigating or elevating decision-making biases and that the underlying constructs should be considered individually.

The findings of the present study support the proposition that professional scepticism, particularly the underlying traits such as questioning mind, suspension of judgement and self-determining could improve decision-making. However, this relationship was only observed for some biases, such as conjunctive events bias and overconfidence bias. Conversely, the present study has also identified instances where traits such as search for knowledge and self-determining increased susceptibility to decision-making biases such as misconception of regression to the mean bias and conjunctive events bias. These findings therefore suggest that the underlying constructs of professional scepticism as a trait may play both an aggravating and mitigating role in financial professionals' susceptibility to decision-making biases. The present study was exploratory in nature, being the first of its kind to explore professional scepticism as a trait, its underlying constructs and the relationship with decision-making biases. As with all studies, its conclusions are subject to verification by future research studies.

The conclusion reached above is interesting, in light of the importance that professional accounting and regulatory bodies such as the ACCA, the IAASB, the International Federation of Accountants (IFAC) and the International Ethics Standard Board for Accounts (IESBA) place on professional scepticism being exercised by financial professionals in order to improve the quality of judgements and decision-making. Based on the present study's findings, professional scepticism as a trait had

no relationship with any of the five biases investigated in the present study, which was not in line with the expectation set by prior studies. However, four of the sub-constructs of professional scepticism as a trait had several significant relationships with some of the biases investigated in the present study, but not with all of them. This reveals the importance of investigating the underlying constructs of scepticism as a trait and its relationship with various biases. Further findings revealed the opposing relationships that some of the underlying constructs of scepticism as a trait had with a particular bias (where the underlying trait elevated bias in decision-making).

These results are surprising, considering that the IESBA Code of Ethics mandates all professional accountants to exercise professional scepticism. According to IESBA, this encompasses several interrelated concepts, such as professional competence and due care, integrity, professional behaviour and, in particular, objectivity (IESBA, 2023, p. 37; SAICA, 2022, p. 39). However, despite the fact that professional scepticism played a key role in some of the listed concepts, it seems to fall short in upholding objectivity. Objectivity, as outlined by the IESBA code, requires "the professional accountant to exercise professional or business judgement without being compromised by: Bias" (IESBA, 2023, p. 22; SAICA, 2020, p. 26). The present study focused only on heuristic related biases, but acknowledges that there are other conscious and unconscious biases that may also play a role in in how judgement is exercised. The findings do not consistently support the belief that increased scepticism may lead to unbiased judgement. Some underlying constructs within scepticism as a trait, such as search for knowledge and self-determining traits, may actually aggravate decision-making biases. These findings further suggest that professional scepticism as a trait does not support objectivity in all respects, which in some instances may potentially lead to higher susceptibility to bias, and therefore to lower quality judgement and decision-making.

8.2.3 Determinants and bias in decision-making

The literature has identified other determinants such as gender, age, experience and personality traits that may also influence financial professionals' susceptibility to decision-making biases. Although these determinants *were not the main focus* of the present study, the acknowledgement of these variables are important, as understanding their influence, together with professional scepticism as a trait, on bias

needed to be considered as well. These variables did not present an exhaustive list of determinants that may influence decision-making biases, so other variables could also exist. The main findings are summarised with reference to the four other determinants and the related hypotheses (see Table 7.18 at the end of Section 7.7 for a summary of the results of the supported and unsupported hypotheses).

8.2.3.1 Gender

Hypothesis 3 focused on the relationship between gender and the identified heuristic-related and other biases in the financial decision-making behaviour of financial professionals. The third hypothesis was divided into five sub-hypotheses for each of the five biases investigated. The first two hypotheses investigated the relationship between gender and confirmation bias (H_{3a}), and misconception of regression to the mean bias (H_{3b}) (two-sided). Additionally, a positive relationship between gender and conjunctive events bias (H_{3c}) and affect bias (H_{3e}) respectively was investigated (one-sided). Lastly, a negative relationship between gender and overconfidence bias (H_{3d}) was investigated (one-sided).

A significant positive relationship was found for both misconception of regression to the mean bias and conjunctive events bias. These findings suggest that women in the present study were more susceptible than men to both biases. For misconception of regression to the mean bias, the findings of the present study contradict those of AlKhars et al. (2019) and Lucena et al. (2021). Conversely, regarding conjunctive events bias, the present study's results align with those of Enslin (2019), who examined a group of management accountants. Additionally, the findings also support those of other studies investigating biases stemming from the anchoring and adjustment heuristic, such as the study of Kudryavtsev and Cohen (2010). For affect bias, the findings did approach significance. These results were positive, suggesting that women were more susceptible than men to affect bias. The literature has also highlighted that women have a stronger emotional reaction than men, which explains their susceptibility to affect bias (Bacha & Azouzi, 2019; Enslin, 2019).

8.2.3.2 Age

Hypothesis 4 focused on the relationship between age and the identified heuristic-related and other biases in the financial decision-making behaviour of financial

professionals. The fourth hypothesis was divided into five sub-hypotheses for each of the biases investigated. The first four hypotheses investigated the relationship between age and confirmation bias (H_{4a}), misconception of regression to the mean bias (H_{4b}), conjunctive events bias (H_{4c}), and overconfidence bias (H_{4d}) (two-sided). The last hypothesis investigated a negative relationship between age and affect bias (H_{4e}) (one-sided).

The present study found no significant relationship between age and any of the five individual biases. These findings support those of Enslin (2019), who examined a sample of management accountants and found no relationship between age and conjunctive events bias. Prior studies have provided mixed results across various decision-making environments. These mixed findings highlight the complexity of the relationship between age and decision-making biases.

8.2.3.3 Experience

Hypothesis 5 focused on the relationship between experience and the identified heuristic-related and other biases in the financial decision-making behaviour of financial professionals. The present study measured experience in two forms, namely general experience and decision-making experience. General experience reflected the total number of years of work experience that a participant had, whereas decision-making experience reflected the total number of years of experience a participant had in making key judgements in decisions. The fifth hypothesis therefore focused on general experience ($H_{5.1}$) and decision-making experience ($H_{5.2}$).

For $H_{5.1}$ the first two hypotheses investigated the relationship between the level of experience and confirmation bias ($H_{5.1a}$) and misconception of regression to the mean bias ($H_{5.1b}$) (two-sided). Additionally, a negative relationship was investigated between the level of experience and conjunctive events bias ($H_{5.1c}$) and affect bias ($H_{5.1e}$) (one-sided). Lastly, a positive relationship was investigated between the level of experience and overconfidence bias ($H_{5.1d}$) (one-sided).

Similarly, for $H_{5.2}$ a relationship was investigated between the level of decision-making experience and confirmation bias ($H_{5.2a}$) and misconception of regression to the mean bias ($H_{5.2b}$) (two-sided). A negative relationship between the level of decision-making experience and conjunctive events bias ($H_{5.2c}$) and affect bias ($H_{5.2e}$) was investigated

(one-sided). Lastly, a positive relationship was investigated between the level of decision-making experience and overconfidence bias ($H_{5.2d}$) (one-sided).

With reference to general experience ($H_{5.1}$), no significant results were found for any of the five biases investigated in the present study. For overconfidence bias, the findings did approach significance. Findings suggest a negative association between general experience and overplacement, which seems to indicate that participants with more general experience were more likely to overplace themselves than to underplace themselves. These findings support the literature, which suggests that some biases are not mitigated by more experience (Deaves et al., 2010; Doukas & Petmezas, 2007; Mishra & Metilda, 2015). Two significant relationships were revealed for decision-making experience ($H_{5.2}$). Firstly, a positive relationship was revealed for overconfidence bias which suggests that participants with more decision-making experience were more likely to underplace themselves than to overplace themselves. These results are the opposite of the results found for general experience and overconfidence and were not anticipated from the literature review. These findings contribute to the literature by highlighting that different measures for experience may yield different results.

The second significant relationship was found for decision-making experience and confirmation bias. For confirmation bias, the relationship was positive, which suggests that participants with more decision-making experience were more susceptible to this bias. Comparable prior studies were all conducted using samples of individual investors, and yielded mixed results, considering only field experience (experience in the investment environment only) (Chalissery et al., 2023; Ossareh et al., 2021; Park et al., 2010). Furthermore, prior research studies examining a sample of professional auditors reported a relationship between experience and affect bias (Bhattacharjee & Moreno, 2002; Henrizi et al., 2021), which the findings of the present study did not confirm.

Overall, the present study adds to the mixed results already derived from prior studies regarding the influencing role of experience on decision-making biases. It argues for more specific measures of experience.

8.2.3.4 Personality traits

Hypothesis 6 focused on the relationship between personality traits and the identified heuristic-related and other biases in the financial decision-making behaviour of financial professionals. The present study aimed to measure the Big Five personality traits. However, because of the limitations found as part of the statistical modelling, only extraversion and neuroticism could be measured. The sixth hypothesis focused on extraversion ($H_{6.1}$) and neuroticism ($H_{6.5}$). With reference to extraversion ($H_{6.1}$), the first hypothesis investigated the relationship between extraversion and confirmation bias ($H_{6.1a}$) (two-sided). The remaining four hypotheses investigated a positive relationship between extraversion and misconception of regression to the mean bias ($H_{6.1b}$), conjunctive events bias ($H_{6.1c}$), overconfidence bias ($H_{6.1d}$) and affect bias ($H_{6.1e}$) (one-sided). With reference to neuroticism ($H_{6.5}$), for the first four hypotheses, a positive relationship was investigated between neuroticism and confirmation bias ($H_{6.5a}$), misconception of regression to the mean bias ($H_{6.5b}$), conjunctive events bias ($H_{6.5c}$), and affect bias ($H_{6.5e}$) (one-sided). For one hypothesis, a relationship was investigated between neuroticism and overconfidence bias ($H_{6.5d}$) (two-sided).

With reference to extraversion ($H_{6.1}$), the present study found that financial professionals that displayed this trait were more susceptible to conjunctive events bias. Similar results were reported by Chalissery et al. (2023) in their study on other biases stemming from the anchoring and adjustment heuristic. With reference to neuroticism ($H_{6.5}$), the present study found that financial professionals that displayed this trait were less susceptible to affect bias. These results were not anticipated from the literature review, which tended to suggest that people who exhibit the neuroticism trait are more susceptible to affect bias (Baker et al., 2021; Khan & Abid Usman, 2021).

An important insight from the findings is the differentiating role that various determinants play in susceptibility to decision-making biases, particularly when one considers the different types of decision-makers and decision-making environments examined in prior research. The present study's focus was financial professionals accredited by the IAASB and the ACCA. Although some prior research included samples with similar backgrounds to the sample in the present study, such as auditors, accountants, financial analysts and tax practitioners, most studies were conducted on individual investors or in the investment environment, and therefore different results could be expected.

8.3 LIMITATIONS

The conclusions of the present study should be considered within the framework of the limitations which applied to the present study. The first limitation relates to the sampling method employed. Two non-probability sampling methods, namely convenience sampling and snowball sampling, were applied, which may have limited the diversity of the sample. As an online survey instrument was used, the researcher had no control over the circumstances in which the responses were framed, but one of the benefits of an online survey was that it led to larger sample size. Increased sample sizes assist in increasing the statistical power of the statistical techniques used and the ability to detect significant effects. Additionally, because the abovementioned sampling methods were used, most of the participants who completed the online survey were chartered accountants accredited by the SAICA, which may limit the generalisability of results, based on certain key demographics.

The length of the questionnaire ensured that a wide range of data could be captured, albeit accompanied by two limitations. Firstly, as a result of the length of time required to complete the questionnaire, a third of the participants did not complete the questionnaire. However, randomisation of questions helped to overcome fatigue and timing issues to obtain enough data to perform the advanced statistical techniques chosen. Secondly, only a limited number of behavioural aspects could be investigated, given the need to limit the length of the questionnaire. The heuristic-related and other biases investigated in the present study are not an exhaustive list of the biases commonly reported in the literature. It is possible that other biases, not included in the present study, are also applicable to financial professionals.

Finally, the last limitation relates to how the present study measured bias, which was constrained by the context that could be provided in an online survey instrument. The richness of the finance environment, for the defined financial professionals who participated in the present study, could therefore not be fully captured, which, in turn, may reduce external validity.

8.4 IMPLICATIONS OF FINDINGS AND RECOMMENDATIONS FOR FUTURE RESEARCH

8.4.1 Contributions to the field of knowledge

The present study provides important contributions to the field of knowledge in the following three main areas. Firstly, the study examines the behavioural manifestation of professional scepticism as a trait and decision-making biases, revealing the lack of an empirical relationship – a novel finding not explored in the literature. Furthermore, the present study provides evidence of the complex relationship between the underlying sub-constructs of scepticism as a trait and decision-making biases. Notably, traits such as questioning mind, suspension of judgement and self-determining have been identified as potentially having a mitigating effect on some decision-making biases, while other traits such as search for knowledge and self-determining may potentially exacerbate susceptibility to certain decision-making biases.

The second important contribution of the present study is offering a better understanding of the relationship between professional scepticism as a trait and decision-making biases amongst financial professionals. Contrary to the expectations from the literature and the views of professional accounting and regulatory bodies, the findings of the present study demonstrate that there is no significant relationship between the five biases investigated in the present study and professional scepticism as a trait. However, some of the underlying constructs in professional scepticism as a trait displayed significant relationships with specific biases, highlighting the importance of exploring the constructs of scepticism as a trait further. It was noteworthy that the present study uncovered unexpected relationships, where some traits of scepticism were found to exacerbate susceptibility to certain decision-making biases, therefore challenging the conventional assumptions. These findings raise critical questions regarding the effectiveness of the current practices which call on professional accountants to exercise professional scepticism as a trait to counter all forms of bias. Professional scepticism continues to be beneficial for decision-making, but it may not counter all heuristic-related biases. The IESBA Code of Ethics mandates professional accountants to exercise professional scepticism with the aim of upholding objectivity, with the expectation that this will reduce susceptibility to decision-making biases. The

findings suggest that advocating for strict adherence to professional scepticism as a trait with the aim of upholding objectivity may in fact increase certain biases, which potentially compromises the quality of judgements and decision-making.

Finally, the present study contributes significantly to an understanding of research methodology in this field, by employing an advanced statistical technique, SEM, to measure relationships between the decision-making biases and professional scepticism as a trait and its six related sub-constructs. This methodological approach has not been employed extensively with reference to measuring the relationship between variables such as professional scepticism as a trait, which consists of latent constructs and decision-making biases. The contribution of using this advanced statistical technique includes being able to measure a complex model with multiple variables and pathways, which makes it more suitable for relationships among latent constructs. Furthermore, SEM accounts for measurement error, thereby providing more accurate estimates of relationships between variables. Lastly, SEM is able to test causal relationships between variables, which helps to distinguish between direct and indirect relationships within a single model.

The next section elaborates on the implications of the present study's findings, recommendations for the practice and the possible areas for future research that were identified from the findings. The section is organised according to the main research areas addressed in the present study: heuristics and the biases of financial professionals, and determinants and bias in decision-making.

8.4.2 Heuristics and the biases of financial professionals

The findings of the present study revealed the susceptibility of financial professionals to decision-making biases. The implications for the practice are two-fold. Firstly, awareness needs to be created of the existence of various biases among financial professionals. This includes, but is not limited to, confirmation bias, misconception of regression to the mean bias, conjunctive events bias, overconfidence bias, and affect bias, and financial professionals' susceptibility to these biases. If professionals are made aware of and acknowledge the existence of these biases, they may be better equipped to determine how various biases may influence the quality of their judgements and decision-making. This view has been supported by professional

accounting bodies such as the ACCA (2017, 2022) and big audit firms (KPMG, 2011). The ACCA argued that awareness of cognitive biases needs to be increased to facilitate the design and implementation of systems and processes to be more resilient to these biases (ACCA, 2017, p. 10). The audit firm KPMG introduced “The KPMG Professional Judgement Framework”, which acknowledges people’s tendency to use shortcuts in their judgement processes, and that such shortcuts (heuristics) may lead to possible bias, which can be lowered, but possibly never entirely eliminated (KPMG, 2011, p. 35). The framework does, however, highlight the importance understanding these mental shortcuts to enable decision-makers to recognise situations where they may be biased.

Recommendations made by the literature to mitigate decision-making biases relate to the reinforcement required in the education and training system to improve the quality of financial professionals’ judgements and decision-making. This reinforcement needs to be implemented in the workplace, which can include training institutions but can also already be incorporated at university level. In practical settings in the workplace, targeted training can be provided, where trainees and professionals come to understand the various biases that exist in decision-making, but are also exposed to how these biases can be mitigated, specifically, in their decision-making domain.

Morewedge et al. (2015) have provided evidence that a single training intervention can improve bias in decision-making. Their single training intervention among a group of tertiary-educated individuals took the form of either an instructional video or a practical computer game, and showcased immediate improved decision-making, which persisted two to three months after the training intervention had been presented. Both interventions revealed significant debiasing effects, but the gaming intervention had the best results, driven by the personal feedback received and the opportunity to practise the decision-making embedded in the gaming intervention (Morewedge et al., 2015, p. 25). Such training interventions show promise as a possible area to explore as a debiasing intervention. Future research studies can be conducted to identify which debiasing techniques, from an educational or training perspective, would be most successful to help lower the susceptibility of financial professionals to these biases.

8.4.3 Determinants and bias in decision-making

For the main determinant of the present study, the findings revealed a complex interplay between professional scepticism as a trait, its underlying sub-constructs, and decision-making biases. The implications for the practice are two-fold. Firstly, the argument made by professional accounting and regulatory bodies advocating for professional scepticism as an important aspect of enhancing the quality of judgements and decision-making remains important on many levels for decision-making. However, the assumption that professional scepticism as a trait will automatically lower all levels of bias needs to be reassessed and requires more empirical evaluation. Crucial questions need to be raised regarding the effectiveness of current practices promoting professional accountants to exercise professional scepticism as a trait, since some elements of this trait may in fact exacerbate susceptibility to certain biases. Future research studies need to provide further evidence to support or contradict the relationship established by the present study. This is important, because of the limited number of prior research studies that have tested this relationship empirically, employing advanced statistical technique to measure these relationships. This may include expanding the testing to include similar populations at a later point in time, other populations, data collected on different biases as well as looking at the underlying constructs of professional scepticism as a trait and not just the entire construct. Further, future studies can investigate how to better measure the underlying traits, such as interpersonal understanding, to truly understand the respective relationships with decision-making biases.

Recommendations made by prior studies and professional accounting and regulatory bodies relate to the enhancement and development of professional scepticism. In context of the present study's findings this would help mitigate some decision-making biases but not all of them. The International Accounting Education Standards Board (IAESB) have highlighted the integral role professional scepticism as a trait plays in the skills set of professional accountants and the importance of developing skills such as a questioning mindset, curiosity, and critical thinking (IAESB, 2018). Agrawal et al. (2021, p. 214) supported this argument and believe some part of professional scepticism should be taught in the classroom, but that it needs to extend beyond that. Through evidence obtained from employers of accounting graduates and employees

of the accounting professional bodies, it was identified that both universities and professional accounting bodies need to play a role in developing this trait. University educators are required to introduce the term “professional scepticism” and develop foundational skills such as critical thinking and a questioning mindset. Seeing that professional scepticism as a trait is expected to be a stable trait, several key elements can only be developed through experience or on-the-job training. Consideration needs to be given to the role that education and training should play in developing professional scepticism as a trait, and specifically identify the elements (constructs) of scepticism as a trait that are worth developing.

For the four other determinants, namely gender, age, experience and personality traits, the present study contributes to the literature by broadening the scope of decision-makers and examining several determinants and susceptibility to biases in a finance decision-making environment. Most prior research studies reviewed considered individual investors or decision-makers in an investment environment. The present study considered a sample of financial professionals accredited by the IAASB and/or the ACCA, which may include auditors, accountants, financial analysts and tax practitioners. Mixed results were revealed when comparing the sample with similar qualification backgrounds from the literature to the present study. Future research may be warranted to determine the underlying factors contributing to these differences. This was evident particularly for gender and biases stemming from the representativeness heuristic, age and misconception of regression to the mean bias, experience and affect bias and lastly, the opposing findings found for neuroticism and affect bias.

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APPENDIX A:

INFORMED CONSENT AND SURVEY

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Faculty of Economic and

Management Sciences

Informed consent for participation in an academic research study

Dept. of Financial Management

Professional trait scepticism and behavioural bias in financial professionals' decision-making

Research conducted by

Mrs C. de Klerk (student id 29043192)

Cell: 073 925 0609

Dear Respondent

You are invited to participate in an academic research study conducted by Charisa de Klerk, a Doctoral student from the Department Financial Management at the University of Pretoria.

The purpose of the study is to determine the association between professional trait scepticism and behavioural bias in financial professionals' decision-making.

Please note the following:

- This study involves an anonymous survey. Your name will not appear on the questionnaire or your responses, and the answers you give will be treated as strictly confidential. You cannot be personally identified based on the answers you give.
- Your participation in this study is very important to us. You may, however, choose not to participate and you may also stop participating at any time without any negative consequences. If you withdraw, any answers you have already given will not be included in the research data.
- Please answer the questions in the attached questionnaire as completely and honestly as possible. This should not take more than 20 minutes of your time.

- The results of the study will be used for academic purposes only and may be published in an academic journal. We will provide you with a summary of our findings on request.
- The data will be stored securely for 10 years in line with the data storage policy of the University of Pretoria, and will be accessible only for research purposes to the principal researcher, Charisa de Klerk, and to the supervisors.
- Please contact the supervisors, Dr Z. Enslin or Prof. J.H. Hall if you have any questions or comments regarding the study (**click here** for their contact details).

Please select an option below before you click the continue button:

- I have read and understand the information provided above and I hereby consent to participate in the study on a voluntary basis.
- I prefer not to participate in the study.

SURVEY

(please note that all details marked in blue have been included for information purposes only, and was be removed from the final survey distributed to participants)

SECTION 1: DEMOGRAPHIC INFORMATION

QUESTION 1:

Please indicate your gender.

- Female
- Male
- Other (Please specify)
- Prefer not to say

QUESTION 2:

What is your current age (in years)?

QUESTION 3:

Of which of the following professional bodies are you a member? (You may select more than one, if applicable):

- ACCA (specify degree obtained)
- SAICA
- SAIPA
- IRBA
- Any other IAASB-associated professional body (specify)
- Studying towards becoming a member of SAICA (specify year of traineeship)
- Studying towards becoming a member of SAIPA (specify year of traineeship)
- Studying towards becoming a member of ACCA (specify number of exams passed, number of years of work experience and/or degree obtained)

QUESTION 4:

How many years of work experience do you have as a financial professional registered with the professional body/bodies chosen in the Question 3? This may include years of traineeship.

QUESTION 5:

For how many years have you been making **key decisions**?

Key decisions are considered decisions which can relate to either strategic, financial or operational decisions that may have a noticeable financial impact on business operations.

QUESTION 6: (Validated scale adopted from (Gosling et al., 2003))

Below, there are a number of personality traits that may/may not apply to you.

Please indicate to what degree you agree with the following statements.

Rate the extent to which the **pair** of traits on average applies to you, even if one characteristic applies more strongly than the other.

(1 = strongly disagree, 2 = disagree moderately, 3 = disagree a little,
4 = neither agree nor disagree, 5 = agree a little, 6 = agree moderately,
7 = strongly agree).

. **Text**	**Factor**	**Scale**						
I see myself as:		Strongly disagree	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree a little	Agree moderately	Strongly agree
1) Extraverted, enthusiastic	E_1	1	2	3	4	5	6	7
2) Critical, quarrelsome (R)	A_1	1	2	3	4	5	6	7
3) Dependable, self-disciplined	C_1	1	2	3	4	5	6	7
4) Anxious, easily upset (R)	N_1	1	2	3	4	5	6	7
5) Open to new experiences, complex	O_1	1	2	3	4	5	6	7
6) Reserved, quiet (R)	E_2	1	2	3	4	5	6	7
7) Sympathetic, warm	A_2	1	2	3	4	5	6	7
8) Disorganised, careless (R)	C_2	1	2	3	4	5	6	7
9) Calm, emotionally stable	N_2	1	2	3	4	5	6	7
10) Conventional, uncreative (R)	O_2	1	2	3	4	5	6	7

E = Extraversion; A = Agreeableness; C = Conscientiousness; N = Neuroticism/ Emotional stability; O = Openness to new experience; (R) = Reverse Scored Item.

SECTION 2: TRAIT SCEPTICISM (Validated scale adopted from Hurtt (2010))

Below, there is a list of statements that people use to describe themselves.

Select the response that indicates how you generally feel about each statement.

(1 = strongly disagree, 2 = disagree moderately, 3 = disagree a little,
4 = agree a little, 5 = agree moderately, 6 = strongly agree).

There are no right or wrong answers. Do not spend too much time on any one statement – go with your first intuition.

Text	Factor	Scale					
		Strongly	Disagree	Disagree a little	Agree a little	Agree	Strongly agree
1) I often accept other people's explanations without thinking about it further. (R)	SD_1	1	2	3	4	5	6
2) I feel good about myself.	SC_1	1	2	3	4	5	6
3) I wait to decide on issues until I can get more information.	SOJ_1	1	2	3	4	5	6
4) The prospect of learning excites me.	SFK_1	1	2	3	4	5	6
5) I am interested in what causes people to behave the way they do.	IU_1	1	2	3	4	5	6
6) I am confident of my abilities.	SC_2	1	2	3	4	5	6
7) I often reject statements unless I have proof that they are true.	QM_1	1	2	3	4	5	6
8) Discovering new information is fun.	SFK_2	1	2	3	4	5	6
9) I take my time when making decisions.	SOJ_2	1	2	3	4	5	6
10) I tend to immediately accept what other people tell me. (R)	SD_2	1	2	3	4	5	6
11) Other people's behaviour does not interest me. (R)	IU_2	1	2	3	4	5	6
12) I am self-assured.	SC_3	1	2	3	4	5	6
13) My friends tell me that I usually question things that I see or hear.	QM_2	1	2	3	4	5	6

14) I like to understand the reason for other people's behaviour.	IU_3	1	2	3	4	5	6
15) I think that learning is exciting.	SFK_3	1	2	3	4	5	6
16) I usually accept things I see, read, or hear at face value. (R)	SD_3	1	2	3	4	5	6
17) I do not feel sure of myself. (R)	SC_4	1	2	3	4	5	6
18) I usually notice inconsistencies in explanations.	QM_3	1	2	3	4	5	6
19) Most often I agree with what the others in my group think. (R)	SD_4	1	2	3	4	5	6
20) I dislike having to make decisions quickly.	SOJ_3	1	2	3	4	5	6
21) I have confidence in myself.	SC_5	1	2	3	4	5	6
22) I do not like to decide until I have looked at all of the readily available information.	SOJ_4	1	2	3	4	5	6
23) I like searching for knowledge.	SFK_4	1	2	3	4	5	6
24) I frequently question things that I see or hear.	QM_4	1	2	3	4	5	6
25) It is easy for other people to convince me. (R)	SD_5	1	2	3	4	5	6
26) I seldom consider why people behave in a certain way. (R)	IU_4	1	2	3	4	5	6
27) I like to ensure that I have considered most available information before making a decision.	SOJ_5	1	2	3	4	5	6
28) I enjoy trying to determine if what I read or hear is true.	QM_5	1	2	3	4	5	6
29) I relish learning.	SFK_5	1	2	3	4	5	6
30) The actions people take and the reasons for those actions are fascinating.	IU_5	1	2	3	4	5	6

SFK = Search for knowledge; SOJ = Suspension of judgement; SD = Self-determining; IU = Interpersonal understanding; SC = Self-confidence; QM = Questioning mind; (R) = Reverse Scored Item.

SECTION 3: BEHAVIOURAL BIASES

QUESTION 1 – Confirmation bias

A consultant claims that when he/she predicts the market will rise, it always does rise. You are required to check the consultant's claim using the following two groups of options:

A. A prediction that the market will rise.

B. A prediction that the market will fall.

QUESTION 2 – Confirmation bias

Which one of the following two options would you focus your search of actual outcomes on to determine whether the consultant's claim is correct or not?

C. Actual rises in the market after the prediction you selected above was made by the consultant.

D. Actual falls in the market after the prediction you selected above was made by the consultant.

QUESTION 3 – Misconceptions of regression to the mean bias

Which of the following scenarios would you prefer?

A. Investing in a business that has performed slightly above average in the recent past, compared to its peers (and that is accordingly priced slightly higher than the average price), because you feel that the business's above average performance is likely to be repeated in future.

B. Investing in a business that has performed slightly below average in comparison to its peers (and that is accordingly priced slightly lower than the average price), because you feel that the business's performance should improve somewhat in future.

QUESTION 4 - Conjunctive events bias

You consider proposing that your company acquire XYZ Corporation, because XYZ is developing a revolutionary new product. All five of the following steps are essential for XYZ to introduce the new product successfully:

1. successful defence of patent rights (95% probability of success);
2. product approval by the relevant national standards authority (90% probability of obtaining approval);
3. successful labour negotiations between the construction firms contracted to build the necessary addition to the present plant and the construction industry trade unions (80% probability of success);

4. successful negotiation of a long-term raw materials contract with a foreign supplier (90% probability of success); and
5. successful conclusion of distribution contract talks with a large national retail distributor (90% probability of success).

You may assume that the probability estimates above were provided by experts.

Based on your intuition, what is your judgement of the probability that XYZ will successfully introduce the new product? (Your acquisition decision would be based on this probability.)

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

QUESTION 5 – Overconfidence bias

How would you describe **your** ability to make **financial decisions**, compared to the financial decision-making ability of other **financial professionals <u>in general</u>**?

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

I have no ability compared to others

I have an average ability compared to others

I have greater ability, compared to others

QUESTION 6 – Overconfidence bias

In this section you will take a quiz consisting of 10 questions on mathematical and logical puzzles. You have 5 minutes to complete the task. Before you see the actual 10 questions, we will present two sample questions to give you an idea of the type of question asked.

- Five friends share three oranges equally. Each orange contains ten wedges. How many wedges does each friend receive?

Options:

A = 3

B = 4

C = 5

D = 6

- Fall is to summer as Monday is to _____?

Options:

A = Tuesday

B = Thursday

C = Sunday

D = Saturday

Before you take the quiz, we want you to guess how your score (number of correct answers) would compare to the scores of other financial professionals who take the quiz.

My score would be better than the score of the following percentage of other respondents:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%

QUIZ ITEMS

QUESTION 7.1

Hand is to glove as head is to…

A. Scarf
B. Cold
C. Glasses
D. Hat

QUESTION 7.2

If the day before yesterday is two days after Monday, then what day is it today?

A. Saturday
B. Sunday
C. Thursday
D. Friday

QUESTION 7.3

Which number should come next in this series: 3, 9, 6, 12, 9, 15, 12, 18?

A. 15
B. 21
C. 12
D. 9

QUESTION 7.4

Which letter logically follows in this sequence: T, Q, N, K, H?

A. D
B. E
C. F
D. H

QUESTION 7.5

Desert is to oasis as ocean is to…

A. Sand
B. Life
C. Island
D. Sun

QUESTION 7.6

What is the average of 12, 6 and 9?

A. 8
B. 9
C. 10
D. 12

QUESTION 7.7

Begin is to began as fight is to…

A. Fraught
B. Peace
C. End
D. Fought

QUESTION 7.8

There are three 600 ml water bottles. Two are full, the third is 2/3rds full. How much water is there in total?

A. 1200 ml
B. 1400 ml
C. 1500 ml
D. 1600 ml

QUESTION 7.9

If two typists can type two pages in five minutes, how many typists does it take to type twenty pages in ten minutes?

A. 6
B. 8
C. 10
D. 12

QUESTION 7.10

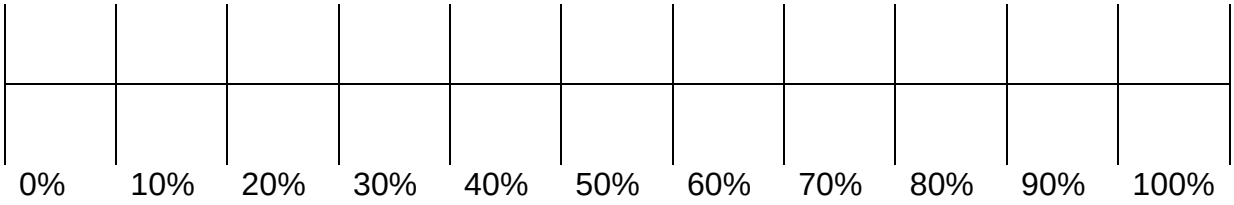
Brother is to sister as nephew is to?

A. Niece
B. Sister
C. Aunt
D. Mother

QUESTION 7.11

Now that you have taken the quiz, how do you think your answers would compare to the answers of other financial professionals who respond to this questionnaire?

My score would be better than the score of the following percentage (in 10% intervals) of other respondents:



QUESTION 8 – Affect bias

You are the manager of a division. You need to make an investment decision, choosing between two investment options. The risk of the investment options is judged to be the same.

If you choose investment **Option A**, you will have to work with Manager Y from a sister division (Division Alpha) of your company. You have worked with Manager A from Division Alpha in the past. You remember that Manager A continually told you that he was a key player in the company and that you could learn from him, even though you hold a similar position to his in your company and have comparable experience. Manager A also boasted that his superior management skills ensured that his staff performed more efficiently than your staff. The possibility that you may have to collaborate with Manager A again on some minor tasks related to this investment decision cannot be excluded.

If you choose investment **Option B**, you will have to work with Manager Z from another sister division of your company (Division Beta). You have worked with Manager B from Division Beta in the past, and maintained a friendly business relationship with him. The possibility that you may have to collaborate with Manager B again on some minor tasks related to this investment decision cannot be excluded.

The possible return profiles of the investment options are presented below. Which investment option would you choose?

A. Investment **Option A**: Possible return of R5 500 000 (55% probability), or R4 500 000 (45% probability). You will work with Manager Y, and there is a possibility that you will have to collaborate with Manager A again.

B. Investment **Option B**: Possible return of R5 500 000 (45% probability), or R4 500 000 (55% probability). You will work with Manager Z, and there is a possibility that you will have collaborate with Manager B again.

APPENDIX B:
CODING FOR OVERCONFIDENCE RESPONSES IN UNFAMILIAR CONTEXTS

CODING CATEGORY	EXPLANATION
1	If a participant placed themselves 12% or lower compared to other financial professionals, then a mark of less than 70% was expected for the participant to have actually achieved a score equivalent to their placement i.e., being ***rational***. If a participant achieved an actual mark higher than 70% but placed themselves 12% or lower compared to other financial professionals, then they would be regarded as being underconfident by ***underplacing*** themselves.
2	If a participant placed themselves between 13% and 28% compared to other financial professionals, then a mark of 70% was expected for the participant to have actually achieved a score equivalent to their placement i.e., being ***rational.*** If a participant achieved an actual mark higher than 70% but placed themselves between 13% and 28% compared to other financial professionals, then they would be regarded as being underconfident by ***underplacing*** themselves. If a participant achieved an actual mark lower than 70% but placed themselves between 13% and 28% compared to other financial professionals, then they would be regarded as being overconfident by ***overplacing*** themselves.
3	If a participant placed themselves between 29% and 53% compared to other financial professionals, then a mark of 80% was expected for the participant to have actually achieved a score equivalent to their placement i.e., being ***rational.*** If a participant achieved an actual mark higher than 80% but placed themselves between 29% and 53% compared to other financial professionals, then they would be regarded as being underconfident by ***underplacing*** themselves. If a participant achieved an actual mark lower than 80% but placed themselves between 29% and 53% compared to other financial professionals, then they would be regarded as being overconfident by ***overplacing*** themselves.

4	If a participant placed themselves between 54% and 81% compared to other financial professionals, then a mark of 90% was expected for the participant to have actually achieved a score equivalent to their placement i.e., being ***rational.*** If a participant achieved an actual mark higher than 90% but placed themselves between 54% and 81% compared to other financial professionals, then they would be regarded as being underconfident by ***underplacing*** themselves. If a participant achieved an actual mark lower than 90% but placed themselves between 54% and 81% compared to other financial professionals, then they would be regarded as being overconfident by ***overplacing*** themselves.
5	If a participant placed themselves between 82% and 100% compared to other financial professionals, then a mark of 100% was expected for the participant to have actually achieved a score equivalent to their placement i.e., being ***rational.*** If a participant achieved an actual mark lower than 100% but placed themselves between 82% and 100% compared to other financial professionals, then they would be regarded as being overconfident by ***overplacing*** themselves.

APPENDIX C:
SEM FIRST AND SECOND ORDER RESULTS

The tables presented below provides the complete set of results for all structural equation modelling (SEM) first and second order model results for confirmation bias, misconception of regression to the mean bias, conjunctive events bias and affect bias.

Confirmation bias SEM results

Table C.1: Confirmation bias – Second-order standardised model results

Relationship	Path Coefficient	Standard error	Two-tailed p-value	One-tailed p-value	Hypothesis supported
PS <— QM	0.800	0.044	0.000***		
PS <— SOJ	0.382	0.062	0.000***		
PS <— SFK	0.748	0.044	0.000***		
PS <— IU	0.611	0.045	0.000***		
PS <— SD	0.608	0.051	0.000***		
PS <— SC	0.365	0.057	0.000***		
CB <— PS	-0.069	0.086	0.421		
CB <— Gender	0.060	0.069	0.382		
CB <— Age	-0.088	0.205	0.670		
CB <— Experience	-0.028	0.208	0.892		
CB <— Decision-making experience	0.252	0.119	**0.034***		$H_{5.2a}$
CB <— E	-0.004	0.085	0.959		
CB <— N	0.062	0.093		0.506	

"A" Significant at the 10% level of significance ($p < .1$)
* Significant at the 5% level of significance ($p < .05$)
** Significant at the 1% level of significance ($p < .01$)
***Significance at the 0.1% level of significance ($p < .001$)

Table C.2: Confirmation bias – First-order standardised model results

Relationship	Path Coefficient	Standard error	Two-tailed p-value	One-tailed p-value	Hypothesis supported
CB <— QM	-0.183	0.267	0.493		
CB <— SOJ	0.132	0.117	0.261		
CB <— SFK	0.094	0.096	0.326		
CB <— IU	0.157	0.122	0.196		
CB <— SD	0.137	0.161	0.395		
CB <— CS	0.178	0.131	0.175		
CB <— Gender	0.060	0.069	0.382		
CB <— Age	-0.088	0.205	0.670		
CB <— Experience	-0.028	0.208	0.892		
CB <— Decision-making experience	0.252	0.119	**0.034***		$H_{5.2a}$
CB <— E	0.074	0.120	0.538		
CB <— N	-0.093	0.113		0.411	

"A" Significant at the 10% level of significance ($p < .1$)
* Significant at the 5% level of significance ($p < .05$)
** Significant at the 1% level of significance ($p < .01$)
***Significance at the 0.1% level of significance ($p < .001$)

Table C.3: Misconception of regression to the mean bias – Second-order standardised model results

Relationship	Path Coefficient	Standard error	Two-tailed p-value	One-tailed p-value	Hypothesis supported
PS <— QM	0.800	0.044	0.000***		
PS <— SOJ	0.382	0.062	0.000***		
PS <— SFK	0.749	0.044	0.000***		
PS <— IU	0.610	0.045	0.000***		
PS <— SD	0.608	0.052	0.000***		
PS <— SC	0.366	0.057	0.000***		
MRB <— PS	-0.050	0.088	0.569		
MRB <— Gender	0.224	0.071	**0.002****		H_{3a}
MRB <— Age	0.156	0.141	0.268		
MRB <— Experience	0.001	0.152	0.993		
MRB <— Decision-making experience	-0.229	0.147	0.120		
MRB <— E	-0.002	0.100		0.985	
MRB <— N	0.023	0.101		0.822	

"A" Significant at the 10% level of significance ($p < .1$)
* Significant at the 5% level of significance ($p < .05$)
** Significant at the 1% level of significance ($p < .01$)
***Significance at the 0.1% level of significance ($p < .001$)

Table C.4: Misconception of regression to the mean bias – First-order standardised model results

Relationship	Path Coefficient	Standard error	Two-tailed p-value	One-tailed p-value	Hypothesis supported
MRB <— QM	-0.146	0.177	0.410		
MRB <— SOJ	0.138	0.098	0.160		
MRB <— SFK	0.281	0.105	**0.007****		**$H_{2.3b}$**
MRB <— IU	-0.001	0.115	0.990		
MRB <— CD	-0.042	0.134	0.751		
MRB <— CS	0.171	0.128	0.183		
MRB <— Gender	0.224	0.071	**0.002****		**H_{3a}**
MRB <— Age	0.156	0.141	0.268		
MRB <— Experience	0.001	0.152	0.993		
MRB <— Decision-making experience	-0.229	0.147	0.120		
MRB <— E	0.081	0.128		0.526	
MRB <— N	-0.076	0.108		0.478	

"A" Significant at the 10% level of significance ($p < .1$)
* Significant at the 5% level of significance ($p < .05$)
** Significant at the 1% level of significance ($p < .01$)
***Significance at the 0.1% level of significance ($p < .001$)

Conjunctive events bias SEM results

Table C.5: Conjunctive events bias – Second-order standardised model results

Relationship	Path Coefficient	Standard error	Two-tailed p-value	One-tailed p-value	Hypothesis supported
PS <— QM	0.803	0.044	0.000		
PS <— SOJ	0.381	0.062	0.000		
PS <— SFK	0.740	0.045	0.000		
PS <— IU	0.615	0.046	0.000		
PS <— SD	0.624	0.051	0.000		
PS <— SC	0.363	0.058	0.000		
CEB <— PS	-0.107	0.098	0.275		
CEB <— Gender	0.234	0.077		**0.002***	**H_{3a}**
CEB <— Age	0.074	0.295	0.802		
CEB <— Experience	0.242	0.323		0.453	
CEB <— Decision-making experience	-0.135	0.167		0.418	
CEB <— E	0.194	0.095		**0.041[A]**	
CEB <— N	-0.081	0.108		0.454	

"A" Significant at the 10% level of significance ($p < .1$)
* Significant at the 5% level of significance ($p < .05$)
** Significant at the 1% level of significance ($p < .01$)
***Significance at the 0.1% level of significance ($p < .001$)

Table C.6: Conjunctive events bias – First-order standardised model results

Relationship	Path Coefficient	Standard error	Two-tailed p-value	One-tailed p-value	Hypothesis supported
CEB <— QM	-0.396	0.202	**0.050***		**$H_{2.1c}$**
CEB <— SOJ	-0.146	0.103	0.155		
CEB <— SFK	0.055	0.119	0.643		
CEB <— IU	0.118	0.106	0.262		
CEB <— SD	0.402	0.156	**0.010****		**$H_{2.5c}$**
CEB <— SC	0.118	0.137	0.388		
CEB <— Gender	0.234	0.077		**0.002***	**H_{3c}**
CEB <— Age	0.074	0.295	0.802		
CEB <— Experience	0.242	0.323		0.453	
CEB <— Decision-making experience	-0.135	0.167		0.418	
CEB <— E	0.119	0.137		0.388	
CEB <— N	0.075	0.122		0.537	

"A" Significant at the 10% level of significance ($p < .1$)
* Significant at the 5% level of significance ($p < .05$)
** Significant at the 1% level of significance ($p < .01$)
***Significance at the 0.1% level of significance ($p < .001$)

Affect bias SEM results

Table C.117: Affect bias – First-order standardised model results

Relationship	Path Coefficient	Standard error	Two-tailed p-value	One-tailed p-value	Hypothesis supported
PS <— QM	0.835	0.044	0.000		
PS <— SOJ	0.360	0.063	0.000		
PS <— SFK	0.697	0.043	0.000		
PS <— IU	0.618	0.047	0.000		
PS <— SD	0.657	0.050	0.000		
PS <— SC	0.396	0.056	0.000		
AB <— PS	-0.121	0.093	0.194		
AB <— Gender	0.134	0.073		0.066	
AB <— Age	0.019	0.167	0.908		
AB <— Experience	-0.036	0.175		0.837	
AB <— Decision-making experience	-0.022	0.130		0.865	
AB <— E	0.038	0.096	0.688		
AB <— N	-0.241	0.101		**0.017**[A]	

"A" Significant at the 10% level of significance ($p < .1$)
* Significant at the 5% level of significance ($p < .05$)
** Significant at the 1% level of significance ($p < .01$)
***Significance at the 0.1% level of significance ($p < .001$)

Table C.8: Affect bias – First-order standardised model results

Relationship	Path Coefficient	Standard error	Two-tailed p-value	One-tailed p-value	Hypothesis supported
AB <— QM	-0.175	0.171	0.307		
AB <— SOJ	0.104	0.103	0.312		
AB <— SFK	0.123	0.103	0.233		
AB <— IU	-0.041	0.108	0.708		
AB <— SD	0.158	0.132	0.232		
AB <— SC	0.138	0.132	0.298		
AB <— Gender	0.134	0.073		0.066	
AB <— Age	0.019	0.167	0.908		
AB <— Experience	-0.036	0.175		0.837	
AB <— Decision-making experience	-0.022	0.130		0.865	
AB <— E	0.136	0.130	0.295		
AB <— N	0.210	0.113		0.063	

"A" Significant at the 10% level of significance ($p < .1$)
* Significant at the 5% level of significance ($p < .05$)
** Significant at the 1% level of significance ($p < .01$)
***Significance at the 0.1% level of significance ($p < .001$)