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GORDON INSTITUTE
OF BUSINESS SCIENCE

University of Pretoria

Overconfidence bias in decision-making at different levels of management

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A research project submitted to the Gordon Institute of Business Science, University of Pretoria in partial fulfilment of the requirements for the degree of Master of Business Administration

9 November 2011

ABSTRACT

Behavioural economics has established that cognitive biases such as the overconfidence bias impact managerial decision-making. Literature has also shown that different levels of management require different skills, values and decision-making processes and styles. It would likely follow that cognitive biases would impact different levels of management in varying ways. This research seeks to expand on current literature in drawing on principles of behavioural economics to further investigate the overconfidence bias and its relationship with different levels of management. This research also seeks to explore whether cognitive ability or reflection can further explain any relationship between overconfidence and level of management.

A sample of managers at professional services firms was surveyed using various assessments of overconfidence. Utilising statistical techniques, it was found that in fact there were differences in overconfidence between levels of management. Specifically, middle management appeared to display different overconfidence tendencies than upper and lower management levels. The relationship between cognitive ability, level of management and the overconfidence bias also appeared to be significant enough to warrant further investigation. The results also showed insight into problems with the current definitions of overconfidence.

Based on the findings, this study concludes by providing several business and academic recommendations.

KEY WORDS: Cognitive bias, Overconfidence, Managerial decision-making, Cognitive reflection.

DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Name

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Signature

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Date

ACKNOWLEDGEMENTS

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Chapter 1

Decision-making is an important element of management which according to Hall "permeates throughout all levels of an organization" (Rahman & De Feis, 2009/10, p. 44).

1.1.   Introduction

The title of this research project is "Overconfidence bias in decision-making at different levels of management."

This study attempts to understand decision making at various levels of management with a particular focus on cognitive biases, specifically, the overconfidence bias, that impact on those decisions.

This chapter will introduce and define the research problem. It will provide the background and context of the research problem as well as motivating the need for this research. Finally, the scope of the research will be discussed.

1.2.   Background

Over the last few decades, behavioural economics has drawn on aspects of psychology and economics to make the assumption that despite the best efforts of management, cognitive biases will often prevent people from making rational decisions (Ariely, 2009). Behavioural economists bring forward the argument that "most human choice is not made deliberately and consciously by weighing up and evaluating all the possible variations and permutations" (Gordon, 2011, p. 173). Human beings in fact make suboptimal decisions as a result of "inherent biases built into our brains and bodies" (Gordon, 2011, p. 173).

Behavioural economics is essentially interested in human choices and how humans make decisions (Gordon, 2011). Since the initial discoveries of Herbert Simon on bounded rationality in the late 1950s, many academics have written about cognitive biases and their impact on managerial decision-making (Bazerman & Moore, 2009).

1.3. Problem Statement

"The global economic crisis has shattered two articles of faith in standard economic theory: that human beings usually make rational decisions and that the market's invisible hand serves as a trustworthy corrective to imbalance" (Ariely, 2009, p. 80). Ariely (2009) argues that companies can avoid catastrophic mistakes by adopting principles of behavioural economics. Other academics including Rotheli have also drawn attention to the behavioural tendencies of managers that led to the financial crisis (Rotheli, 2010).

Cognitive biases, and specifically the overconfidence bias, have also been discussed as reasons for failed mergers and acquisitions (Doukas & Petmezas, 2007). During the last two decades, US firms have spent over $3.4 trillion on over 12,000 mergers. At the announcement of merger bids, during the same period, the acquiring shareholders have lost over $220 billion (Malmendier & Tate, 2008). Overconfidence applies to the merger decisions of corporate managers, as managers tend to believe that future merger outcomes are under their control or they may overestimate synergy gains of potential mergers. "Overconfident managers, like investors with perceived superior stock-picking skills, are likely to engage in multiple acquisitions resulting in persistent inferior returns" (Doukas & Petmezas, 2007, p. 537).

The above cases highlight that academics are emphasising the irrationality of management decision-making and the importance for companies to learn and understand the causes of leader error.

Hunter, Tate, Dzieweczynski and Bedell-Avers (2011, p. 2) draw on previous literature and define a leader error as when "an avoidable action (or inaction) is chosen by a leader which results in an initial outcome outside of the leader's original intent, goal, or prediction". Understanding how and why leaders make errors in decision making is important for leaders and for those that are impacted by their decisions (Hunter, Tate, Dzieweczynski, & Bedell-Avers, 2011).

Management Consulting firm McKinsey & Co recently interviewed over 2000 executives in a survey about decision making. Sixty percent of executives surveyed felt that bad management decisions were as frequent as good management decisions (Lovallo & Sibony, 2010). Recognising cognitive biases and understanding them might help to limit the negative impacts of these errors or bad management decisions and can also assist in leadership development (Dai, Tang, & deMeuse, 2011).

Academics including Bhandari and Deaves (2006) and Hunter et al. (2011) have established that leaders are not rational, but are rather "human beings with flaws and biases" (Hunter et al., 2011, p. 6). Hunter et al. (2011) and other academics, discuss that cognitive biases are likely to influence the errors that leaders make in their decisions. Overconfidence is one such bias that has been identified as leading to suboptimal decision making results or errors (Bhandari & Deaves, 2006).

Different levels of management also play a vital role in the decision making process (Dai et al., 2011). "The way a successful manager approaches the decision making process changes as he or she moves up in the organisation" (Brousseau, Driver, Hourian, & Larsson, 2006, p. 111). Managers must in fact adjust their decision making style as their careers progress (Dai et al., 2011). One style mentioned by Brousseau is that some managers just look for the key facts. Behavioural economics refers to these managers as satisficers (Brousseau et al., 2006). Cognitive bias leads managers to satisfice in decision-making (Bazerman & Moore, 2009) and according to Brousseau et al. (2006, p. 115), "failing to evolve in how you make decisions can be fatal to your career". An understanding of the cognitive biases that impact on decision style will assist managers to evolve.

In addition to the link between decision-making and level of leadership, Frederick (2005) has also linked cognitive abilities with decision-making. He argues that decision researchers have been more interested in the average effect of experimental manipulation and tended to ignore individual differences in people such as cognitive abilities (Frederick, 2005).

A study of the current literature reveals that most authors that write in the field of behavioural economics and cognitive bias or leadership cover these fields separately. Recently, academics including Parker and Fischhoff (2005) and others have correlated decision making with certain variables including age, sex or cognitive ability (Parker & Fischhoff, 2005). Academics have now also linked specific biases such as overconfidence with cognitive ability (Parker & Fischhoff, 2005); (Hoppe & Kusterer, 2011).

The overconfidence bias has not however been associated to any particular level of management. The question still remains as to whether there is in fact a relationship between overconfidence and level of management. By understanding the overconfidence bias in greater detail, organisations will be able to play a more active role to counterbalance overconfidence (Malmendier & Tate, 2008).

Understanding biases and specifically the overconfidence bias may assist organisations to make better decisions.

1.4. Purpose

This study attempts to add to the academic landscape in investigating cognitive biases (specifically the overconfidence bias) in decision-making at various levels of management in an organisational hierarchy. Overconfidence is a cognitive bias that is extremely relevant in managerial decision-making and has been shown to affect behaviour on financial markets (Cesarini, Sandewall, & Johannesson, 2006).

Academics have shown the need to dive deeper into this area stating that "it would certainly … be valuable information if one could somehow discriminate between individuals that are more or less afflicted by behavioural phenomena" (Oechssler, Roider, & Schmitz, 2009, p. 147).

The purpose of the study is to further investigate the overconfidence bias by understanding the relationship between overconfidence and different levels of management. The cognitive ability of managers may further explain the relationship between management level and overconfidence. This

understanding should enable recommendations to be made to companies on decision-making and on mentoring and coaching of aspiring leaders.

1.5. Scope

The research project focused on decision-making and cognitive bias of managers. An online survey, investigating overconfidence and cognitive ability, was distributed to managers at different levels within service firms in South Africa. This research is limited to the overconfidence bias as other cognitive biases will not be investigated.

1.6. Structure of the Report

This document will follow a typical layout for a research report. The literature review discusses the current academic literature relating to behavioural economics and cognitive bias in management decision-making. Chapter two will refine the research problem based on pertinent literature and indicate the need for the research into cognitive bias across levels of management. Chapter three defines the precise purpose of the research and outlines the hypotheses and research questions used in testing the various developed propositions. The details of the methodology used for the research are provided for in Chapter four. Potential limitations are also discussed in Chapter four. Chapter five presents the results of the various statistical and other tests conducted on the received data. These results are then discussed and analysed in the context of the formulated research questions and literature review. This is done in Chapter six. Finally, Chapter seven brings the results together and highlights the main findings of the research, providing recommendations for academia and business.

Chapter 2

2.1. Introduction

Given the purpose of this research as bringing a number of management theories together, it is important to focus on each area.

Behavioural economics and specifically cognitive biases are a key element of this research. Herbert Simon is credited with the initial discoveries on bounded rationality in the 1950's (Bazerman & Moore, 2009). The overconfidence bias was first demonstrated by Albert and Raffia in 1969 (Bazerman & Moore, 2009). This study will focus on the overconfidence bias and looks more recently into academic literature to gain an understanding of overconfidence and its importance to managerial decision making.

This research will also examine the organisational hierarchy to determine its relationship to the overconfidence bias as well as looking at academic research on cognitive ability and how this may assist in explaining the relationship between management level and the overconfidence bias.

2.2. Behavioural Economics

The theory around cognitive bias in decision making can be traced back as early as 1957/8 when Herbert Simon went against rational economic thought to propose that judgment is in fact bound in its rationality (Bazerman & Moore, 2009). "Traditional economic theory postulates an 'economic man', who in the course of being economic is also rational … The concept of 'economic man' … is in need of fairly drastic revision" (Simon, 1955, p. 99). Sent (2005, p. 227), in her work discussing Simon's theories, explains that Simon's research started with the "conviction that human rationality was bounded due to external, social

constraints and internal, cognitive limitations". It is argued that rather than rational thought, "within the behavioural economic way of thinking, behaviour is king" (Gordon, 2011, p. 173).

As people's intentions do not always result in a particular expected behaviour, we can understand more about decision making by explaining actual decisions that get made (Gordon, 2011). Gordon (2011) states that peoples' choices and decisions are based on available information or rules of thumb called heuristics or biases, rather than perfect and absolute decisions.

Academics quote Kahneman and Tversky in describing cognitive biases that lead to errors in decision-making and feel that "biases entice decision makers away from making optimal decisions" (Das & Teng, 1999, p. 760). Gordon takes this approach further and states that "Most people are completely unaware of the heuristics or contextual factors that influenced the decision" (Gordon, 2011, p. 174).

Decision-making is a key element of behavioural economics and given the purpose of this research, it is necessary to understand decision making in more detail.

2.3. Decision-Making

In understanding decision-making, it is necessary to examine a number of elements. System thinking provides information on the cognitive processes behind decision-making, which then allows for a better understanding of decision-making processes and styles. This information is pivotal in positioning cognitive bias in decision-making.

2.3.1. System Thinking

Academics agree on the characteristics of two types of cognitive processes (Kahneman, 2003). These types of thinking and reasoning have been genericaly called System 1 and System 2 (Stanovich & West, 2000). The characteristics of the Systems are described in figure 1 below.

Figure 1 - Cognitive systems (Kahneman, 2003)
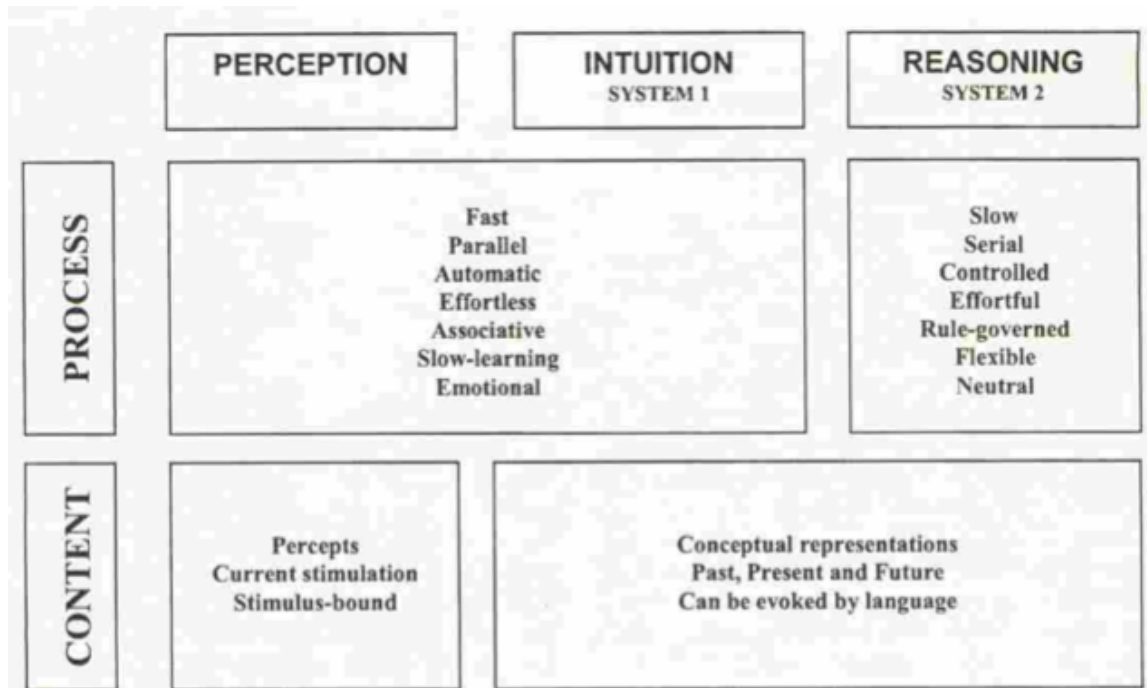
System 1 thinking is "automatic, largely unconscious and relatively undemanding of computational capacity" (Stanovich & West, 2000, p. 658). Operations of System 1 are generally fast, effortless and charged with emotion. This kind of intuitive thought comes to mind spontaneously (Kahneman, 2003). System 2 thinking is different in that it encompasses analytic intelligence (Stanovich & West, 2000), is slower and deliberately controlled (Kahneman, 2003).

Whether a decision should use System 1 or System 2 thinking is dependant on the amount of effort required. System 2 or effortful processes, overlap and impact on each other, whereas, System 1 or effortless processes do not "suffer much interference when combined with other tasks" (Kahneman, 2003, p. 1451). Decision makers have limited capacity for mental effort and therefore many decisions that require System 2 thinking are made using System 1. According to Kahneman (2003, p. 1463), "The preferences of System 1 are not necessarily consistent with the preferences of System 2". Decision shortcuts, or biases, are much more likely to occur in System 1 thinking (Bazerman & Moore, 2009).

2.3.2. Decision Making Processes

Hey and Knoll (2011) discuss three types of decision making processes. Aided analytical, unaided analytical and non analytical. "The three categories differ in their analytical degree, in the amount of required resources, and in the amount of information procurement" (Hey & Knoll, 2011, p. 400).

Decision processes can differ in terms of importance, ambiguity, complexity and time or monetary constraints. Decision makers also have individual differences with respect to knowledge of strategy, ability to implement and motivation. It is these characteristics of the decision problem and of the decision maker that will generally define the decision-making process or strategy (Hey & Knoll, (2011)).

Hey and Knoll (2011), cite academics in discussing the decision-making strategic selection. Decision-making strategies could be based on a cost benefit analysis with the strategy that maximises the net gain being selected. Decision

makers also tend to "adopt heuristics which may or may not approximate the optimal strategy" (Hey & Knoll, 2011 p. 400).

2.3.3. Decision Making Styles

Brousseau et al. (2006, p. 112) discuss several types of decision-making styles that differ in the fundamental ways of "how information is used and how options are created". In terms of information use, there are 'Maximisers' that strive to make well informed decisions and find the best possible answer, and there are 'Satisficers' that are "ready to act as soon as they have enough information to satisfy their requirements" (Brousseau et al., 2006, p. 112).

There are also managers that are 'single focus' that believe in taking one course of action in making a decision and those that are 'multifocused' that look at all possible options and could take several of them (Brousseau et al., 2006).

The decision making styles are summarised in figure 2 below.

Figure 2 - Four styles of decision-making (Brousseau et al*., 2006)*

Decisive and Flexible managers place a focus on speed and action. Whereas decisive managers will select a plan and stick to it, flexible managers are more adaptable and able to change course if needed (Brousseau et al*.,* 2006). Heirarchical and Integrative managers however are more focused on analysis and information gathering (Brousseau et al*.,* 2006).

Dai et al*.* (2010), discuss how managers' decision-making styles can evolve during a career. As discussed above, circumstances can also influence the decision-making style, with managers needing to potentially call on all four styles (Brousseau et al*.,* 2006).

Given the evolving decision-making styles of management, it can be expected that cognitive biases would impact different levels of management in different

ways. It is therefore imortant to explore the concept of cognitive bias in decision making.

2.4. Cognitive Bias in Decision Making

"People rely on a limited number of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgemental operations. In general, these heuristics are quite useful, but sometimes they lead to severe and systematic errors" (Kahneman, 2003, p. 1460).

Many biases have been identified. These heuristics and biases allow people to make judgements with incomplete and imperfect information (Sent, 2005). A number of them are discussed below.

Das and Teng (1999) cite Tversky and Kanemam and introduce the three major heuristics that are responsible for a number of biases. These heuristics are representativeness, availability, and adjustment and anchoring (Das & Teng, 1999).

The representative heuristic refers to managers relying on representative information or on information that corresponds with previously formed stereotypes (Bazerman & Moore, 2009). The availability heuristic explains that people assess situations by remembering similar past situations. "An event that evokes emotions and is vivid, easily imagined, and specific, will be more available than an event that is unemotional in nature, bland, difficult to imagine, or vague" (Bazerman & Moore, 2009 p. 7). Decision makers also tend to place

emphasis on an initial starting point (or anchor) without making sufficient adjustments later on (Das & Teng, 1999).

Some of the more common biases mentioned in literature include the ease of recall bias where managers make decisions based on what is vivid and recent; and regression to the mean where managers develop false assumptions without taking into effect that extreme events tend to "regress to the mean" (Bazerman & Moore, 2009).

The fundamental attribution error occurs where individuals draw conclusions about attributes and personalities of others even where reasonable causes for their behaviour exists (Hunter et al., 2011). This bias together with the "base rate fallacy" theorises that managers ignore certain information to rely on less relevant information. As an example, a manager may make a decision based on a recent piece of information rather than on years of prior information (Hunter et al., 2011). As discussed in Hunter et al. (2011) decision makers see what they want to see.

The final bias to be discussed is the hindsight bias which allows managers to believe that their judgment is better than it actually is. Managers innately believe that they could have predicted the outcome of events (Choi & Choi, 2010). This bias makes managers feel that the world is more predictable than it actually is (Russo & Schoemaker, 1992).

The availability bias, the anchoring bias, the confirmation bias and the hindsight bias are cited as cognitive causes for the overconfidence bias (Russo & Schoemaker, 1992).

Since this study focuses specifically on the overconfidence bias, emphasis will not be placed on this bias.

2.5. Overconfidence

"Having appropriate confidence is important for making appropriate risky decisions, for knowing when to seek advice and information, and for communicating one's knowledge" (Soll & Klayman, 2004, p. 312). However, managers can also display overconfidence.

"Overconfidence is the tendency for people to overestimate their knowledge, abilities and the precision of their information" (Bhandari & Deaves, 2006, p. 5).

Overconfidence was initially demonstrated by Albert and Raffia in 1969 and according to Bazerman and Moore (2009) can describe two phenomena. "The first is the tendency of individuals to express excessive belief in their own capacity" (Cesarini, et al., 2006, p. 454). Being too confident in our abilities can lead to blocking out of new evidence or alternative perspectives. The other overconfident phenomenon is the overestimation of the preciseness of knowledge, which leads managers to become overly optimistic about favourable outcomes (Hilton, Regner, Cabantous, Charalambides, & Vautier, 2011).

Hilton et al. (2011) consider Moore and Healy's definitions for overconfidence in discussing three kinds of overconfidence. Overestimating the precision of one's knowledge, overestimating the quality of one's performance and overestimating one's ranking in a group are called overprecision, overestimation and overplacement respectively (Moore & Healy, 2008). Overplacement is often referred to as the 'better than average effect' (Hilton et al., 2011).

Overconfidence leads investors to "overweight their own private information at the expense of ignoring publicly available information" (Chuang & Lee, 2006, p. 2490). Additionally, Chuang and Lee (2006) bring other academics to prove that overconfident investors mistakenly attribute market gains to their own ability to pick winning stocks. This leads to an underestimation of risk (Chuang & Lee, 2006).

Overconfidence is an extremely relevant bias for managers in many industries. It can affect behaviour on financial markets (Cesarini, et al., 2006), developing time and budgets to complete projects, and general strategic managerial decision-making. It is often used to explain the high rate of investment in mergers and acquisitions given the vast historical data showing that such ventures often fail (Malmendier & Tate, 2008). Specifically in mergers and acquisitions, overconfidence can be displayed by managers overestimating synergy gains of the merger. This may come from the belief that the manager's leadership skills are better than average (Doukas & Petmezas, 2007). It has been proven that "overconfident CEOs are unambiguously more likely to make lower-quality acquisitions when their firm has abundant internal resources" (Malmendier & Tate, 2008, p. 42).

Academics bring a number of case studies to highlight the implications of the overconfidence bias. Hunter et al. (2011) describe how overconfidence after prior successes led an overzealous CEO at Quaker foods to acquire a product line that was incongruent with the strategic plan and culture of the organisation. This ultimately resulted in losses to Quaker foods and the sale of the product line (Hunter et al., 2011). McKenzie shows how overconfidence in predicting a

range of sales can also have negative consequences on production capacity (McKenzie, Liersch, & Yaniv, 2008). In addition, Hilton et al. (2011, p119) states that "highly overconfident entrepreneurs run businesses that are less profitable than those run by less overconfident entrepreneurs".

A review of the literature therefore provides for a number of different definitions of the overconfidence bias. For the purposes of this study, the major focus will be on:

1. Overprecision;
2. Overestimation; and
3. Overplacement.

Clearly the overconfidence bias has been found to be relevant to management in decision-making. There is however, a distinct lack of literature surrounding this bias and the varying impact that it has on different types and levels of management.

A deeper insight into the bias will come from an understanding of how overconfidence has been assessed.

2.5.1. Assessment of Overconfidence

The different types of overconfidence have been tested using a number of methods. According to Hilton et al. (2011, p. 118), "Miscalibration depends at least in part on the format used to measure it." This means that depending on which test is used, different results for overconfidence may appear.

Overconfidence has been tested through experimentation with a confidence interval assessment test. In 1992 Russo and Schoemaker developed a test that has been cited extensively in academic literature (Hilton et al., 2011). The test involved a list of questions where participants had to provide high and low estimates such that the participant is ninety percent certain that the correct answer will fall within the set limits. It is expected that only ten percent of the answers should not lie in the correct ranges. The interval assessment test is a test of "what we do know and what we do not know" (Russo & Schoemaker, 1992, p. 8).

The Russo and Schoemaker study found that "of the 2000 plus individuals to whom we have given a ten question quiz using 90 percent confidence intervals, fewer than one percent were not overconfident" (Russo & Schoemaker, 1992, p. 9). This study therefore indicated that in general managers were overconfident.

Another test that is discussed in Cesarini et al. (2006) is called the frequency assessment or the probability estimation test. After the interval assessment, the participants were asked how many of their own answers in the interval assessment contained the true value. This test determined whether managers felt that they have done better than results show. The frequency assessment determines a manager's belief in their own capability (Cesarini et al., 2006).

By asking participants how many questions they believed their peers had answered correctly, Cesarini et al. (2006) used the peer frequency assessment to confirm that managers anticipate the overconfidence of others. In other words, did managers feel that other managers would be overconfident in answering the interval assessment?

Utilising the above tests for overconfidence, literature suggests that overconfidence is a managerial issue. However, there are other methods that in fact suggest a general "underconfidence rather than overconfidence in judgement" (Hilton et al., 2011, p. 119). These tests have not been considered in this review.

The current literature has started to correlate the overconfidence bias with age, gender and cognitive ability (Hoppe & Kusterer, 2011) however, there appears to be little research done to test the overconfidence bias across different leadership levels in an organisational hierarchy.

2.6. Levels of Management

To further understand the relationship between overconfidence and management level, it is important to delve into current management theory.

Recent studies including DeChurch, Hiller, Murase, Doty and Salas (2010), have highlighted that leadership needs are dependent on the leader's position and level within an organisation. DeChurch et al. (2010, p. 1069) conducted a study of the literature and found that theory and research has been focused on either the top levels of management, which is "generally the province of business scholars", or the lower level of management for psychology discussions. DeChurch et al. (2010) argues that not many research papers are level rich going into details on the different levels of management other than top and bottom.

Dai et al. (2011, p. 367) argue on this and state that "there is a rich tradition in the study of management that recognises changing managerial functions across

organisational levels". They go on to discuss the Pipeline model of leadership development as well as Stratified Systems Theory, both of which discuss varying roles and functional domains within an organisational hierarchy (Dai et al., 2011).

The leadership pipeline model was based on research initially done at General Electric in the 1970's (Drotter & Charan, 2001). The research was later taken to over 80 companies where Drotter and Charan developed a "six passage model for understanding the leadership requirements throughout an entire company" (Drotter & Charan, 2001, p. 22). This model is depicted in figure 3 below.

Figure 3 - Leadership pipeline model (Charan, Drotter, & Noel, 2001, p. 7)
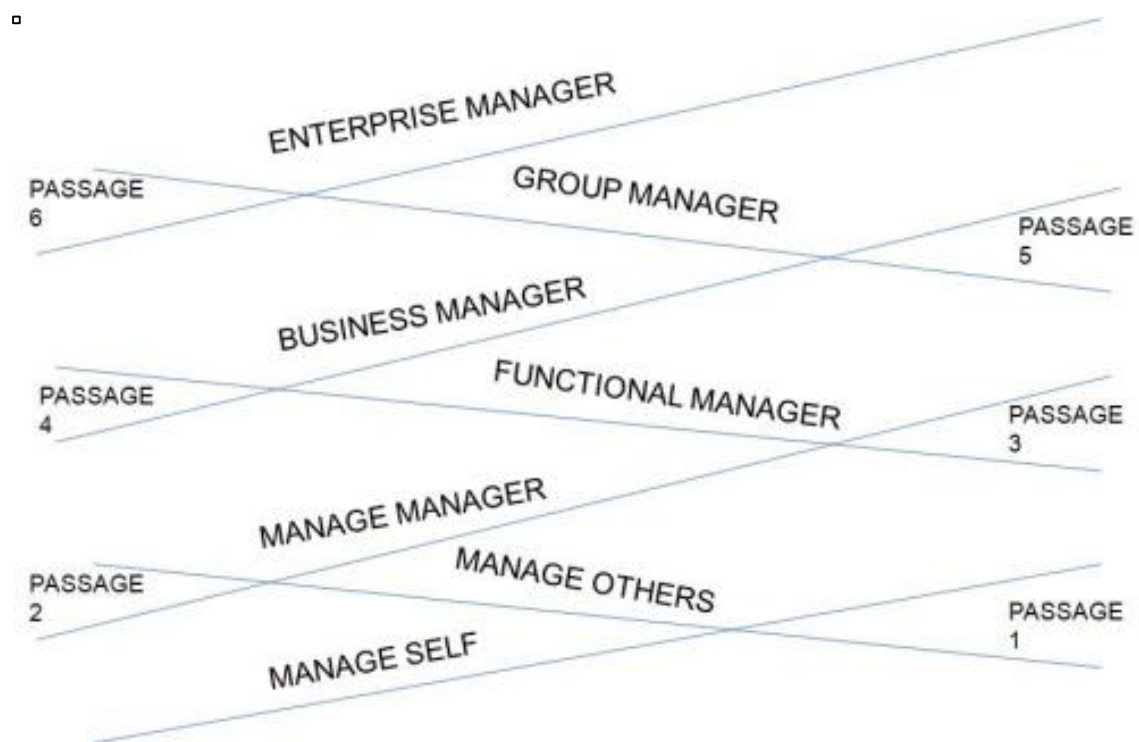
The leadership pipeline highlights that each transition or passage to a new level of leadership requires changes in job requirements, skills and values (Charan, Drotter, & Noel, 2001).

Charan, Drotter and Noel (2001) highlight that some of the transitions are more difficult then others. For example, passage 2 that requires a leader to move into the role of managing others can be particularly difficult as it is the first time that managers must concern themselves with strategic issues. Passage 3 is also difficult, as it requires a manager to start thinking about long-term strategy (Charan et al., 2001).

Stratified systems theory on the other hand presents three layers or functional domains of leadership; the production or command domain, the organisational domain, and the strategic domain (Dai et al., 2011).

The production or command domain is the lowest functional domain and involves concrete and accomplished tasks that require small group interactions. The organisational domain involves coordination of multiple subsystems in an organisation. The top level of leadership is the strategic domain. At this level, new business units are developed and nurtured, and networks are formed. Stratified systems theory identified different sets of leadership skills that are required at the various levels of leadership (Dai et al., 2011). Dai et al. (2011, p. 367) go on to explain that moving from the bottom levels of management to the top requires "increasing interpersonal and conceptual skills but less technical skills."

On a more simple level, three general levels of leadership have been identified in literature – lower, middle and upper (or supervisor, middle and executive) (DeChurch et al., 2010; Dai et al., 2011). The bottom level is leadership that involves supervision. Middle management establishes operational goals and coordinates the effort to meet these objectives. The top level is more strategic

and establishes the vision and objectives for the organisation (DeChurch et al., 2010).

Similar thinking is brought by Dai et al. (2011), that discusses leadership transition points in the course of a management career. Each transition, or level of leadership, "requires people to acquire new ways of managing" (Dai et al., 2011, p. 368).

It has also been identified that decision-making styles evolve during a management career (Dai et al., 2011). As a manager evolves from lower to upper management, the approach to decision-making also evolves (Brousseau et al., 2006). *The study done by Brousseau found that the predominant style for lower levels of management was decisive; while for higher levels of management a more flexible decision style was displayed (Dai et al., 2011).*

This could be explained by a theory proposed in Zaccaro and Klimoski (2001). Leaders are meant to give a sense of purpose and understanding to the strategies and activities of an organisation. This leads to a feeling that the leader (manager) needs to know what he is doing and that the decisions he makes will work (Zaccaro & Klimoski, 2001).

While exploring responses to decision-making situations, Jago and Vroom (1977, p. 131) found that there is a "consistent picture of increasing participativeness with increasing hierarchical level". It is recommended however, that further study be done to investigate the behaviours and competencies at different organisational levels (DeChurch et al., 2010). In addition, Dai et al. (2011) state that no study that has examined the evolvement

of leadership competency profiles (including specific biases that impact on those competencies) across organisational level of management has been done.

A review of the literature of levels of management appears to show varying degrees of differences in the required skills and values. The leadership pipeline theory has shown that transitions between levels are often difficult and require specific coaching. Different transition points from lower to middle to upper management often involve new challenges for managers which may impact on the way that a manager at those various levels makes a decision.

Literature discussing the stratified systems theory also states that the increasing complexity facing a manager as they progress through an organisation requires different skills and new ways of learning. In addition, upper levels of management require higher levels of cognitive ability (Fick, 2010).

2.7. Cognitive Ability

Behavioural studies have suggested a link between general cognitive abilities and decision-making (Del Missier, Mantyla, & De Bruin, 2011). Cognitive Ability may also play a role in explaining the relationship between overconfidence and level of management. As such, below is a review of academic literature on cognitive ability as it relates to cognitive biases.

"People with higher cognitive ability differ from those with lower cognitive ability in a variety of important and unimportant ways" (Frederick, 2005, p. 25). One of these differences according to Frederick is in judgement and decision-making

(Frederick, 2005). Parker and Fischhoff (2005, p. 16) found that "decision making performance was predictably related to measures of cognitive abilities".

From the literature, it appears that individuals with low cognitive abilities tend to be significantly more affected by behavioural biases (Hoppe & Kusterer, 2011). In fact, specific tests have been done correlating various cognitive biases including the anchoring bias (Oechssler et al., 2009), base rate fallacy and overconfidence with cognitive ability (Hoppe & Kusterer, 2011).

Cognitive ability or "IQ" has been assessed in many ways. In assessing the link between cognitive abilities and different decision making heuristics, academics like Stanovich and West (2008) utilised participants SAT scores. They felt that this was a good index of cognitive ability as it loads highly on psychometric testing (Stanovich & West, 2008). Other tests include the Wonderlic Personnel Test (WPT) and the Need for Cognition scale (NFC) (Frederick, 2005).

The cognitive reflection test (CRT) however, was developed by Frederick in 2005 and is currently being used in other academic literature (Oechssler et al., 2009; Hoppe & Kusterer, 2011) as a measure of one type of cognitive ability.

The CRT was shown to be predictive of decision-making theories. "The relation is sometimes so strong that the preferences themselves effectively function as expressions of cognitive ability" (Frederick, 2005, p. 26). CRT also compares favourably to more complex personality traits (Oechssler et al., 2009).

The CRT is a simple to administer, three item, test. The test is created with an intuitive answer that springs to mind. Solutions on the CRT, when explained,

appear easy. However to get to the correct answer, decision makers need to suppress a wrong answer that springs to mind (Oechssler et al., 2009).

Although some biases cannot be linked to cognitive ability, Stanovich and West (2008, p. 690) have found that "highly intelligent people will display fewer reasoning biases when you tell them what the bias is and what they need to do to avoid it".

Khaneman, (2003, p. 1450) discusses the high error rate in Frederick's cognitive problems which illustrates "how lightly the output of effortless associative thinking is monitored: people are not accustomed to thinking hard, and are often content to trust a plausible judgement that quickly comes to mind". *This shows that the CRT test and cognitive reflection is linked to decision-making and behavioural economics.*

The CRT has been used to differentiate between impulsive and reflective decision makers (Hoppe & Kusterer, 2011). As discussed, the link has been made between cognitive bias and cognitive ability. Experimentation found that subjects with high cognitive ability were in fact more accurate and less overconfident (Hoppe & Kusterer, 2011). Lower cognitive ability individuals tended to be both more overconfident and under-confident than individuals with higher cognitive ability (Hoppe & Kusterer, 2011).

2.8. Summary

This research proposes to bring together different academic findings to determine the impact of level of management and cognitive ability on the overconfidence bias.

Behavioural economists have recently brought the concepts of cognitive biases to the front of managers' minds. The literature on management theory is complex with the simplest form looking at only three levels of management. Cognitive ability testing has been around for a long time with academics recently linking decision-making processes with cognitive ability. There have also been proposed links between several of the factors.

Figure 4 - Relationship between variables
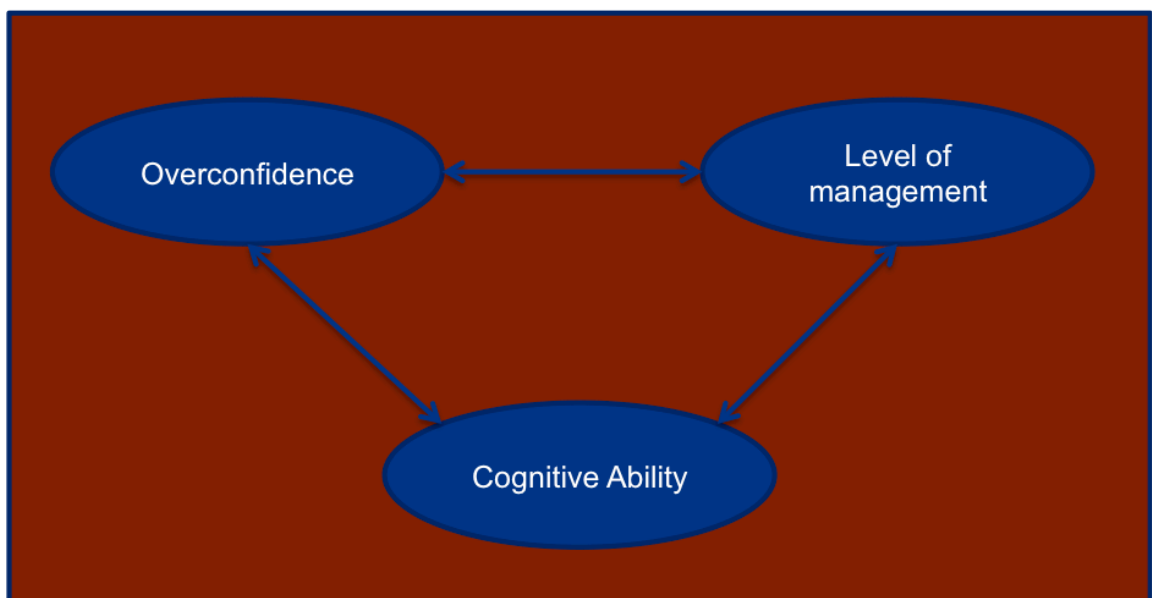
Figure 4 displays the three areas that are being looked at in this study. Academics have highlighted the gaps that exist in relation to these three areas. The following chapters of this research first raise some of the outstanding issues in this field and then purport to shed some light on them through a study of managers.

Chapter 3

3.1. Introduction

Chapters one and two provided the current academic thinking around cognitive biases and levels of management and the purpose and need for this study. The gaps in the literature are now explained as research questions and hypotheses to be tested in later chapters.

3.2. Research Problem

From the literature review, it is clear that cognitive biases play a major role in limiting the effectiveness of managerial decision-making. Further, it has also been suggested by Plous as quoted in Bazerman and Moore (2009, p 37) that "no problem in judgement and decision-making is more prevalent and more potentially catastrophic than overconfidence".

Although this study is not focusing on causality of overconfidence, an understanding of why managers may be overconfident can assist in creating an understanding of which managers are overconfident. As employees drive leaders to show confidence, this study aims to understand whether or not there is a relationship between levels of leadership and overconfidence.

As has been seen in literature, cognitive abilities can predict cognitive biases (Hoppe & Kusterer, 2011). This study also aims to understand how the cognitive ability of managers (specifically cognitive reflection) further explains the relationship between overconfidence and level of leadership.

This research aims to combine the three different areas of review being overconfidence bias, level of management and cognitive ability. As such, the following hypotheses will be tested and research questions explored.

3.3. Hypotheses

3.3.1. Overconfidence

H1: The overconfidence bias is evident at various levels of management.

Literature has shown that the overconfidence bias plays a role in management decision-making (Russo & Schoemaker, 1992). This study will aim to understand the various types of overconfidence across levels of management and to estimate the extent of the various types of overconfidence at the various levels.

Specifically, this study will focus on overconfidence defined as:

1. Overprecision;
2. Overestimation; and
3. Overplacement.

3.3.2. Overconfidence and Level of Management

H2: There are statistically significant differences between the levels of overconfidence displayed at different levels of management.

It is understood that managerial functions and decision-making styles change across organisational levels (Dai et al., 2011). This study investigates the speculation that the higher up the level of management, the more likely the manager will display an association with the overconfidence bias.

3.4. Research Questions

3.4.1. Cognitive Ability and Overconfidence

Research Question 1: To what extent is cognitive ability (reflection) related to overconfidence?

Literature suggests a link between decision-making and cognitive ability (Frederick, 2005). In the context of this study, this relationship is important, as the relationship between overconfidence and level of management may be impacted by the cognitive ability of the managers involved in the study.

3.4.2. Cognitive Ability, Level of Management and Overconfidence

Research Question 2: Does cognitive ability (reflection) define or moderate the relationship between overconfidence and level of management?

Besides any independent relationships that may exist between level of management and overconfidence; and cognitive ability and overconfidence, this research aims to determine whether a relationship exists between the combination of level of management and cognitive ability on the one hand and overconfidence on the other hand.

This research question aims to explore if cognitive ability (reflection) will have an impact on the relationship between level of management and overconfidence.

Chapter 4

4.1. Introduction

This research endeavoured to discover the association amongst various variables being the overconfidence bias, level of management and cognitive ability. The research was descriptive in nature in that it attempted to describe phenomena or characteristics associated with a subject population (Blumberg, Cooper, & Schindler, 2008). Quantitative analysis was conducted on the collected data to better understand the association between the variables. This chapter discusses the selected methodology and reviews the population, sample and unit of analysis for this study. The chapter concludes with the limitations of the study.

4.2. Research Design

A survey was distributed to the three levels of management as defined in DeChurch et al. (2010) being lower, middle and upper management. The survey was administered online to gather responses from the sample selected.

As noted in Blumberg et al. (2008), a survey is highly versatile and is a cost effective method of gathering information. By doing the survey online, it allowed for quick and easy data gathering and analysis. The online tool provided by Survey Monkey was used to administer the survey.

Questions had an upfront filter to assess the demographic of the sample. Demographics collected included, age, gender and level of management. Questions were then structured around the overconfidence bias and cognitive ability. Names were not collected to ensure anonymity for all participants.

The methodology for testing overconfidence and cognitive ability has been developed in previous literature and is described below.

4.2.1. Overconfidence

As discussed above, overconfidence can be used to describe a number of phenomena. The first phenomenon to be tested is the overestimation of the precision of one's knowledge (Hilton et al., 2011). This was tested using the *interval assessment* as described by Russo and Schoemaker (1992). The second overconfidence phenomenon is an excessive belief in one's own capacity (Cesarini et al., 2006), in oher words, overestimating the quality of ones performance (Hilton et al., 2011). This was tested using a *frequency asessment* as discused in Cesarini et al. (2006). Overplacement is the third type of overconfidence which is discussed in Moore and Healy (2008). This is often referred to as the 'better than average" effect and was tested using the *peer frequency assessment* as discussed in Cesarini et al. (2006).

4.2.1.1.   Interval Assessment

The interval assessment examines overprecision (Moore & Healy, 2008). The interval assessment was similar to that as administered by a number of academics including McKenzie et al. (2008), Russo and Schoemaker (1992) and Soll and Klayman (2004). The subjects were provided with 10 general knowledge questions with the following instructions:

"For each of the following questions, provide a low and a high estimate such that you are 90 percent certain the correct answer will fall within these limits. You should aim to have 90 percent hits and 10 percent misses." (Russo & Schoemaker, 1992, p. 8).

A correct answer is defined as providing an interval that contains the true value. A manager is deemed to be overconfident if they achieve less than 9 correct answers.

The extent of overconfidence (or under confidence) was then determined by subtracting the number of correct answers from 9 (being the amount that a participant should be aiming for).

The actual questions asked have been included in Appendix A.

The interval assessment has been found to successfully predict economically significant outcomes and is therefore seen to have external validity (Hilton et al., 2011). However, to account for other academic viewpoints like Cesarini et al. (2006), other methods of testing overconfidence were included.

4.2.1.2. Frequency Assessment

The frequency assessment was discussed in Cesarini et al. (2006). After the interval assessment, the participants were asked how many of their own answers in the interval assessment contained the true value.

Overconfidence in the frequency assessment is determined by subtracting the number of correct answers (in the interval assessment) from a participant's answer to the frequency assessment. This was used to determine whether managers feel that they have done better than results show. The frequency assessment determines a manager's belief (or excessive belief) in their own capability.

The wording of the questions asked has been included in Appendix A

4.2.1.3.   Peer Frequency Assessment

Participants were then asked how many questions they believed their peers had answered correctly. Cesarini et al. (2006) use the peer frequency assessment to confirm that managers anticipate the overconfidence of others. This study follows Hilton et al. (2011) and uses the peer frequency assessment to assess whether managers evaluate themselves as being better than others. The peer frequency score can be subtracted from the frequency score to determine overconfidence.

The wording of the questions asked has been included in Appendix A

4.2.2. Cognitive Ability

The cognitive ability test used was the cognitive reflection test (CRT) as defined in Frederick (2005) and used in Oechssler et al. (2009) and Hoppe and Kusterer (2011). The 3 questions read as follows:

1. A bat and a ball together cost 110 cents. The bat costs 100 cents more than the ball. How much does the ball cost? (Spontaneous answer: 10 cents; correct answer: 5 cents).

2. If it takes 5 machines 5 min to make 5 widgets, how long would it take 100 machines to make 100 widgets? (spontaneous answer: 100 min; correct answer: 5 min).

3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? (spontaneous answer: 24 days; correct answer: 47 days).

The above tests have been used extensively in literature and as such do not require a pilot application before being used in this study.

4.3. Population and Sampling

The population for this study is all managers across the three levels of an organisational hierarchy. As there is no sampling frame for this, the sample for the study was based on a non probability convenience sample (Blumberg et al., 2008). Managers at professional services firms within South Africa were used as the sample.

The level of management for employees in professional services firms is clearly defined as there is a hierarchical structure that consists of Managers, Senior Managers and Directors.

Managers at professional services firms are responsible for management of engagements but still require supervision on most tasks. Senior Managers are moving into the management realm of coordinating efforts to meet certain goals and objectives. They are also starting to become involved in strategic decisions. The directors at professional services firms are ultimately responsible for establishing vision and organisational strategy. These levels correlate with the levels of management defined in DeChurch et al. (2010), being lower, middle and upper.

The intention with the study was to achieve a high response rate from each level of management. In order to obtain a statistically significant response, over 30 responses from each level of management were obtained.

The unit of analysis for this study is the individual decision makers.

4.4. Data Gathering

The online survey was emailed to staff at professional services firms. As response rates can be traditionally low, a statement accompanied the link to the online survey from a senior level executive requesting staff members to complete the survey.

Additionally, individuals were approached personally to complete the survey. Managers were given 2 weeks to respond to the survey.

4.5. Data Analysis

In order to test the hypotheses and explore the research questions, a number of levels of analysis were performed on the data that was gathered from the survey.

4.5.1. Interval Assessment Hypothesis

The hypothesis for the interval assessment is written as follows:

$H_0: \mu I = 0$

$H_1: \mu I > 0$

where µI is the mean number of correct answers subtracted from 9. The null hypothesis suggests that on average, respondents are not overconfident.

4.5.2. Frequency Assessment Hypothesis

The hypothesis for the frequency assessment is written as follows:

$H_0: \mu_{F-I} \leq 0$

$H_1: \mu_{F-I} > 0$

where μ_{F-I} is the mean of the differences between the number of answers that each respondent thought he or she got right (F) and each respondent's actual number of correct answers (I).

This was a paired sample analysis. The null hypothesis indicates that respondents do not believe they got more right answers than they actually did and hence are not overconfident.

4.5.3. Peer Frequency Assessment Hypothesis

The hypothesis for the peer frequency assessment is written as follows:

$$H_0: \mu_{F-PF} \leq 0$$

$$H_1: \mu_{F-PF} > 0$$

where μ_{F-PF} is the mean of the differences between the number of responses each respondent thought he or she got right (F) and the number of answers that respondent believed his or her peers got right (PF).

This was a paired sample analysis. The null hypothesis indicates that respondents do not believe they got more right answers than their peers did and are not overconfident.

4.5.4. Levels of Analysis

Statistical significance tests were run on all of the below analyses where relevant. "A difference has statistical significance if there is good reason to believe that the difference does not represent random sampling fluctuations only" (Blumberg et al., 2008, p 744).

One sample T-tests were used when testing for significance of individual samples. These tests are used "to determine the statistical significance between a sample distribution mean and a parameter" (Blumberg et al., 2008, p. 757). The Kolmogorov tests are often used when comparing two independent samples where similar distributions are not assumed (Blumberg et al., 2008) and were used in this study to compare the various differences between levels of management.

In all of the significance tests in this study a significance level of 0.05 was selected.

Correlation is used to measure the strength of a relationship between variables, while regression is used to estimate the nature of the relationship (Blumberg et al., 2008). "With regression, an equation is developed to predict the values of a dependent variable" (Blumberg et al., 2008, p 790). It was hoped that this study would provide information to enable the prediction of overconfidence based on level of management and the cognitive ability of an individual.

The relationship between the variables was looked at across the various levels of analysis discussed below.

1. Simple descriptive statistics were examined to determine which levels of management are associated with the various overconfidence biases. This analysis was conducted on 2 levels:

   a) Are managers at particular levels overconfident?

   b) How overconfident are managers at the different levels of management? (the extent of overconfidence).

2. Pearson Correlations between different levels of management and overconfidence (are managers overconfident or not) were calculated to determine the strength of the relationship between a particular level of management and overconfidence. Statistical significance tests were conducted to determine if there is a meaningful difference between the levels of management.

3. Correlations between the extent of overconfidence and level of management were used to determine the strength of the nature of the relationship between overconfidence and level of management. In this case, overconfidence is the dependant variable. This determined whether, and to what extent different levels of management are overconfident.

   Initially it was intended to run regressions on the extent of overconfidence and level of management. It was quickly seen however that the level of overconfidence was not a linear progression through the various levels of management. It follows that it would not have been meaningful to attempt to perform a linear regression exercise.

4. Pearson correlations were calculated between cognitive ability and overconfidence.

5. The final stage of analysis combined the variables of cognitive ability and level of management to determine the extent of their joint association with overconfidence.

Table 1 below links the hypotheses and research questions to the research methodology used as well as the level of analysis.

Table 1 - Data analysis

| Hypotheses	Methodology	Level of Analysis
Hypothesis 1 The overconfidence bias is evident at various levels of management.	• Interval Assessment • Frequency Assessment • Peer Frequency Assessment	• Descriptive statistics
Hypothesis 2 There are statistically significant differences between the levels of overconfidence displayed at different levels of management.	• Interval Assessment • Frequency Assessment • Peer Frequency Assessment	• Correlations between different levels of management and overconfidence were calculated to determine the strength of the relationship between level of management and overconfidence.
Research Question 1 To what extent is cognitive ability (reflection) related to overconfidence?	• Interval Assessment • Frequency Assessment • Peer Frequency Assessment • CRT	• Correlations were calculated between cognitive ability and overconfidence
Research Question 2 Does cognitive ability (reflection) define or moderate the relationship between overconfidence and level of management?	• Interval Assessment • Frequency Assessment • Peer Frequency Assessment • CRT	• Analysis combining the variables of cognitive ability and level of management to determine the extent of their joint association with overconfidence.

Figure 5 below describes the relationship between the variables being investigated.

Figure 5 – Assessed relationship between variables
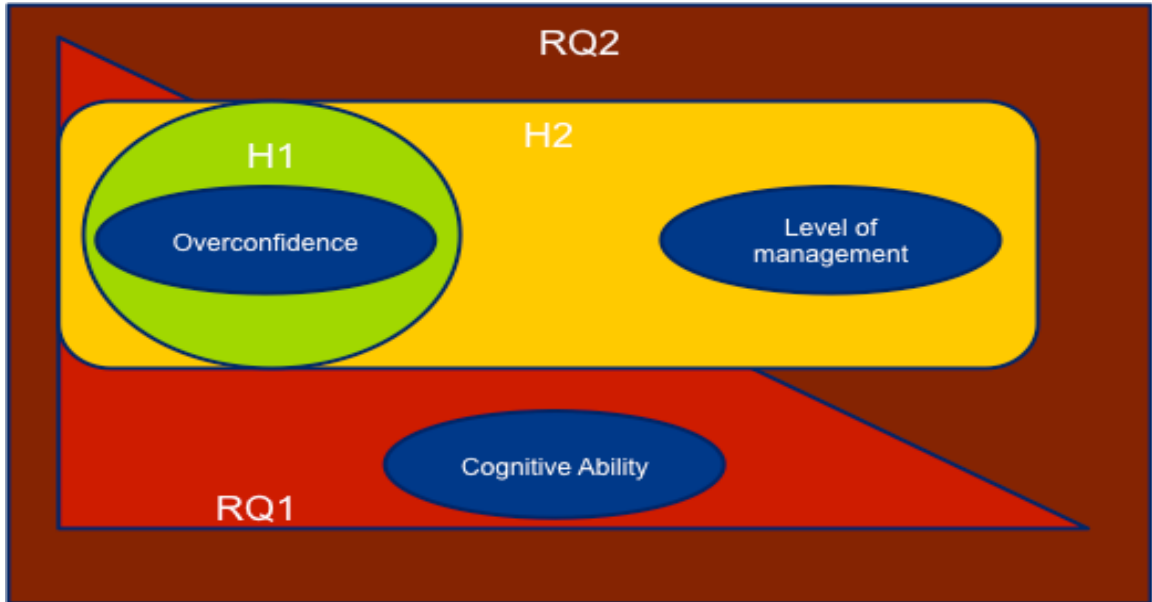
4.6. Limitations

In interpreting the results of this study, the researcher has taken consideration of the limitations associated with the study.

The sample is limited and specific to the services industry. The findings should therefore not be extrapolated across all management fields. A relatively small sample size could lead to sampling errors. This study has however reached a minimum threshold to make it relevant.

The tests chosen for both overconfidence and cognitive ability are only one of a number of tests available. The selected assessments for overconfidence have been utilised in academia and appear robust (Hilton et al., 2011). The test could be extended to include a test-retest methodology. Other overconfidence

assessment methods have found underconfidence. It would be useful to look at these tests and the impact they could have on this study.

It can also be argued that cognitive ability cannot be determined by the three questions as described in Frederick (2005). There are in fact many more detailed assessments that measure cognitive ability that could have been used. The CRT was a convenient assessment for the purposes of this study. There is also no time limit given to the survey which may allow managers too much time to try and get the answers right. It would be interesting to see the response times. The CRT has however been proven as a reliable test for cognitive reflection.

Other limitations include managers not understanding the relevance of the questions to the topic of decision-making and not answering all questions or not giving enough thought to them. The researcher did attempt to encourage managers to complete the survey with the required attentiveness.

Finally, as the survey was not done under laboratory conditions, it was uncertain whether managers were discussing the answers with each other or took a very long time to answer. Again to mitigate this, the researcher when encouraging managers to respond explained the importance of individual responses.

4.7. Conclusion

This chapter explained the process to be followed in conducting the research. An online survey was sent to managers at professional service firms. Various overconfidence tests and a cognitive reflection test were included in the online

survey. A number of levels of analysis were then performed to test or further

understand the provided hypotheses and research questions.

Chapter 5

5.1. Introduction

This chapter will present the results of the research that was undertaken for this study. The information will be presented in line with the hypotheses and research questions formulated in Chapter three and the methodology as proposed in Chapter four of this research.

An online survey was administered to assess the overconfidence bias at the three levels of management as defined in DeChurch et al. (2010) being lower, middle and upper management. The survey consisted of a section asking demographic based questions. This was followed by a set of questions aimed at assessing various aspects of the overconfidence bias and the cognitive reflection ability of the sample.

As discussed in Chapter four, the population for the study was all managers across the three levels of an organisational hierarchy. A non-probability sample of managers at professional services firms in South Africa was taken.

5.2. Demographics

The below is a presentation of the demographics of the sample that responded to the survey. The total number of respondents to the survey was 138. The gender, age and level of management of the respondents was collected and was comprised of the following:

5.2.1. Gender

The gender of the respondents was gathered in the survey and was split as seen in figure 6.

Figure 6 - Gender breakdown of respondents
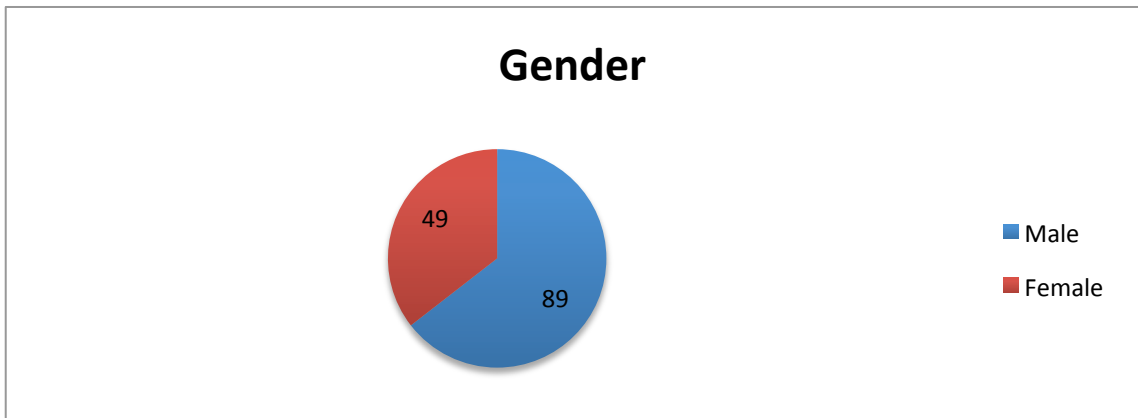
The majority of respondents were male with 35.5% of the respondents being female and 64.5% male.

5.2.2. Age

The age of the respondents was broken down into a number of categories. 20 - 29, 30-39, 40-49, 50-59, 60-69 and was split as below in figure 7.

Figure 7 – Age breakdown of respondents
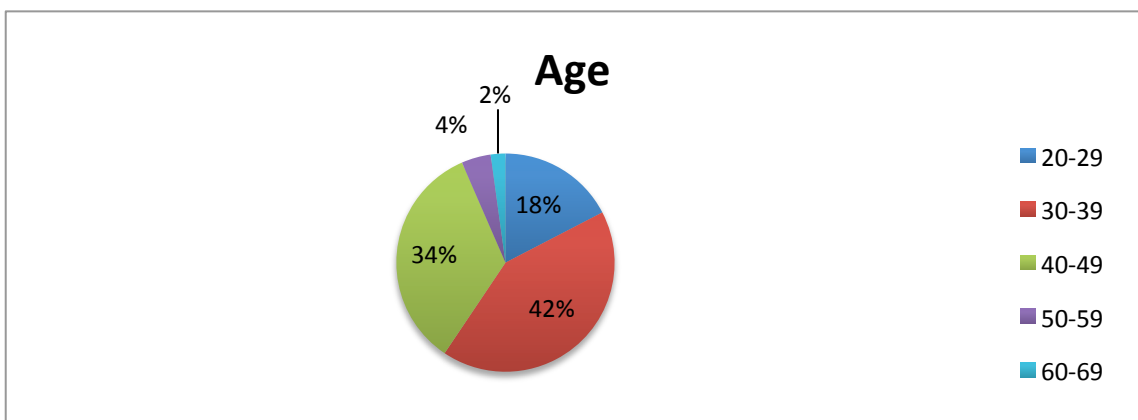
As can be seen above, the majority of respondents fell between the two age brackets of 30-39 (42%) and 40-49 (34%). The next largest age bracket was 20-

29 (18%) with over 50's (6%) only making up a small percentage of the respondents.

5.2.3. Level of Management

As discussed, there were three levels of management assessed. The respondents were broken up as in figure 8.

Figure 8 - Level of management of respondents
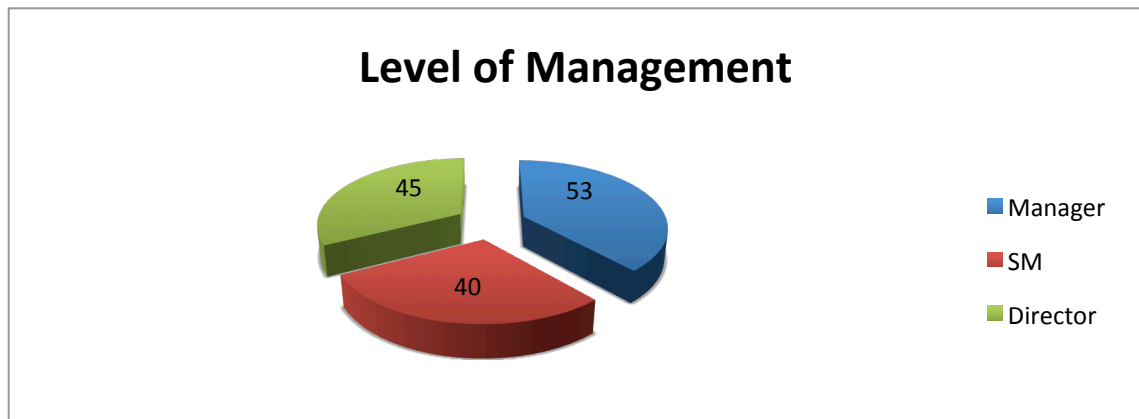
There was a fairly even split between the levels of management with managers making up 38.4% of the respondents, senior managers making up 29% and directors making up 32.6%.

5.3. Revisiting Methodology

5.3.1. Overconfidence

Overconfidence can be used to describe a number of phenomena.

The interval assessment, used to test overprecision, provided the respondents with 10 general knowledge questions. Respondents needed to provide a low and a high estimate such that they were 90% confident that the correct answer would fall within these given limits.

The frequency assessment, used to determine an excessive belief in one's own capacity, asked the respondents to answer how many of their answers to the interval assessment contained the true value.

Overplacement or the better than average effect, was tested using the peer frequency assessment. Respondents were asked how many questions they believed that their peers had answered correctly.

5.3.2. Cognitive Ability

The test used to determine cognitive ability was the CRT as defined in Frederick (2005). Respondents were asked three questions to test cognitive reflection (a proxy for cognitive ability).

5.3.3. Confidence Levels

A confidence interval of 95% was selected for all hypotheses. In all cases, where the computed p-value is less than 0.05, the null hypothesis is rejected.

5.3.4. Levels of Management

As discussed in Chapter 4, the sample for the study was management in professional services firms. The three levels that were assessed were managers, senior managers, and directors (incorporating associate directors). These three levels correlate with the three management levels being lower, middle and upper.

The results were captured and reported in terms of manager, senior manager and director. When discussing the results however, these levels are referred to as lower, middle and upper management.

5.4. Hypothesis 1

The first hypothesis for this study was that the overconfidence bias is evident at various levels of management.

5.4.1. Interval Assessment - General

Respondents were asked ten questions. These questions are provided for in Appendix A. As respondents were asked to work within a 90% confidence interval, the overconfidence result was calculated by subtracting the actual number of correct answers (being within the given upper and lower limits) from 9.

Table 2 - interval assessment descriptive statistics

Count	138
Average	5.99
Standard deviation	1.80
Coeff. of variation	30.14%
Minimum	0.0
Maximum	9.0
Range	9.0
Median	6.0

The average number of correct answers obtained was 3.01. As respondents were asked to work within a 90% confidence interval, this resulted in the average respondent being overconfident by 5.99 (9-3.01). This data has a standard deviation of 1.80. The lowest number of correct answers was 0 and the highest was 9.

For more detail on the frequency and distribution of the sample, see Appendix B.

Hypothesis Test for Interval Overconfidence

As presented in chapter four, the hypothesis for interval overconfidence can be written as follows:

$$H_0 : \mu I = 0$$

$$H_1 : \mu I > 0$$

where µI is the mean number of correct answers subtracted from 9. The null hypothesis suggests that on average, respondents are not overconfident.

The t-test tests the null hypothesis that the mean Interval overconfidence equals 0.0 versus the alternative hypothesis that the mean Interval overconfidence is greater than 0.0. Using a t-test, the computed t statistic is 38.97 with a P-Value of 0.0. Since the P-value for this test is less than 0.05, we can reject the null hypothesis at the 95.0% confidence level.

Therefore on average, when assessing overprecision using the interval assessment, all respondents were statistically significantly overconfident.

5.4.2. Interval Assessment – By Demographics

The interval assessment data was also reviewed at the various demographic levels of gender, age and level of management.

5.4.2.1.   Gender

Figure 9 - Interval overconfidence by gender
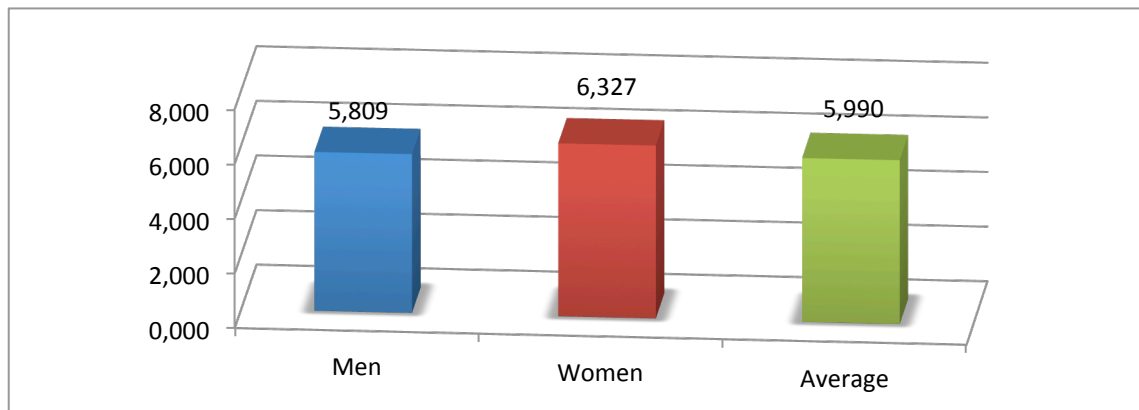
From the above figure, it appears that on the interval assessment, females (6.327) were more overconfident then males (5.809). In other words, the male respondents were able to provide more correct answers within the range provided.

As with the general tests, it can be clearly seen that both males and females were significantly overconfident. Using a Kolmogorov–Smirnov test to test for differences between the samples, an approximate P value of 0.0002 was calculated. Since this value is less than 0.05, there is a statistically significant difference between men and women on the interval assessment.

5.4.2.2. Age

Figure 10 - Interval overconfidence by age
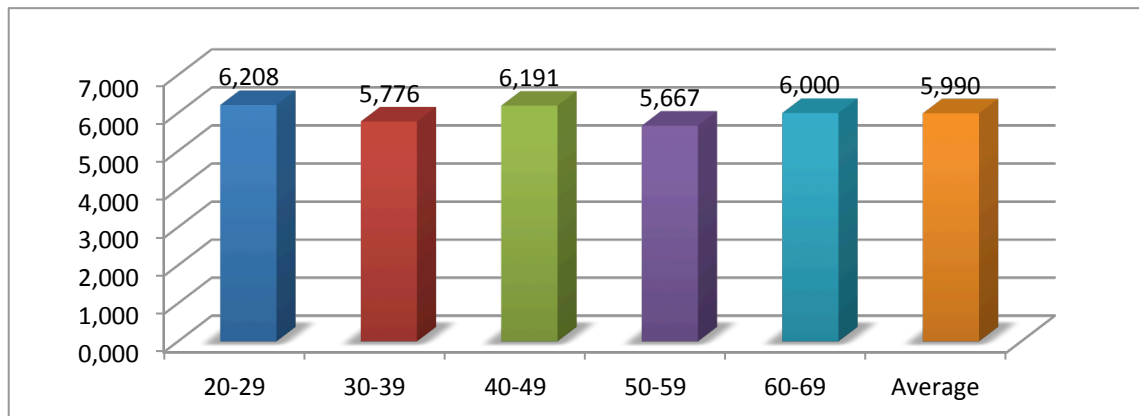
From the above figure, it appears that there is no real pattern with regards to age and overconfidence. The most overconfident were the youngest group (20-29) (6.208) with the least overconfident group being the 50-59 year olds (5.667).

As with the general tests, it can be clearly seen that all age groups were significantly overconfident.

5.4.2.3. Level of Management

Figure 11 - Interval overconfidence by level of management
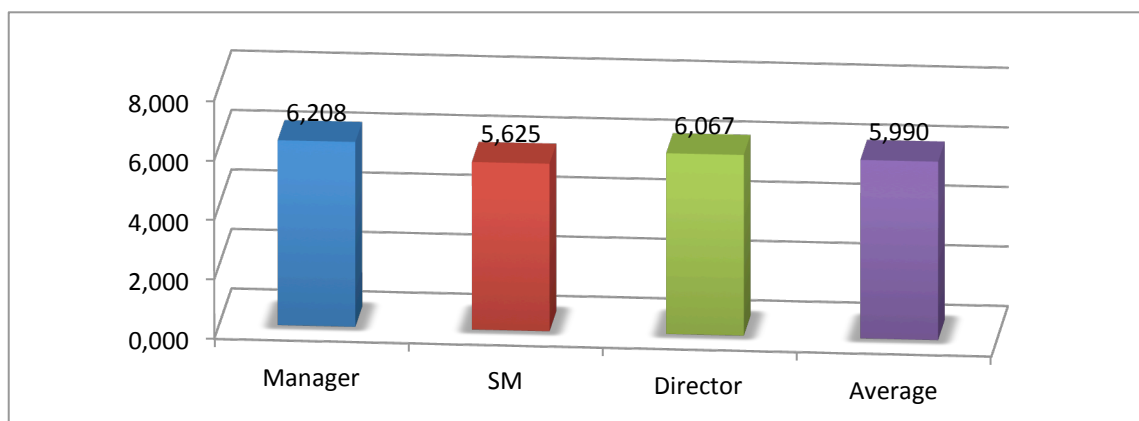
From the above figure, it appears that managers were the most overconfident (6.208) with senior managers being the least (5.625).

As with the general tests, it can be clearly seen that all levels of management were significantly overconfident. T-tests were run to determine the significance of the overconfidence at each level of management.

In each case, (manager, senior manager and director level), a P-Value of 0.0 was computed. Since the P-value for this test (in each case) is less than 0.05, we can reject the null hypothesis at the 95.0% confidence level.

Therefore at each level of management, when assessing overprecision using the interval assessment, all respondents were statistically significantly overconfident.

Significant differences between the levels of management will be discussed under hypothesis 2.

5.4.3. Frequency Assessment - General

The question that was asked in the frequency assessment was the following:

"Look back at the answers from section 2. Without changing any of the stated intervals, estimate how many of the 10 intervals you believe contain the true value. In other words, how many correct answers do you think you had in section 2?"

The overconfidence result was calculated by subtracting the number of actual correct answers from the number that the respondent believed were correct.

Table 3 - Frequency assessment descriptive statistics

Count	138
Average	2.73
Standard deviation	2.74
Coeff. of variation	100.13%
Minimum	-5.0
Maximum	10.0
Range	15.0
Median	3.0

As discussed above, the average number of correct answers obtained in section 1, was 3.01. The average response to the question of how many questions respondents thought they got correct was 5.74. This led to the average overconfidence of respondents being 2.73 with a standard deviation of 2.73. The least overconfident person actually got 5 more correct answers than anticipated (which means they were actually under-confident) while the most overconfident person thought they had all answers correct when in fact they had none.

For more detail on the frequency and distribution of the sample, see Appendix B.

Hypothesis Test for Frequency overconfidence

As presented in chapter four the hypothesis for interval overconfidence can be written as follows:

$$H_0 : \mu_{F-I} \leq 0$$

$$H_1 : \mu_{F-I} > 0$$

where μ_{F-I} is the mean of the differences between the number of answers that each respondent thought he or she got right (F) and each respondent's actual number of correct answers (I).

The null hypothesis indicates that respondents do not believe they got more right answers than they actually did and hence are not overconfident.

Using a t-test, the computed t statistic is 11.73 with a P-Value of 0.0 Since the P-value for this test is less than 0.05, we can reject the null hypothesis at the 95.0% confidence level.

Therefore on average, when assessing overestimation using the frequency assessment, all respondents were statistically significantly overconfident.

5.4.4. Frequency Assessment – By Demographics

The frequency assessment data was also reviewed at the various demographic levels of gender, age and level of management.

5.4.4.1. Gender

Figure 12 - Frequency overconfidence by gender
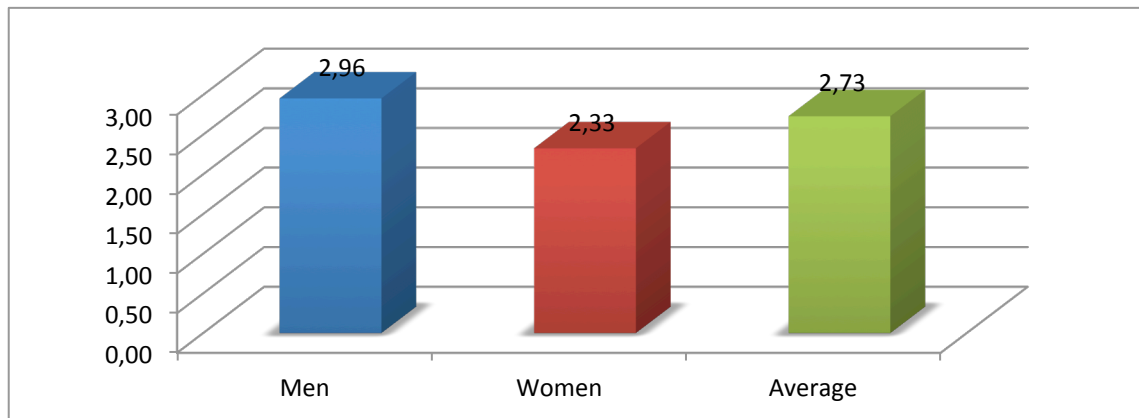
From the above figure, it appears that on the frequency assessment, females (2.33) were less overconfident then males (2.96). In other words, the female respondents were better able to predict how many correct answers they had.

As with the general tests, it can be clearly seen that both males and females were significantly overconfident. Using a Kolmogorov–Smirnov test to test for differences between the samples, an approximate P value of 0.013 was calculated. Since this value is less than 0.05, there is a statistically significant difference between men and women on the interval assessment.

5.4.4.2.   Age

Figure 13 - Frequency overconfidence by age
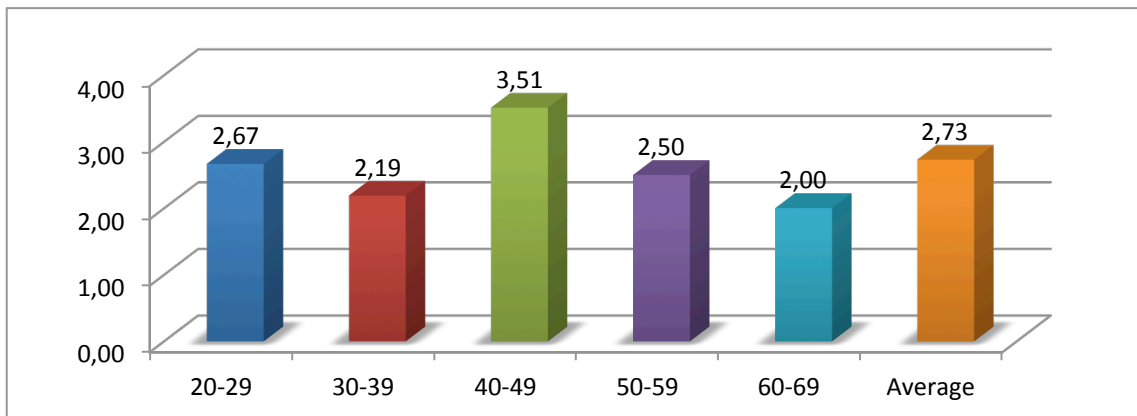
From the above figure, it appears that there is no real pattern with regards to age and frequency overconfidence. The most overconfident group (by quite a difference) was the 40-49 age group (3.51) with the least overconfident group being the 60-69 year olds (2.00).

As with the general tests, it can be clearly seen that when assessing overestimation using the frequency assessment, all age groups were significantly overconfident.

5.4.4.3.   Level of Management

Figure 14 - Frequency overconfidence by level of management
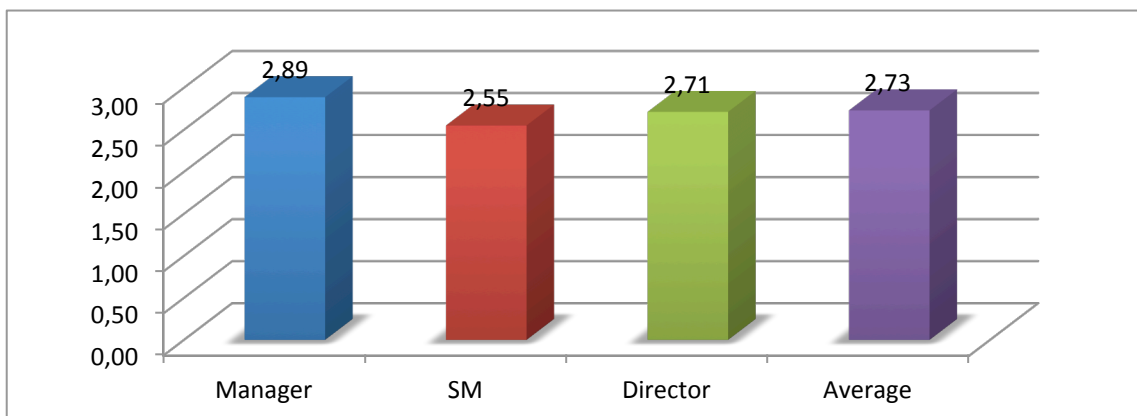
From the above figure, it appears that managers again were the most overconfident on the frequency assessment (2.89) with senior managers being the least (2.55).

As with the general tests, it can be clearly seen that all levels of management were significantly overconfident. T-tests were run to determine the significance of the overconfidence at each level of management.

In each case, (manager (8.24329E-11), senior manager (3.99233E-8) and director level (2.67373E-7)), a very low P-Value was computed. Since the P-value for this test (in each case) is less than 0.05, we can reject the null hypothesis at the 95.0% confidence level.

Therefore at each level of management, when assessing overestimation using the frequency assessment, all respondents were statistically significantly overconfident.

Significant differences between the levels of management will be discussed under hypothesis 2.

5.4.5. Peer Frequency Assessment - General

The question that was asked in section 4 was the following:

"All participants receive the same instructions as you do. State the average number of correct answers that you think the other participants have managed to capture with their confidence intervals. In other words, how many correct answers do you think the other participants had in section 2?"

Overconfidence was calculated by subtracting the answer to this question from the answer to the previous question in section 3 (frequency).

Table 4 - Peer frequency assessment descriptive statistics

Count	137
Average	0.139
Standard deviation	1.799
Coeff. of variation	1297.49%
Minimum	-10.0
Maximum	6.0
Range	16.0
Median	0.0

The average response to the question of how many questions respondents thought they got correct was 5.74 (section 3). The average response to section 4 was 5.62. This led to the average overconfidence of respondents being 0.139 with a standard deviation of 1.80.

For more detail on the frequency and distribution of the sample, see Appendix B.

Hypothesis Test for Peer frequency overconfidence

As presented in chapter four, the hypothesis for interval overconfidence can be written as follows:

$$H_0 : \mu_{F-PF} \leq 0$$

$$H_1 : \mu_{F-PF} > 0$$

where μ_{F-PF} is the mean of the differences between the number of responses each respondent thought he or she got right (F) and the number of answers that respondent believed his or her peers got right (PF).

The null hypothesis indicates that respondents do not believe they got more right answers than their peers did and are not overconfident.

Using a t-test, the computed t statistic is 0.902 with a P-Value of 0.184. Since the P-value for this test is greater than or equal to 0.05, we cannot reject the null hypothesis at the 95.0% confidence level.

Therefore on average, when assessing overestimation using the peer frequency assessment, it cannot be said that respondents are overconfident.

5.4.6. Peer Frequency Assessment – By Demographics

5.4.6.1. Gender

Figure 15 - Peer frequency overconfidence by gender
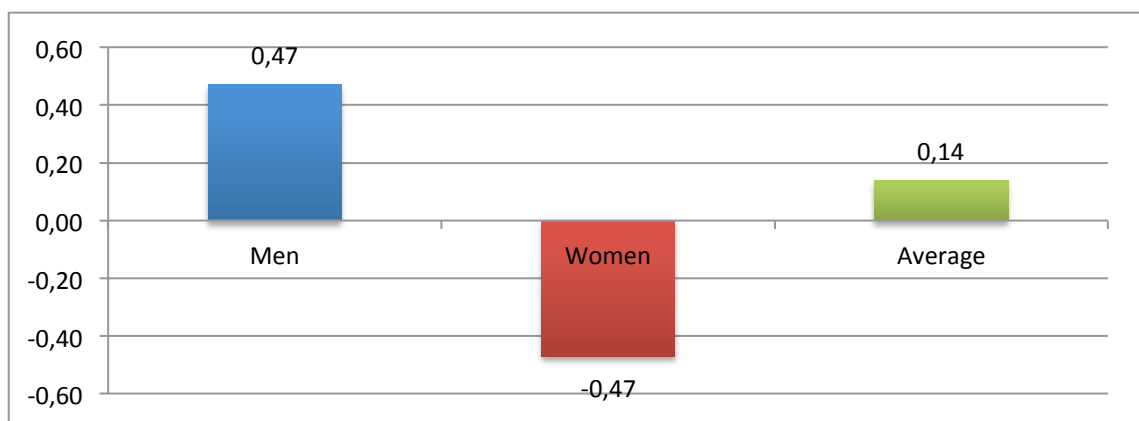
From the above figure, it appears that on the peer frequency assessment, females (-0.47) were less overconfident then males (0.47). In fact, females appear under-confident on this test, while males remain overconfident.

Statistically, using a t-test, it was established that men were statistically overconfident (P-value of 0.0003), while women (with a P-value of 0.96) were not overconfident. Men and women were statistically significantly different from each other.

5.4.6.2. Age

Figure 16 – Peer frequency overconfidence by age
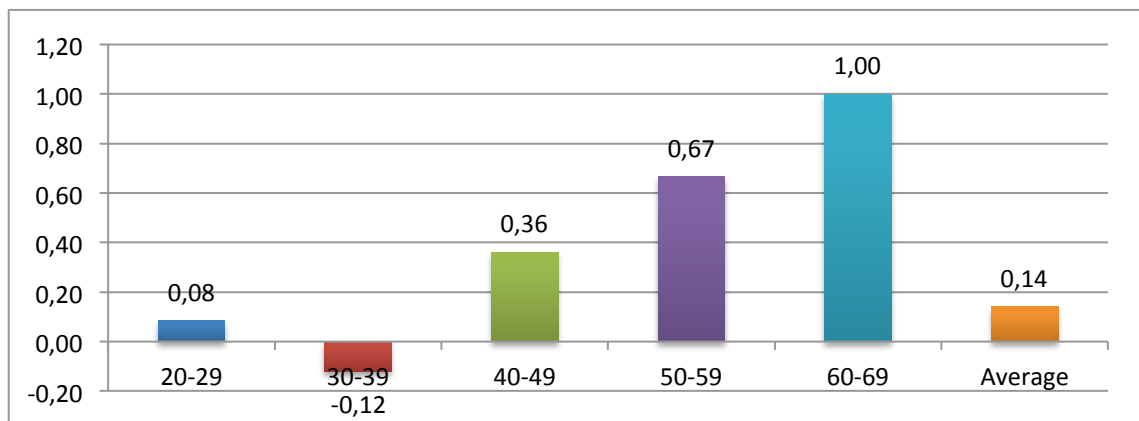
From the above figure, it appears that in terms of the "better than average effect", age may be a factor. The older groups (60-69, and 50-59) were generally more overconfident (1.00 and 0.67) than the younger ones (20-29, and 30-39) with scores of 0.08 and -0.12. However, it needs to be noted that the level of overconfidence for all the age groups was very low (0.14).

Figure 17 - Frequency overconfidence by level of management
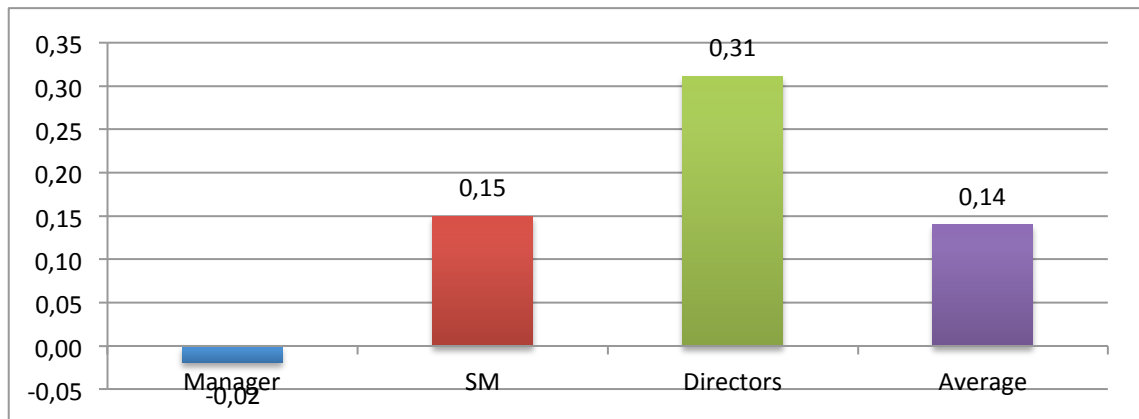
From the above figure, it appears that for the first time, managers were not the most overconfident (-0.02); in fact they appear to have been under-confident on the peer frequency assessment. All levels of management displayed extremely low, if any, levels of overconfidence on this assessment.

T-tests were run to determine the significance of the overconfidence at each level of management.

Manager:

When testing for significance at the manager level, the computed t statistic was -0.078 with a P-Value of 0.53. Since the P-value for this test is greater than or equal to 0.05, we cannot reject the null hypothesis at the 95.0% confidence level.

Therefore at manager level, when assessing overplacement using the peer frequency assessment, the respondents were not statistically significantly overconfident.

Senior Manager:

When testing for significance at the senior manager level, the computed t statistic was 0.408 with a P-Value of 0.343. Since the P-value for this test is greater than or equal to 0.05, we cannot reject the null hypothesis at the 95.0% confidence level.

Therefore at senior manager level, when assessing overplacement using the peer frequency assessment, the respondents were not statistically significantly overconfident.

Director:

When testing for significance at the director level, the computed t statistic was 1.709 with a P-Value of 0.047. Since the P-value for this test is less than 0.05, we can reject the null hypothesis at the 95.0% confidence level.

Therefore at director level, when assessing overplacement using the peer frequency assessment, the respondents were statistically significantly overconfident. However, if we were to use a lower alpha for a higher confidence level, directors too would not be statistically significantly overconfident.

Summary:

Using the peer frequency assessment, only directors displayed statistically significant overconfidence.

Significant differences between the levels of management will be discussed under hypothesis 2.

5.4.7. Demographic Clusters

In looking at the clusters, all three assessments for overconfidence were reviewed to gain a better understanding of overconfidence per demographic cluster.

5.4.7.1. Gender

Figure 18 - Overconfidence by gender
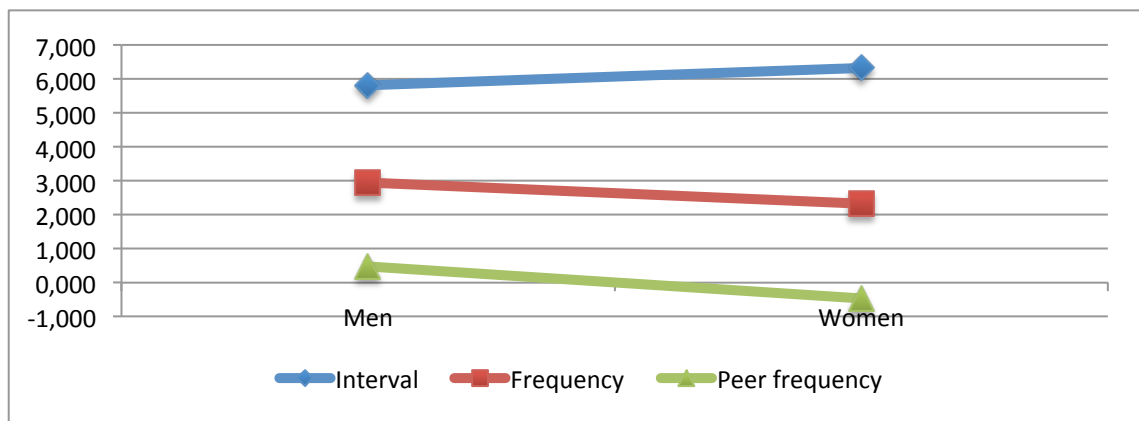
The above figure shows that on the interval assessment (overprecision), women tended to be more overconfident than men. When it comes to assessing one's own ability either on a task or compared to others, women tended to be less overconfident then men.

5.4.7.2. Age

Figure 19 - Overconfidence by Age
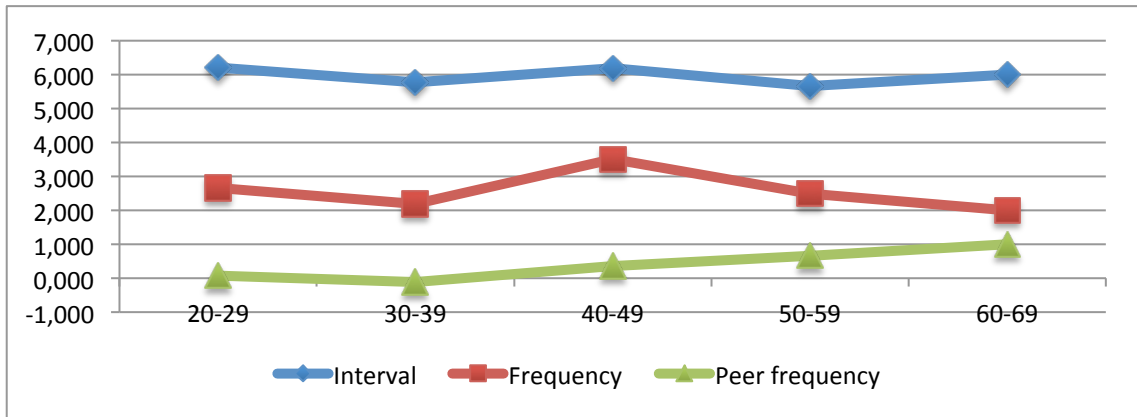
The above figure shows no real pattern in terms of a relationship between age and overconfidence. It appears that middle-aged managers (40-49) tend to be more overconfident then others on the interval and frequency assessments.

5.4.8. Overconfidence Versus Under Confidence

Figure 20 – Overconfidence versus under confidence for Interval and frequency assessments
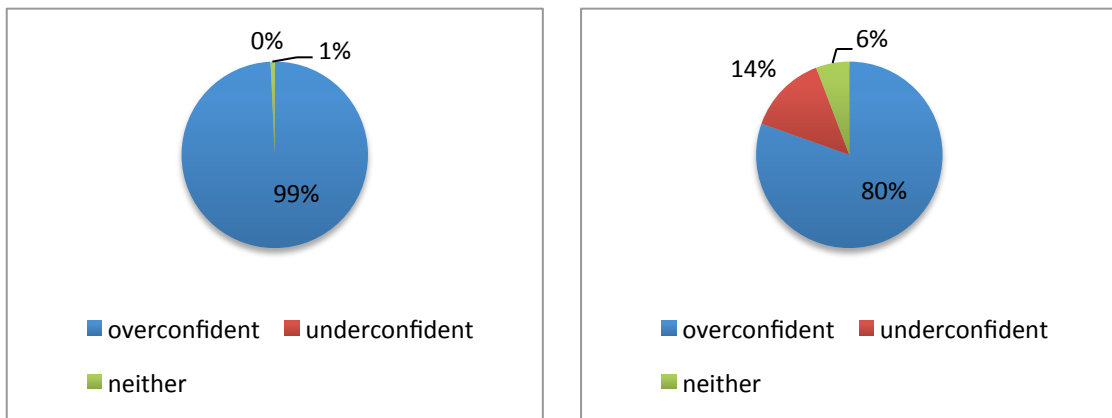
Figure 21 – Overconfidence versus under confidence for Peer frequency assessment
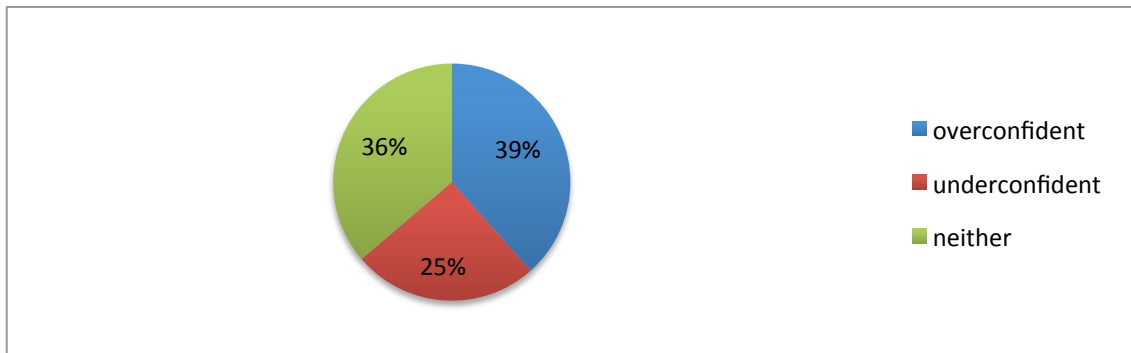
The above figures show the percentage of respondents that displayed overconfidence, under confidence or neither.

It is interesting to note that on the interval assessment, there was not one respondent that answered more than 9 questions correctly and only 1 respondent answered 9 correct answers as was asked.

The other two assessments had more under confident respondents (14% on frequency and 25% on peer frequency) as well as respondents that displayed neither under or overconfidence (6% on frequency and 36% on peer frequency). When assessing overplacement using the peer frequency assessment, results were evenly split between those that were overconfident (39%) and those that displayed neither over nor under confidence (36%). This is explored further below.

Figure 22 - Peer Frequency breakdown for mangers and senior managers
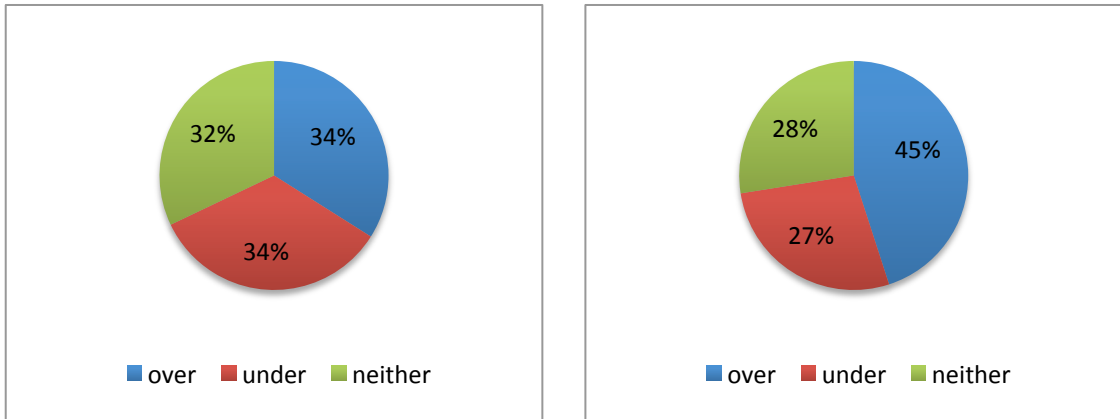
Figure 23 - Peer frequency breakdown for directors
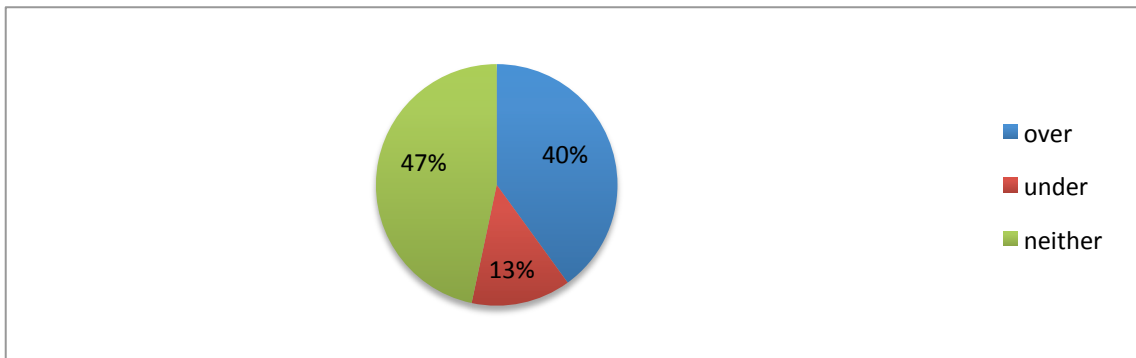
The above figures 22 and 23 show the breakdown of responses of the various levels of management to the peer frequency assessment. The split is fairly even for managers with senior managers having the highest percentage of overconfident respondents (45%), with almost half of the directors (47%) being neither over or under confident.

5.5. Hypothesis 2

The second hypothesis for this study was that there are statistically significant differences between the levels of overconfidence displayed at the different levels of management.

Figure 24 displays the results of the different overconfidence assessments per level of management.

Figure 24 - Overconfidence across levels of management
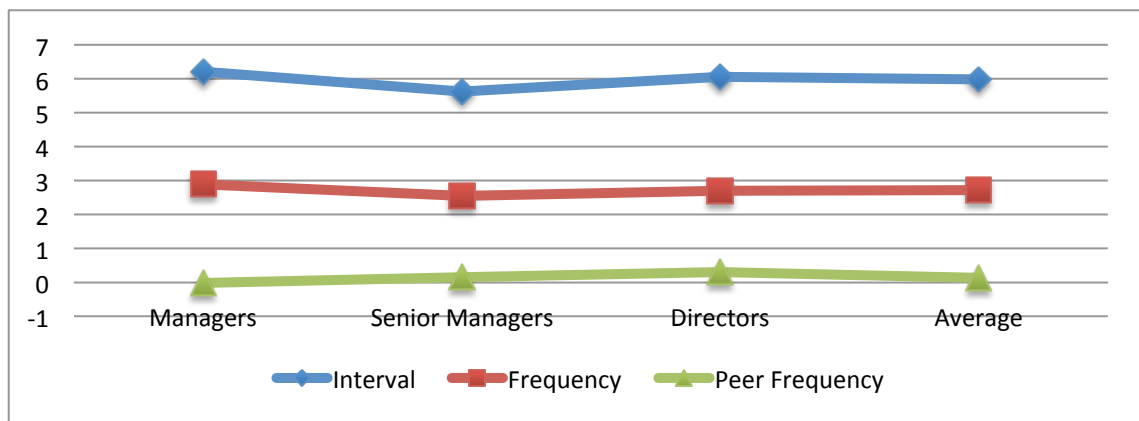
	Managers	Senior Managers	Directors	Average
Interval	6,207	5,625	6,067	5,992
Frequency	2,886	2,55	2,711	2,731
Peer Frequency	-0,0192	0,15	0,3111	0,138

5.5.1. Interval Assessment

The null hypothesis is that there is no statistically significant difference between the level of overconfidence displayed at the different levels of management. Using the interval assessment, the following results were noted.

Table 5 - Summary statistics for interval overconfidence across levels of management

INTERVAL	Manager	SM	Directors
Count	53	40	45
Average	6.208	5.625	6.067
Standard deviation	1.736	2.047	1.643
Coeff. of variation	27.97%	36.39%	27.09%
Minimum	1.0	0.0	2.0
Maximum	9.0	9.0	9.0
Range	8.0	9.0	7.0
Median	6.0	6.0	6.0

5.5.1.1. Manager to Senior Manager

A Kolmogorov-Smirnov test was run to compare the distributions of the two samples. This test is performed by computing the maximum distance between the cumulative distributions of the two samples. In this case, the maximum distance is 0.328. The approximate P-value for the test was 0.015. Since the P-value is less than 0.05, there is a statistically significant difference between the two distributions at the 95.0% confidence level.

5.5.1.2. Manager to Director

A Kolmogorov-Smirnov test was run to compare the distributions of the two samples. The maximum distance is 0.276 with a P-value of 0.0503. Since the P-value is greater than 0.05, there is not a statistically significant difference between the two distributions at the 95.0% confidence level.

5.5.1.3. Senior Manager to Director

A Kolmogorov-Smirnov test was run to compare the distributions of the two samples. The maximum distance is 0.297 with a P-value of 0.047. Since the P-value is less than 0.05, there is a statistically significant difference between the two distributions at the 95.0% confidence level.

5.5.1.4. Summary of Levels

Table 6 – Summary significance results using interval assessment

Interval	Manager	Senior Manager	Director
Manager	-	Significant	No Significance
Senior Manager	Significant	-	Significant
Director	No Significance	Significant	-

Using the interval assessment to determine overconfidence, the results show that there is no statistical significance between the level of overconfidence of managers and directors. However, senior managers were significantly less overconfident than both managers and directors.

The null hypothesis cannot be rejected when assessing managers to directors. The null hypothesis is rejected however when looking at the difference in overconfidence between senior managers and other levels of management. Therefore, in assessing overprecision using the interval assessment, the alternative hypothesis is accepted for the difference between senior managers and other levels of management.

5.5.2. Frequency Assessment

The null hypothesis is that there is no statistically significant difference between the level of overconfidence displayed at the different levels of management. Using the frequency assessment, the following results were noted.

Table 7 - Summary statistics for frequency overconfidence across levels of management

INTERVAL	*Manager*	*SM*	*Directors*
Count	53	40	45
Average	2.887	2.55	2.71
Standard deviation	2.651	2.45	3.10
Coeff. of variation	91.81%	96.038%	114.39%
Minimum	-2.0	-5.0	-4.0
Maximum	9.0	8.0	10.0
Range	11.0	13.0	14.0
Median	3.0	2.5	4.0

5.5.2.1.   Manager to Senior Manager

A Kolmogorov-Smirnov test was run to compare the distributions of the two samples. The maximum distance is 0.236 with a P-value of 0.159. Since the P-value is greater than 0.05, there is not a statistically significant difference between the two distributions at the 95.0% confidence level.

5.5.2.2.   Manager to Director

A Kolmogorov-Smirnov test was run to compare the distributions of the two samples. The maximum distance is 0.247 with a P-value of 0.103. Since the P-value is greater than 0.05, there is not a statistically significant difference between the two distributions at the 95.0% confidence level.

5.5.2.3.   Senior Manager to Director

A Kolmogorov-Smirnov test was run to compare the distributions of the two samples. The maximum distance is 0.361 with P-value of 0.008. Since the P-value is less than 0.05, there is a statistically significant difference between the two distributions at the 95.0% confidence level.

5.5.2.4. Summary of Levels

Table 8 – Summary significance results using frequency assessment

Frequency	Manager	Senior Manager	Director
Manager	-	No Significance	No Significance
Senior Manager	No Significance	-	Significant
Director	No Significance	Significant	-

Using the frequency assessment to determine overconfidence, the results show that there is no statistical significance between the level of overconfidence of managers and directors. There is also no significance between the level of overconfidence in managers and senior managers. However, senior managers were significantly less overconfident than directors.

Therefore, when assessing overestimation using the frequency assessment, one would accept the null hypothesis for all scenarios other than senior managers to directors.

5.5.3. Peer Frequency Assessment

The null hypothesis is that there is no statistically significant difference between the level of overconfidence displayed at the different levels of management. Using the peer frequency assessment, the following results were noted.

Table 9 - Summary statistics for peer frequency overconfidence across levels of management

INTERVAL	*Manager*	*SM*	*Directors*
Count	52	40	45
Average	-0.019	0.15	0.311
Standard deviation	1.776	2.327	1.221
Coeff. of variation	-9238.58%	1551.03%	392.60%
Minimum	-4.0	-10.0	-3.0
Maximum	6.0	4.0	2.0
Range	10.0	14.0	5.0
Median	0.0	0.0	0.0

5.5.3.1. Manager to Senior Manager

A Kolmogorov-Smirnov test was run to compare the distributions of the two samples. The maximum distance is 0.417 with a P-value of 0.0008. Since the P-value is less than 0.05, there is a statistically significant difference between the two distributions at the 95.0% confidence level.

5.5.3.2. Manager to Director

A Kolmogorov-Smirnov test was run to compare the distributions of the two samples. The maximum distance is 0.559 with a P-value of 5.67587E-7. Since the P-value is less than 0.05, there is a statistically significant difference between the two distributions at the 95.0% confidence level.

5.5.3.3. Senior Manager to Director

A Kolmogorov-Smirnov test was run to compare the distributions of the two samples. The maximum distance is 0.42 with a P-value of 0.001. Since the P-value is less than 0.05, there is a statistically significant difference between the two distributions at the 95.0% confidence level.

5.5.3.4. Summary of Levels

Table 10 – Summary significance results using peer frequency assessment

Peer frequency	Manager	Senior Manager	Director
Manager	-	Significant	Significant
Senior Manager	Significant	-	Significant
Director	Significant	Significant	-

Using the peer frequency assessment to determine overconfidence, the results show that there is a statistically significance difference between the level of overconfidence in all levels of management.

Therefore when assessing overplacement using the peer frequency assessment, the null hypothesis can be rejected for all scenarios. The level of overconfidence is significantly different across levels of management.

5.5.4. Correlations

No correlation was found between level of management and overconfidence on any of the assessments. The correlation coefficients for the interval, frequency and peer frequency assessments were -0.04, -0.02 and 0.08 respectively.

5.6. Research Question 1 – Cognitive ability and overconfidence

Research question 1 aimed to understand the extent of the relationship between cognitive ability and the overconfidence bias.

The respondents were divided based on the number of correct answers they received on the CRT. Zero correct answers was categorised as very low, one correct answer was low, two correct answers was medium and three correct answers was high.

Figure 25 – CRT Scores breakdown
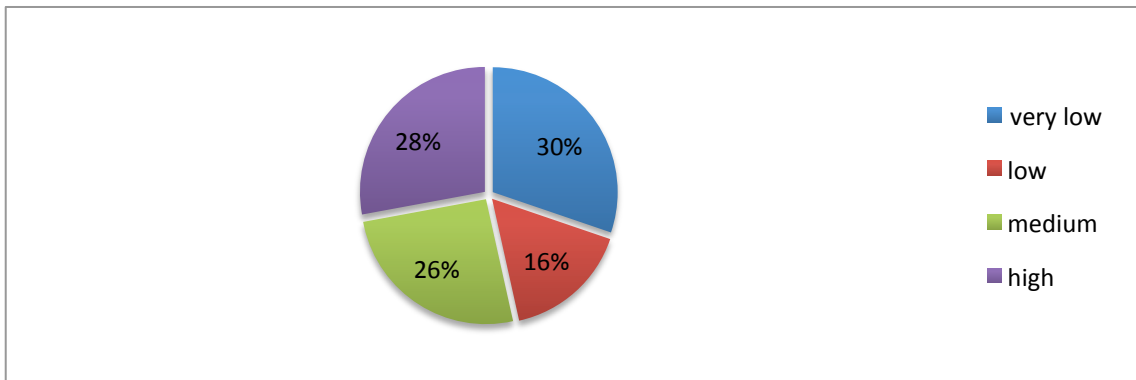
Figure 26 - CRT scores per level of management
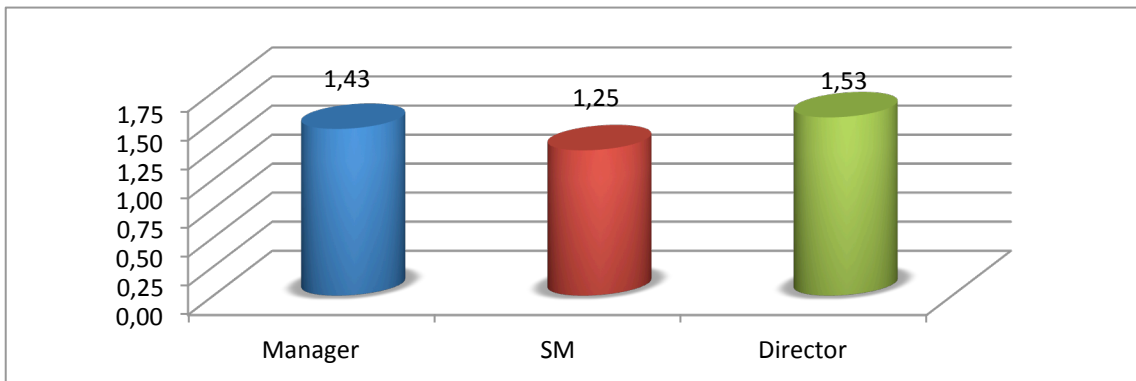
As can be seen from the above graphs, the CRT scores of the respondents were split fairly evenly. The average number of correct answers was 1.511 with 28% scoring high and 30.2% scoring very low. It can also be seen that the directors appeared on average to score higher (1.53) than managers (1.43) and senior managers (1.25).

All levels of management were statistically significantly different in terms of CRT scores.

5.6.1. Interval Assessment

Figure 27 - Interval assessment by CRT results
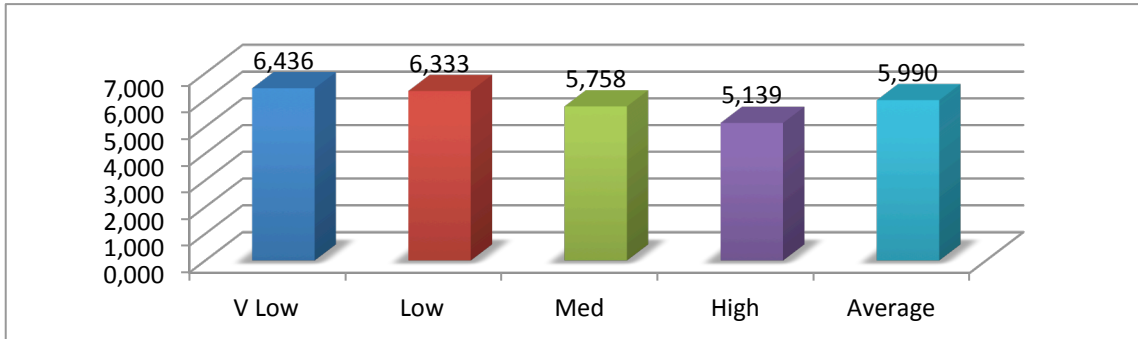
It appears as though the interval assessment is displaying a linear relationship between CRT scores and level of interval overconfidence. The higher the CRT score, the lower the overconfidence.

5.6.2. Frequency Assessment

Figure 28 - Frequency assessment by CRT score
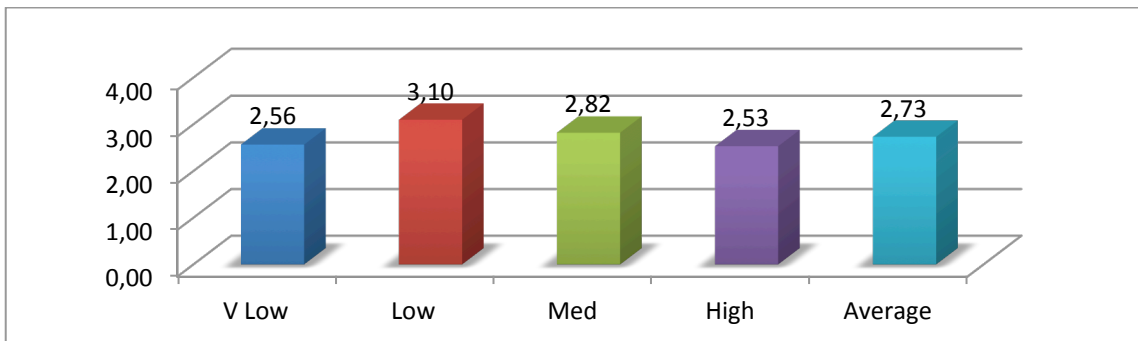
Aside from the anomaly of those that scored very low on the CRT, the frequency assessment is displaying a similar pattern to the interval assessment.

5.6.3. Peer Frequency Assessment

Figure 29 - Peer frequency assessment by CRT score
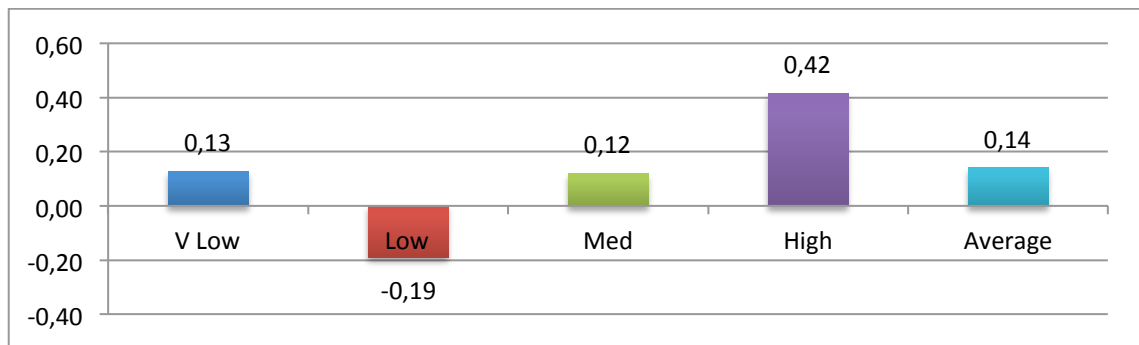
The peer frequency test appears to be displaying the opposite results to the other tests with overconfidence levels increasing with higher scores on the CRT.

5.6.4. Overall

Figure 30 - Summary of overconfidence assessments by CRT score
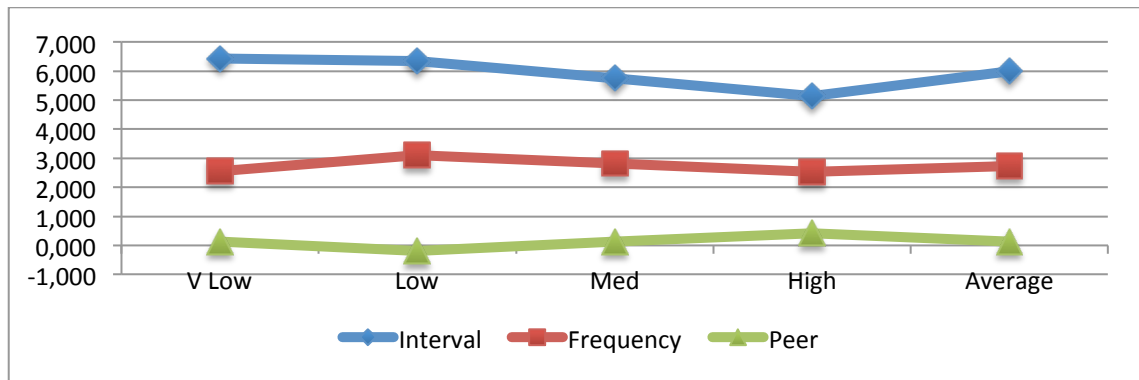
When performing a correlation to determine the strength of linear relationships between CRT score and level of overconfidence, the interval assessment proved to be the strongest with a correlation coefficient of -0.29. The correlation coefficient of the frequency and peer frequency assessments came out very close to 0 (-0.01 and 0.07 respectively).

5.7. Research Question 2 – Level of management, cognitive ability and overconfidence

The final research question aimed to investigate whether a relationship exists between the combination of level of management and cognitive ability with the overconfidence bias.

Figure 31 - CRT scores compared to Overconfidence levels for different levels of management
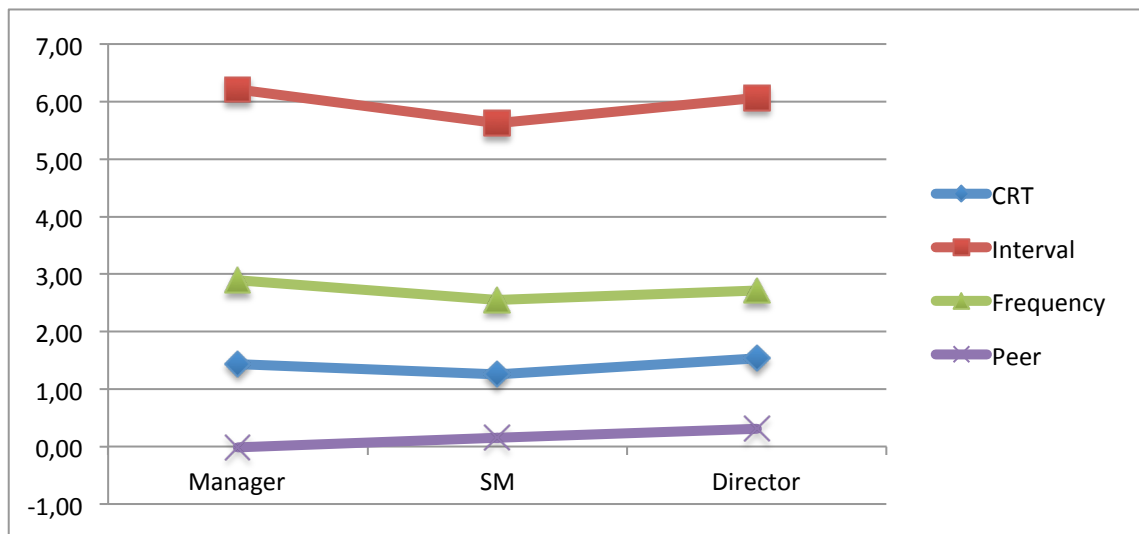
The above figure 31 compares the average CRT scores achieved for the different levels of management with overconfidence levels. Both the interval and frequency assessment results seem to be following a similar pattern to the CRT scores.

As the interval assessment showed a correlation between CRT score and level of management, the below figures provide some more detail on the data obtained for the interval assessment.

Figure 32 - Scatter plot of CRT scores v Interval overconfidence per level of management
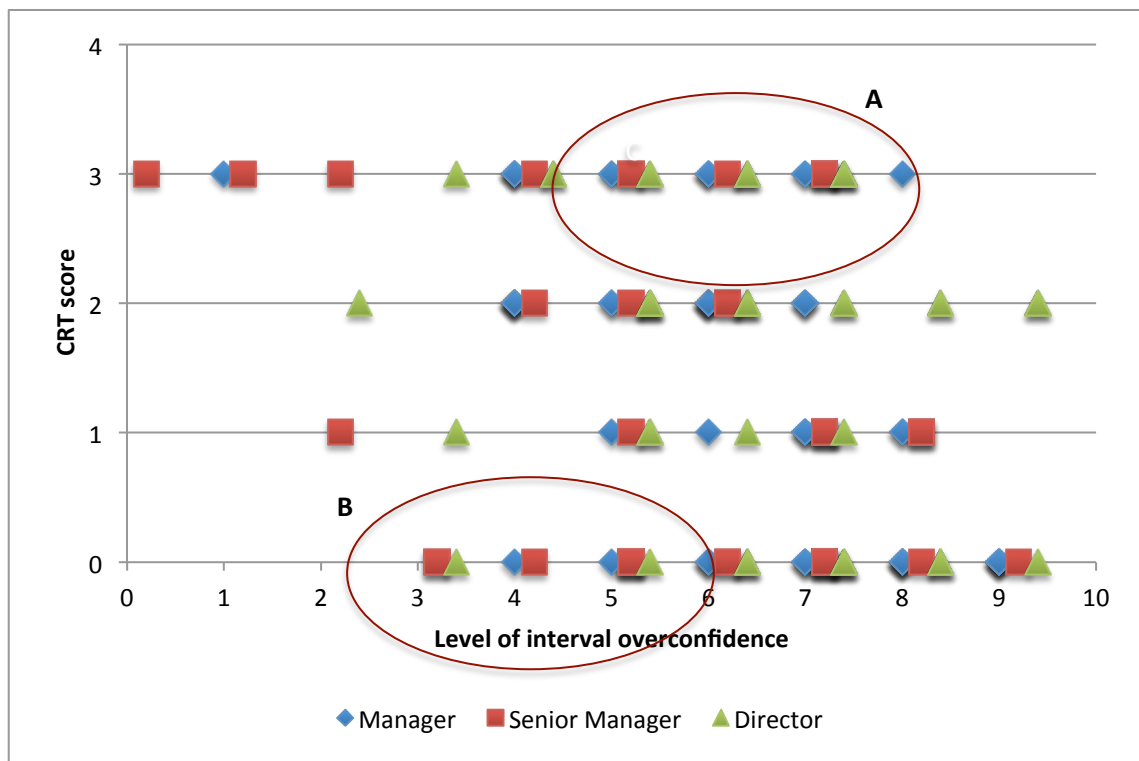
Figure 32 shows the scatterplot for CRT scores and interval overconfidence by level of management. The above figure seems to be showing the general negative correlation between CRT scores and overconfidence. It is also showing a larger spread of data for senior managers.

Circles A and B represent the areas of unexpected results. These will be discussed further in chapter 6.

Due to overlaps however, this figure does not show the complete picture and additional information is provided below.

Figure 33 - Frequency of interval overconfidence by level of management
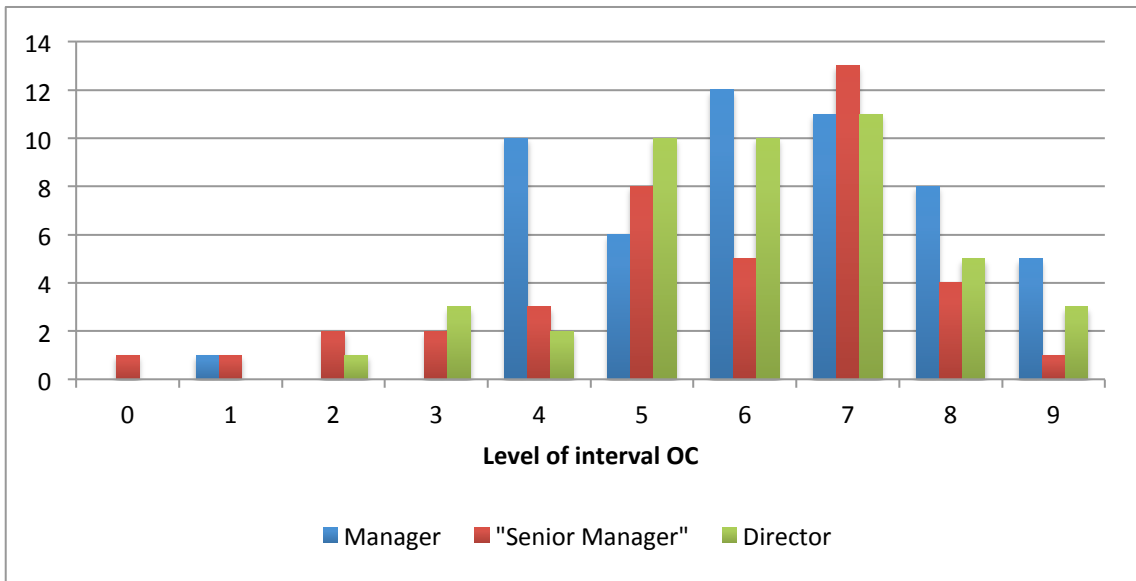
Figure 34 - Cumulative density function for interval overconfidence by level of management
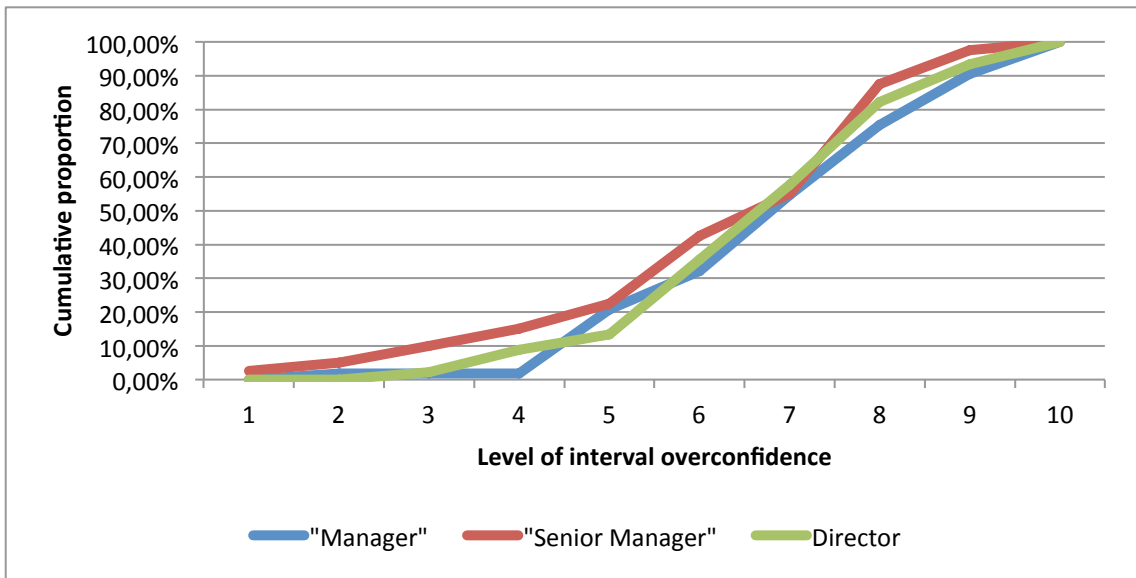
The above figures 33 and 34 provide a deeper picture of the interval overconfidence assessment results and shed some light on the relationship between CRT scores, level of overconfidence and level of management. What is seen is that the senior manager sample has a more pronounced tail than the other levels of management.

5.7.1. Combination of CRT Score and Level of Management

To ensure sufficient and valid data was tested, for this part of the study the CRT responses were collated into two groups of low and high. Respondents that answered zero or one correct answer were considered 'low' and those with two or three correct answers were considered 'high'.

Table 11 - Combination of CRT and Level of Management

	Low Manager	Low SM	Low Director	High Manager	High SM	High Director
Interval	6,90	6,17	6,13	5,29	4,80	5,96
Frequency	3,05	2,42	2,88	2,68	2,87	2,54
Peer	0,15	-0,33	0,38	-0,11	0,93	0,31

Figure 35 - Interval assessment
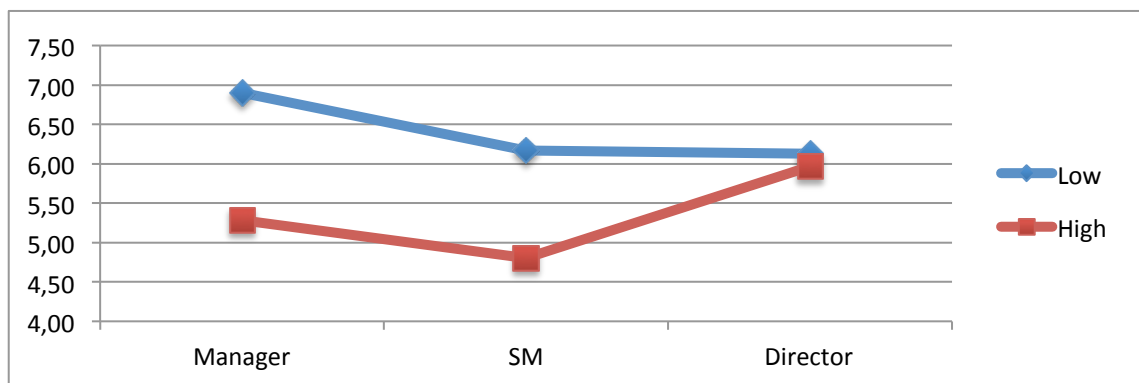
In looking at the combination of CRT score and level of management on the interval assessment, figure 35 provides little insight. When scoring high on the CRT, managers (5.29) appeared less overconfident than directors (5.96), however, when scoring low on CRT, managers (6.9) appeared more overconfident than directors (6.13).

Figure 36 - Frequency assessment
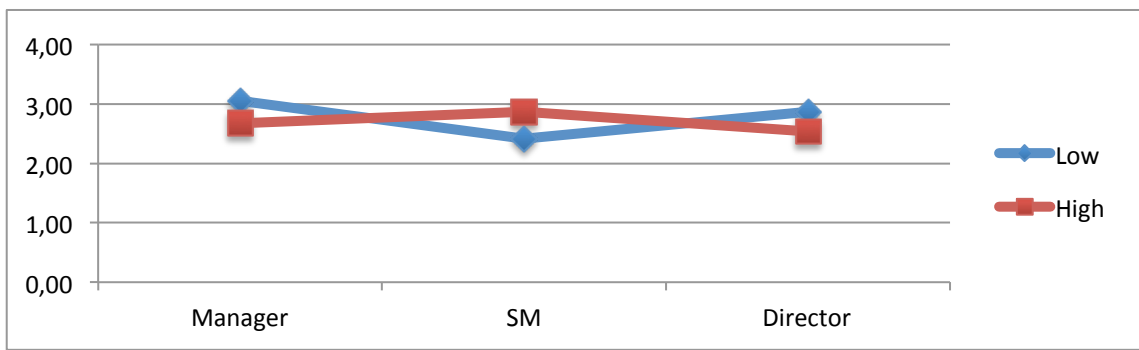
Figure 37 - Peer frequency assessment
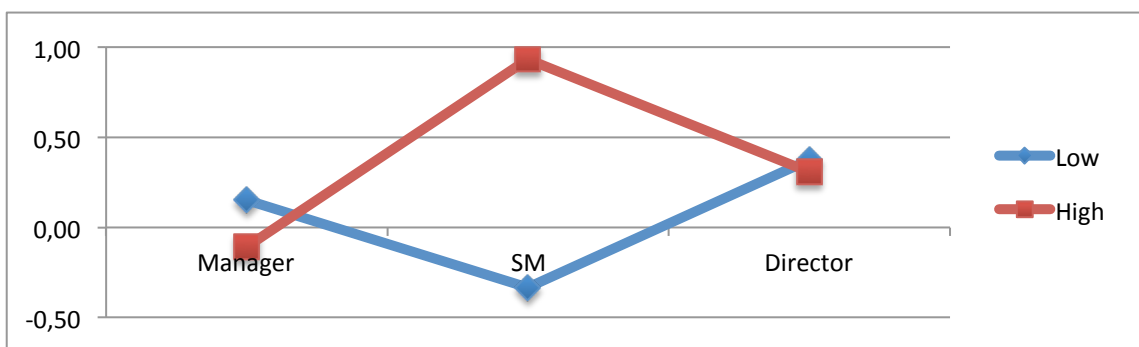
In looking at the combination of CRT score and level of management on the frequency and peer frequency assessments, figure 36 and figure 37 show a similar pattern with low CRT scores providing the reverse overconfidence levels of high CRT scores.

Figure 38 - Combination graph
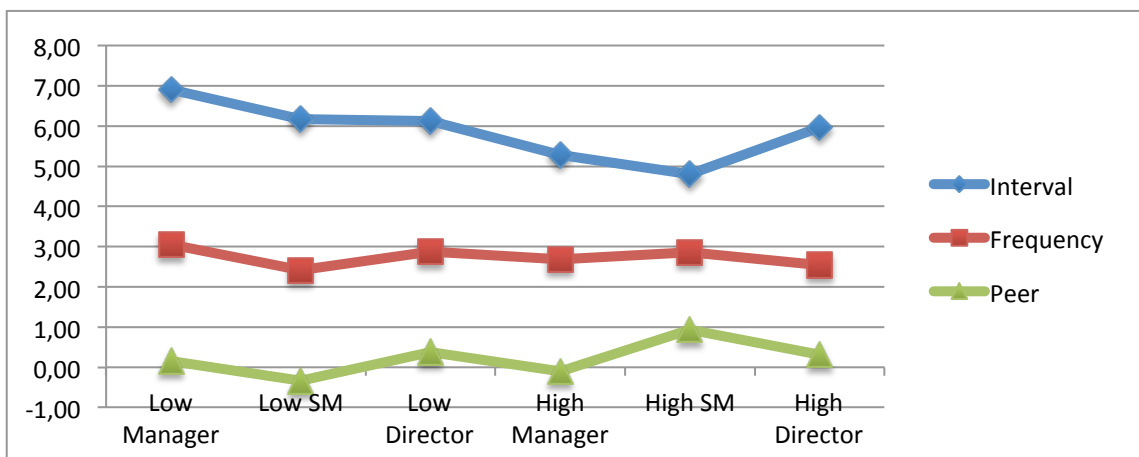
Although the shape of the peer test and the frequency test look similar, it appears that cognitive reflection cannot explain the direction of the relationship between overconfidence and level of management.

5.8. Summary

This chapter presented the results on a number of different levels. The results displayed a general overconfidence in managers and differences between the various tests used for overconfidence as well as differences between levels of management and gender.

CRT was found to correlate only slightly with overconfidence leading to interesting results for the relationship between cognitive ability, level of management and overconfidence.

The results will be interpreted and analysed further in chapter six.

Chapter 6

6.1. Introduction

The main purpose of the study as highlighted in Chapter one was to further investigate the overconfidence bias by understanding the relationship between overconfidence and different levels of management. The previous chapter presented the results of the research. This chapter will discuss those results in light of the purpose of the research as well as the literature review conducted in Chapter two.

The demographics of the sample will first be discussed, followed by discussions and analysis of the results for each of the hypotheses formulated in Chapter three.

6.2. Demographics

It is important to understand the demographics of the sample obtained as this may have a bearing on the results.

As discussed in Chapter 5, a large majority of the respondents were male. In addition, 76% of the sample was aged between 30-49. In interpreting the results, consideration was had for this defined sample. This study did not explore the correlations between age and level of management, but it likely that age is correlated to level of management and therefore may have a bearing on the relationship between level of management and overconfidence.

There was a relatively even split between the different levels of management.

6.3. Hypothesis 1

In hypothesis 1 the study sought to determine whether the overconfidence bias was evident at various levels of management.

6.3.1. Interval Assessment

When Russo and Schoemaker ran their overconfidence study in 1992 using the interval assessment, they found fewer than one percent of the sample to be not overconfident (Russo & Schoemaker, 1992). The results obtained from the interval assessment conducted in this study correlate strongly with the findings of Russo and Schoemaker. In fact, as seen in figure 20, exactly 99% of respondents in this study were overconfident on the interval assessment.

6.3.2. Frequency Assessment

Similarly, the results of the frequency assessment also showed a statistically significant level of overconfidence for all respondents. Two points differed between the interval assessment and the frequency assessment:

a. on the frequency assessment it was 80% of respondents that displayed overconfidence and not 99%; and

b. the average level of overconfidence was significantly lower on the frequency assessment.

These results are consistent with those found in Cesarini et al. (2006), who showed significant differences in overconfidence results obtained on the interval assessment and the frequency assessment.

The implications of these results are that managers across the board are less overconfident when they have to rate their performance then they are when actually performing on a task.

6.3.3. Peer Frequency Assessment

The Peer frequency assessment as used in Cesarini et al. (2006) revealed that managers anticipate the overconfidence of others. The assessment was extended in a different way in this study. The assessment followed Hilton et al. (2011) and was used to show the better than average effect, in other words, that managers feel that they are better than other managers.

Larrick correlates the better than average effect to overconfidence saying that the two biases are closely related (Larrick, Burson, & Soll, 2007). "Individuals who believe they are better than average are also more likely to be overconfident" (Larrick et al., 2007, p. 91). Larrick does not however, as other academics do, equate the two biases.

Our results are similar to those found in Hilton et al. (2011) as respondents proved not to be significantly overconfident on this scale. Participants in the Hilton study reported that they had in fact performed worse than other participants (Hilton et al., 2011). This phenomenon of underconfidence was also seen in this study.

The implication of this underconfidence seen on the peer frequency assessment means that even highly overconfident managers on a task still feel that they are not as competent as their peers. Even though the results of our study were consistent with the literature, a possible explanation for this could be the

perceived calibre of the recruitment processes in professional services firms. The perception is that all employees are of a particular standard and therefore managers in general are always feeling that there are smarter people in the organisation. This could be assessed in future research.

6.3.4. Demographic Findings

The results showed that men were overconfident on all assessments, while women were found to be overconfident on the interval and frequency assessments and underconfident on the peer frequency assessment.

Our results were again in line with literature in that Cesarini et al. (2006) found that women were more overconfident then men on the interval assessment while being similar to men on the frequency assessment.

As seen in figure 19, this study did not seem to reveal any relationship between age and overconfidence for the interval or frequency assessments. There did however appear to be a linear relationship between age and the better than average effect (peer frequency). A possible explanation for older managers feeling better than average could be that they feel that with time, they have gained more experience and knowledge. Further research could explore this relationship in more detail.

6.3.5. Difference in the Various Overconfidence Assessments

As discussed above, three different assessments were conducted each testing for a different definition of overconfidence. Overestimation of one's own knowledge was tested using the interval assessment. Overestimation was

tested via the frequency assessment. Finally, overplacement, or 'better than average' was tested via the peer frequency assessment.

What was found in this study was that the first two assessments seemed to be similar in results, while the peer frequency assessment differed in a number of ways:

a. The first two assessments (interval and frequency), while showing different results, both showed significant overconfidence in managers. The peer frequency assessment however did not show significant overconfidence.

b. As can be seen in figure 19, there are similar patterns in the overconfidence results according to age on the interval and frequency assessments. The peer frequency assessment showed a different pattern.

c. Figure 24, which shows an overview of overconfidence by level of management, also displays a similar pattern between the interval and frequency assessments. Again, the peer assessment is showing a different pattern.

d. When looking at overconfidence by CRT scores in figure 30 (which will be discussed further on), a difference was also seen between the peer frequency assessment and the pattern displayed by managers on the other assessments.

e. The final difference can be seen in looking at the percentage of managers that displayed overconfidence on the different tests. On the interval and frequency assessments the numbers were high, 99% and 80% respectively. On the peer frequency assessment, this number was drastically different. Only 39% of managers were classified as overconfident on this assessment.

A possible explanation for the differences could be that the first two assessments relate to the performance of a particular task and how one rates their own performance. The peer frequency assessment however asks the respondent to rate how other people performed. In other words, it asks a manager to compare how one performed relative to others.

As discussed in Larrick, Burson and Soll (2007), the relationship between overconfidence and the better than average effect is not always positive. Further investigation could be done on findings in this study to determine this relationship in terms of hard and easy questions and the impact of perceived difficulty on the relationship between overconfidence and the better than average effect. This however is beyond the scope of this work.

6.4. Hypothesis 2

For hypothesis 2, this study sought to determine if there are significant differences between the levels of overconfidence displayed at different levels of management.

6.4.1. Discussion of Results

In looking at figure 24, which displays overconfidence across the different levels of management, in connection with tables, 6, 8 and 10, which discuss the significance results, some interesting results can be seen.

The results from the interval and frequency assessments highlight similarities between the lower and upper management levels. On both assessments, middle management displayed lower overconfidence levels.

On the interval assessment, middle management were statistically significantly less overconfident than both lower and upper management. On the frequency assessment, middle management appeared less over confident than lower and upper management with only the difference between middle and upper management proving to be significant.

Both the interval and the frequency assessments displayed a similar pattern. The peer frequency assessment was the only assessment to show a linear relationship with lower management the least overconfident and upper management being the most. The peer frequency assessment did in fact show significant differences in the level of overconfidence between all levels of management. It must be noted however that on the peer frequency assessment, only upper management were found to be significantly overconfident.

These results show that level of management does have a relationship with overconfidence levels. Middle management proved to be more likely to allow for correct answers either through a wider range or more precise knowledge. Middle management also tended to rate themselves more effectively than other managers.

6.4.2. Actual Versus Expected Results

In Chapter 2, there was discussion around differences in managers and decision-making styles across levels of leadership. Dai et al. (2011) discuss the pipeline model of leadership as well as stratified systems theory, which highlight differences in levels of leadership. These differences are in required leadership skills and values.

Dai et al. (2011) also discuss the requirement for more conceptual skills the higher up the level of management. This conceptual skill would most likely require more System 2 thinking.

Given the current literature, one would expect that different levels of management would be impacted differently by cognitive biases and hence there would be a difference in overconfidence levels at different levels of management. In addition, with more System 2 thinking required at higher levels of management one would also expect that there would be a linear progression with more satisficing and biases at play the higher up the level of management.

What is interesting to note is that our results seem to go against these expectations. Only middle management were shown to be significantly different to both lower and upper levels of management. In addition, only the peer frequency assessment displayed any kind of linear progression showing lower management as the least overconfident and upper management as the most. In fact, middle management came out as the least overconfident of all managers.

The leadership pipeline model as brought in Charan et al. (2001) discusses the difficulties in the transition between different levels of management. Charan et al. (2001), demonstrate that certain transitions are harder than others as they require management to deal with particular issues for the first time. Middle management appear to have to undergo some of these difficult transitions as mentioned in the pipeline model. When moving into the role of managing others, middle management need to concern themselves for the first time with strategic

issues and then with long term strategy. It would therefore follow that middle management may be less overconfident when faced with these new challenges.

Another possible explanation of these results could be the sample that was drawn. Professional services firms tend to hire similar people and therefore the differences in the levels of management may not be as pronounced as in other industries.

DeChurch et al. (2010) contends that there is not much detail known on middle management as all the studies have been conducted on upper and lower levels of management. While our study was only conducted in the professional services industry, it does provide some evidence for further studies to explore why middle management would be less susceptible to the overconfidence bias.

6.5. Research Questions

Research questions 1 and 2 were related in terms of trying to understand the impact that cognitive ability (reflection) would have on the relationship between overconfidence and level of management. As such, they will be dealt with together for the purposes of this analysis.

6.5.1. Relationship Between CRT and Overconfidence

Current academic thinking, including that in Frederick (2005) and Parker and Fischhoff (2005), provide for a relationship between cognitive abilities and decision-making performance. Hoppe and Kusterer (2011) go deeper and show that those with low cognitive abilities tend to be more affected by behavioural biases.

This relationship appears to be have been confirmed in this study. Figure 30 depicts this relationship across all the different overconfidence assessments. On the interval and frequency assessments, the relationship seems to be fairly linear with higher scores on the CRT tending to result in lower overconfidence levels. The peer frequency assessment has this result reversed.

However, when a correlation was performed on the relationship between CRT scores and level of overconfidence, the correlation coefficients came out very low. The highest correlation was on the interval assessment with a correlation coefficient of -0.29. The frequency and peer frequency assessment came out with coefficients very close to 0. This appears to go against current academic thinking. A possible explanation for the non-correlation could be the relatively low sample numbers or that the differences between the CRT scores for the different levels of management is not different enough to impact the results.

Highly intelligent people have an ability to learn how to display fewer reasoning biases (Stanovich & West, 2008). This study did not include a retest methodology where respondents were told of the bias and how to avoid it, yet there still seemed to be a pattern with people with higher levels of cognitive reflection being less overconfident.

The results from this study were inconclusive regarding the direction of the relationship between CRT and overconfidence.

6.5.2. Impact of CRT on the Relationship Between Overconfidence and Level of Management

As discussed above, and as can be seen in figure 30, the interval and frequency assessments appear to be showing a negative relationship between

CRT score and level of overconfidence. Only the interval assessment is showing any kind of statistical correlation with higher CRT scores tending to show lower levels of overconfidence.

However, when looking at figure 31, which shows the level of overconfidence by level of management, a different trend appears. In this figure, the level of overconfidence seems to be following the same trend as the CRT scores. Middle management, who on average scored the lowest on the CRT, also were on average the least overconfident. One would have expected that upper management, who scored on average the highest on the CRT to be the least overconfident.

This seems to indicate that there is a further variable that explains this relationship between overconfidence and the combination of CRT and level of management.

This relationship could possibly be explained by the different decision-making styles as discussed in Dai et al. (2011). Through their study it was found that lower management is 'decisive' while upper management is 'flexible'. Both of these decision-making styles satisfice and make quick decisions fraught with cognitive bias. Being flexible in decision-making implies that upper management are more flexible to changing their original decision and trying several options. This could explain the higher scores on the CRT as it involves pushing aside a simple solution to get to the correct answer. Therefore, even though they are overconfident, their specific decision-making style of flexibility allows them to perform better on the CRT. This does not however explain the 'dip' for middle

management in that they scored poorly on the CRT and were the least overconfident. Further studies could explore this anomaly.

What is noticeable in figures 32, 33 and 34 is that middle management differs from the other groups. The interval assessment reveals a larger spread of results with a longer tail (more senior managers were less overconfident). Table 5 also shows that middle management have the largest standard deviation of all managers indicating a wider spread.

Interestingly, it would be expected that the results circled in 'A' in figure 32 should be more to the left, and the results circled in 'B' should be more to the right. Meaning that higher scores on the CRT would result in lower levels of overconfidence and lower scores on the CRT would result in higher levels of overconfidence. This would make the results more in line with current academic thinking. Possible explanations for the results being different to expected could be the relatively small sample size or the similarities in CRT scores between all levels of management.

The combination of CRT score with level of management does not appear to be teaching us anything new about the overconfidence bias. On the interval assessment, middle management that scored high on the CRT are proving to be the least overconfident. This is as expected and is in line with the assessments done with the individual variables. There is also no significant correlation to speak of.

When the variables were combined, the size in each sample was reduced and this could have had an impact on the results.

While hypothesis 2 is showing a difference in levels of overconfidence between the different levels of management, the lack of a large difference in CRT scores may be the reason for inconclusive results for the additional research questions.

6.6. Summary of Findings

In general, the assessments done on overconfidence matched findings from previous research and confirmed that overconfidence is a bias that is evident in management. Some tests provided for a greater level of overconfidence than others.

This study did show differences in the level of overconfidence for different levels of management. Middle management were significantly different to other managers on all of the overconfidence assessments. As discussed above, middle management tended to be more precise in their assessments of their own performance.

Although the study did not provide a direction for the relationship, it did appear, at least on the interval assessment, that cognitive reflection scores did have a relationship with the level of overconfidence. Interesting results were also found when the cognitive reflection score was combined with the level of management. Several anomolies were exposed as part of the results. A possible explanation for these anomolies and lack of directional relationship results could be the nature of the sample employed. All managers came from professional services firms. Different results may emerge for different samples.

Chapter 7

7.1.   Introduction

Chapter five and six presented the results of this study and discussed them in light of the purpose of the research as well as the literature review conducted in Chapter two. This final chapter aims to consolidate these findings and provide academic and business recommendations based on these findings.

7.2.   Summary of Findings

Much of the findings in this study were in line with current academic thinking. However, in discriminating "between individuals that are more or less afflicted by behavioural phenomena" (Oechssler, et al., 2009, p. 147) this study has added valuable information to the academic landscape.

Differences in the levels of overconfidence were found on different assessments. However, this study found that in general managers did display overconfidence tendencies on a number of different assessments that were conducted.   This supports previous findings.

A significant finding of this study was that there does appear to be differences in the levels of overconfidence at different levels of management.

This study found that it was middle management that appeared to be the least overconfident both on a task (interval assessment) and when judging themselves on a task (frequency assessment). This may be as a result of the difficulties faced by middle management in progressing through an organisation.

As discussed in Chapter six, it would be expected that upper management would be more overconfident. This study has found that upper and lower levels

of management seemed to both be significantly more overconfident than middle managers.

While cognitive reflection was found to have a relationship with the overconfidence bias, the relationship of CRT scores and cognitive reflection did not appear significant to define the relationship between overconfidence and level of management. It did however provide a foundation for further studies to be conducted to uncover this relationship further.

7.3. Recommendations

7.3.1. Recommendations for Academic Research

An interesting finding of this study was the differences that were found between the various assessments for overconfidence. The interval and frequency assessments displayed overconfidence for all levels of management. Chapter six described how the peer frequency assessment, which tests for overplacement or 'better than average', produced different results to the other two assessments in many ways.

This study recommends that further research be done into whether overplacement or better than average should be considered as a separate cognitive bias to overconfidence.

In addition, while this study found that middle management were less overconfident than other levels of management. The causes of overconfidence may have an impact on which types of managers are affected by the overconfidence bias. Causes of overconfidence were not looked into and as such, from this study it is recommended that researchers interested in the field

of cognitive bias should focus on what causes overconfidence in managers. This may lead to a deeper understanding of the bias and the type and level of manager impacted by overconfidence. It would also add great value to understand what is specific and unique to middle managers that led them to display lower levels of overconfidence.

This study found that there were differences in the level of overconfidence for different levels of management. It would be interesting to determine if similar differences occurred with other cognitive biases. Anchoring bias and the hindsight bias were cited as causes for the overconfidence bias and as such it would be expected that a similar relationship would be found with various levels of management.

In addition, as it has been found that there are differences in the behaviour of different levels of management, it would be interesting for academics to investigate which cognitive biases impact which levels of management.

From the data of this study it would also be of interest to researchers to look into the way that managers answered the questions. The overconfidence assessments themselves could be challenged by looking into the ranges of answers that were provided on the interval assessment. Were managers trying to provide a more narrow range that was in fact close to the correct answer?

Cognitive reflection was found to have a relationship with overconfidence. Further studies could be conducted into whether teaching managers about overconfidence would lead them to be less susceptible to the bias. It would be

expected that people with higher cognitive reflection scores would be able to learn and change behaviours.

Finally, this study only researched three levels of management. Many more levels are discussed in academia. These additional levels could be researched providing a richer understanding of the overconfidence bias in the corporate environment.

7.3.2. Recommendations and Impact for Business

It was discussed early on in this study that understanding why leaders make errors is important. This study hopefully provides some answers to the problem of reducing the frequent bad management decisions being made.

The study found that managers were less overconfident when they had to rate themselves on a task compared to when they actually performed a task. This was seen in the lower levels of overconfidence displayed on the frequency and peer frequency assessments. It may therefore be useful on important decisions to have managers think about their performance and rate themselves immediately after making a decision. It may be useful to have the managers answer the following questions; How well do you think you performed when making this decision? Do you think that others would have made the same decision or a better one?

These questions may force the manager to rethink their initial instinctive overconfident decision.

As was seen in this study from the frequency assessment, middle management appeared to be more precise in terms of identifying when they were correct.

Middle managers also appeared less overconfident when performing a task. This lower level of overconfidence will potentially allow them to ignore less information and be more open to different decision options. Business may do well in inviting more collaboration between middle and upper management on larger decisions. Middle management may be more objective in looking at optimal solutions.

Literature shows that middle management is focused on coordinating and establishing operational goals. Business may do well in identifying middle managers that score well on cognitive reflection tests and training them on strategy early in their careers.

To build effective leadership, the leadership pipeline model in Charan et al. (2001) discusses that organisations need to identify leadership candidates early, provide them with opportunities and growth assignments and give them useful feedback when coaching them. Through the findings from this study, it would be useful to identify those middle managers about to progress through difficult transitions. Special coaching should be established for middle management to ensure that they progress to the upper levels of management while remaining less susceptible to cognitive biases such as overconfidence.

7.4. Conclusion

The overconfidence bias has been shown to impact managerial decision-making. Literature also discusses models of management such as the leadership pipeline that show differences between different levels of management. There has however been a lack of research to investigate any relationship between the overconfidence bias and levels of leadership. This

research has expanded on current literature in bringing behavioural economics and leadership models together to show that a relationship does appear to exist between the overconfidence bias and levels of management.

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PROPOSED ONLINE SURVEY – DOV PALUCH

As part of my MBA dissertation, I am conducting research on decision making at various levels of management. To that end, you are asked to respond to the below survey. The survey questions will help us to better understand how managers make decisions and some of the biases that impact the decision making process. The survey should take no more than 15 minutes of your time.
Your participation is voluntary and you can withdraw at any time. All data will be kept confidential. By completing the survey, you indicate that you voluntarily participate in this research.
If you have any concerns, please contact me. My details are provided below:
Dov Paluch – dovpaluch@gmail.com – 0827737947

This survey is made up of 5 sections.

Section 1
Please state your age: (20-29 / 30-39 / 40-49 / 50-59 / 60-69)
Gender (Male / Female)
Level of Management (Manager / Senior Manager / Associate Director / Director (Partner))

Section 2
Without researching the correct answers, for each of the following questions, provide a low and a high estimate such that you are 90 percent certain the correct answer will fall within these limits. You should aim to have 90 percent hits and 10 percent misses.

Question 1:
Martin Luther King's age at death? 39
      Please provide a Low Estimate: eg 20
      Please provide a High Estimate: eg 99

Question 2:
Length of the Nile river (km)? 6695
      Please provide a Low Estimate:
      Please provide a High Estimate:

Question 3:
Number of books in the Old Testament? 24
      Please provide a Low Estimate:
      Please provide a High Estimate:

Question 4:
Weight of an empty Boeing 747? 178800 kg
      Please provide a Low Estimate:
      Please provide a High Estimate:

Question 5:
Gestation period (in days) of an Asian elephant? 22 months (660 days)

Please provide a Low Estimate: [ ]
Please provide a High Estimate: [ ]

Question 6:
Diameter of the moon (km)? 3474 km
Please provide a Low Estimate: [ ]
Please provide a High Estimate: [ ]

Question 7:
Population of New York? 8 175 133
Please provide a Low Estimate: [ ]
Please provide a High Estimate: [ ]

Question 8:
Number of countries and territories in the world? 235
Please provide a Low Estimate: [ ]
Please provide a High Estimate: [ ]

Question 9:
Number of time zones in Asia? 33
Please provide a Low Estimate: [ ]
Please provide a High Estimate: [ ]

Question 10:
Life expectancy in India in 2002? 53
Please provide a Low Estimate: [ ]
Please provide a High Estimate: [ ]

Section 3
Look back at your answers from section 2. Without changing any of the stated intervals, estimate how many of these intervals you believe contain the true value. In other words, how many correct answers do you think you had in section 2?
Correct answers? [ ]

Section 4
All participants receive the same instructions as you do. State the average number of correct answers that you think the other participants have managed to capture with their confidence intervals. In other words, how many correct answers do you think that other participants had in section 2?
Correct answers? [ ]

Section 5
Please answer the following 3 questions:

1. A bat and a ball together cost 110 cents. The bat costs 100 cents more than the ball. How much does the ball cost? 5 cents [ ]

2. If it takes 5 machines 5 min to make 5 widgets, how long would it take 100 machines

    to make 100 widgets? 5 mins ⬚

3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48

    days for the patch to cover the entire lake, how long would it take for the patch to

    cover half of the lake? 47 days ⬚
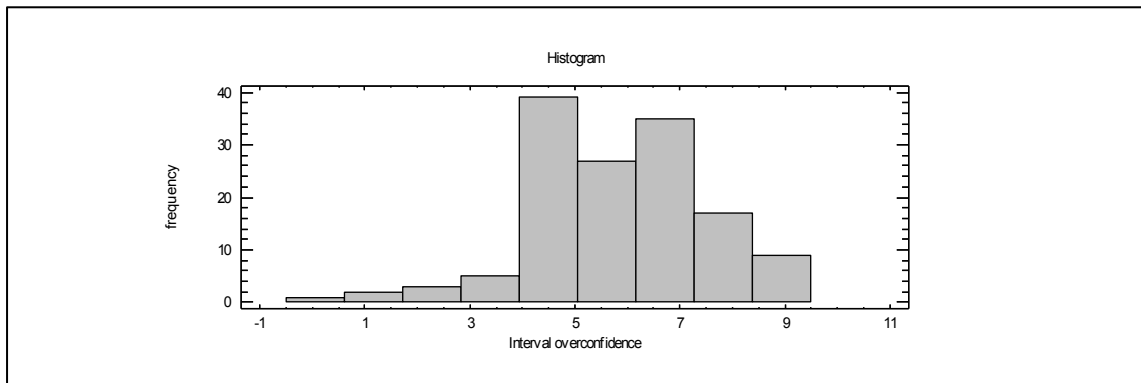
Figure 39 - Interval assessment histogram
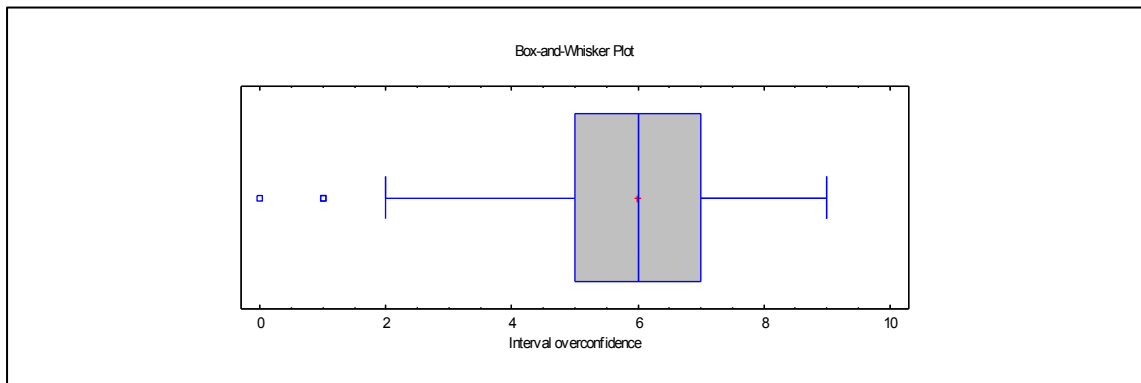

Figure 40 - Interval assessment box and whisker

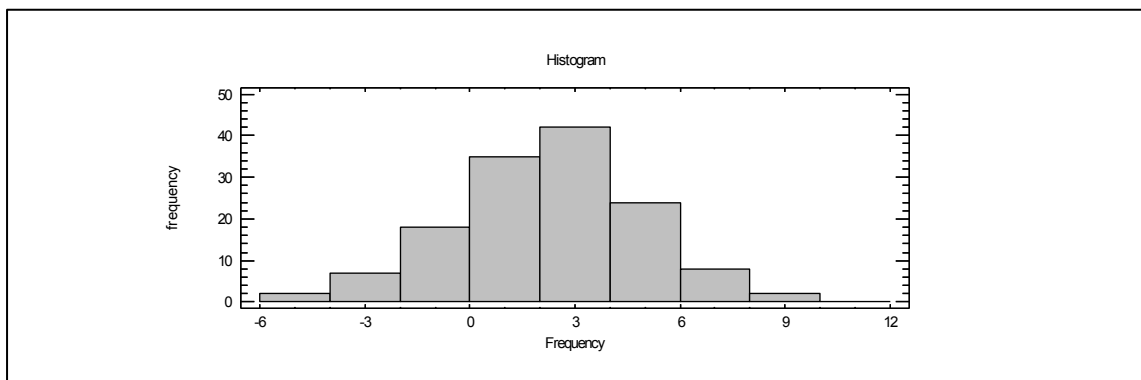**Figure 41 - Frequency assessment histogram**
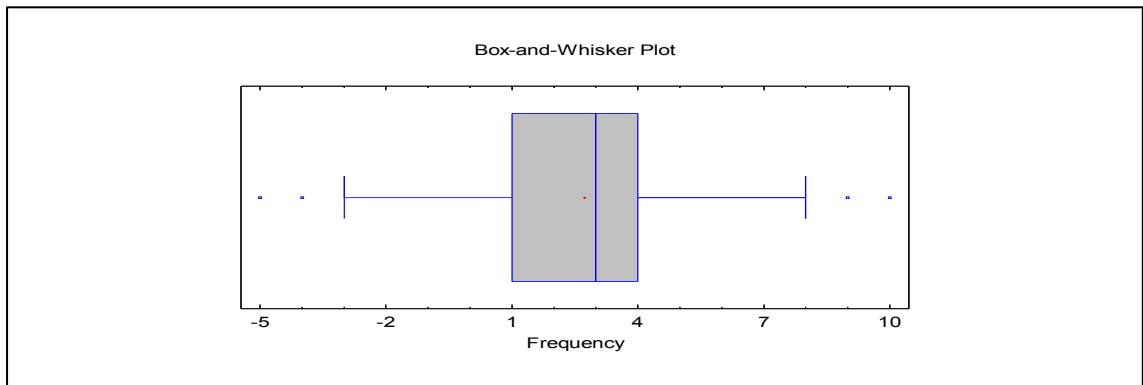
Figure 42 - Frequency assessment box and whisker

Box-and-Whisker Plot

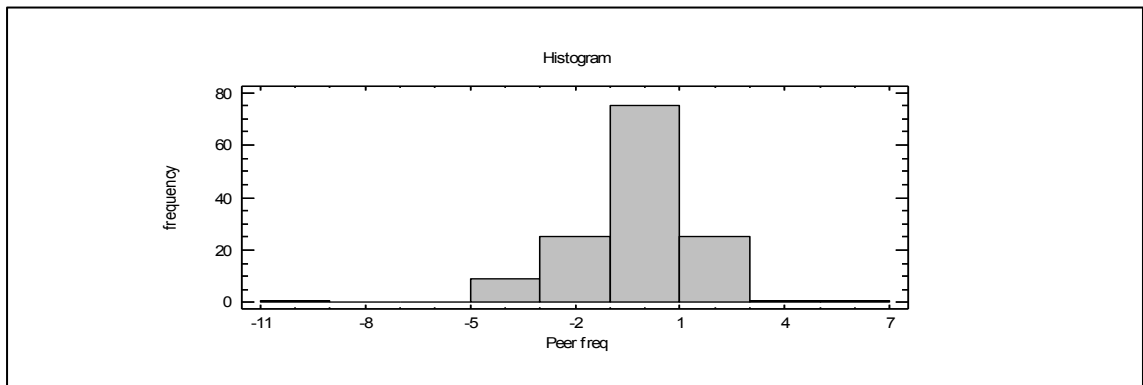**Figure 43 - Peer frequency assessment histogram**

Histogram

Figure 44 - Peer frequency assessment box and whisker

Box-and-Whisker Plot