L-Università ta' Malta

OVERCONFIDENCE BIAS AND THE GENDER EFFECT.

Is there more than just gender?

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Abstract

Overconfidence describes the tendency for people to overestimate their skills, expertise, and accuracy in their judgement and plays a key role in everyday decision-making processes. Several studies have documented that overconfidence is one of the most common biases in the business world and suggest a tendency for men to exhibit higher levels of overconfidence than women. However, in previous research, gender was taken as a given difference. This study set out to examine whether gender is a key predictor of the exhibit of overconfidence bias and explores the degree to which age and level of education influence the impact of the bias. For this, an online experiment was designed that provided quantitative data from 94 participants. This study identified that out of age, education, and gender, gender is the main predictor of overconfidence bias. The data suggests that women are more risk-averse when it comes to estimating one's skills. In surprising contrast to that, the women who did show boldness in decision-making tended to overestimate their skills way more than their male counterparts. These findings imply the possibility that risk-prone decisions made by women could be led by stereotype threat or optimism rather than overconfidence. Evidence is presented that shows that the gender effect of women exhibiting higher levels of overconfidence than men expands with increasing age. This result supports the view that age influences the development of biases differently across genders.

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1. Chapter: Introduction

1.1. Introduction

The initial chapter of the dissertation provides an overview of the current research project. It clarifies the objectives of the dissertation and introduces the research questions that will lead the research.

1.2. Overview

This study explores the impact of gender, age, and education on the exhibit of overconfidence bias. Overconfidence bias, a phenomenon identified in social psychology, involves the tendency to overestimate one's abilities, knowledge, or performance. This bias has a researched effect on our decision-making processes and is impactful in business decisions (West & Zimmermann, 1991). Niederle and Vesterlund (2007) suggest that men tend to compete and exhibit higher levels of overconfidence bias than women. The present research expands on Niederle and Vesterlund's gender study and adds the social factors of age and education to it. Social cognitive theory is used as a theoretical framework, it asserts that gender roles are not predetermined but developed over time through social upbringing and environmental influence (Bussey & Bandura, 1999). Recent studies from Lackner and Sonnabend (2020), as well as Amirkhanyan, Krawczyk and Wilamowski (2021) show that gender roles have led to gender differences in the exhibit of overconfidence bias, with men being more overconfident and willing to take risks than women in various tasks. In a business context, it has been found that men show higher levels of overconfidence in their skills as well as in their ventures, compared to women (Carter, Mwaura, & Ram, 2015). According to Nouri and AhmadiKafeshani (2019) female entrepreneurs show less proneness to overconfidence bias, starting smaller firms with slower growth while being more accurate in predicting budget (Invernizzi, Menozzi, Passarani, Patton, & Viglia, 2016).

1.3. Research gap and relevance of the study

The grand body of literature implies that the expected dichotomy between males and females is the primary driver of different exhibits of overconfidence bias. They have taken differences between men and women or male and female entrepreneurs as a given without considering other potential influences that could trigger overconfidence bias. To avoid the exaggeration of a gender dichotomy this study includes the variables age and education. Studies from Romania and France suggest that overconfidence bias exists across different age groups (Corbu, Oprea, & Frunzaru, 2021) (Francisco, 2018). Furthermore, studies on decision-making found that overconfidence increases with higher levels of education (Mishra & Metilda, 2015). By investigating the relationship between gender and overconfidence bias and taking the factors of age and education into the equation, this thesis tackles the current knowledge of how individuals' behaviour and decision-making processes are related to gender differences alone. It also provides insights into how different exhibits of overconfidence bias may impact gender disparities in various workplaces. By exploring the role of other variables in overconfidence bias, this thesis seeks to offer a more nuanced understanding of the phenomenon and to provide significant implications for entrepreneurs and decision-makers looking to address gender disparities in various fields. The findings may also contribute to broader discussions about gender roles and expectations and their impact on individuals' lives.

1.4. Aims of the study

This study seeks to contribute to a better understanding of overconfidence bias and its relationship to the social factors of gender, age and level of education. Social cognitive theory will be used as a theoretical background, with this choice the study aims to view gender as a social construct rather than a biological givenness, which will influence the implications of this research.

By taking the research of Niederle and Vesterlund (2007) as a foundation, this study aims to re-visit the outcomes of the original study. This will be achieved by not only testing the exhibit of overconfidence bias based on gender differences but also differences in age and level of education.

This research project aims to detect not only if these three factors influence overconfidence bias, but also how age and education exhibit overconfidence in comparison to gender. This process will involve collecting data from a diverse sample of participants and analysing the data using appropriate statistical techniques to identify any significant differences.

Based on of the aims of this study, the research questions are:

RQ1 - To what extent does gender explain overconfidence bias?

RQ2 - Do age differences explain overconfidence bias over and above gender?

RQ3 - Do levels of education explain overconfidence bias over and above gender?

1.5. Summary

This chapter introduces the current research focused on overconfidence bias and the differences in the exhibit of this bias influenced by the factors of gender, age and education. It has outlined the objectives of the dissertation and the research questions associated with it.

2. Chapter: Literature Review

2.1. Introduction

The introductory section emphasises the importance and applicability of the study in conceptualising decision-making processes, particularly in managerial situations. In-depth discussion is given on the idea of overconfidence bias, including its definition, potential advantages, and its effects on individuals and society. The last chapter strives to gather knowledge in which gender, age, and education influence human cognition and how these factors will furthermore influence the main topic of this thesis: overconfidence bias.

2.2. Overconfidence bias

2.2.1. Heuristics and biases

Heuristics are mental shortcuts that people employ to swiftly and effectively form opinions and make decisions (Gigerenzer & Gaissmaier, 2011). These mental shortcuts serve to make decision-making simpler but can also lead to mistakes and biases in judgment (Bazerman & Moore, 2008). Popular examples are the availability heuristic, which describes the probability of events depending on how easily they may be thought about, and the representativeness heuristic which occurs when predicting the possibility of an event based on how similar it is to a known structure (Kahnemann, 2011).

Heuristics are susceptible to biases. Our brain's natural tendency to analyse information and make decisions by using mental shortcuts that avoid processing all available information is known as cognitive bias. Cognitive biases can influence how we understand, recall, evaluate, and reason information, frequently causing us to reach incorrect or unfavourable conclusions (Kahnemann, 2011). These biases can take many different forms, from the overconfidence bias to the propensity for people to process information that is agreeing with their preexisting beliefs, also called confirmation bias (Tversky & Kahnemann, 1974).

In this project, a focus is laid on the influence of heuristics and biases in managerial decision-making. Decision-making biases explain the tendency to diverge from rational thinking when rating options to make choices (Zhang & Cueto, 2017). While using biases to simplify decision-making strategies may reduce uncertainty and speed up decision-making for entrepreneurs, they may also limit decision-making effectiveness and result in poor managerial judgments (Bazerman & Moore, 2008). A bibliometric analysis in 2017 has found that the bias with the strongest influence on managerial decision-making, among overconfidence, confirmation, and anchoring bias, is overconfidence (Costa, Carvalho, Moreira, & Willer do Prado, 2017) which is also the subject of this study.

2.2.2. Defining overconfidence bias

Overconfidence bias is a typical cognitive bias that can influence judgment in a variety of situations. It describes the tendency for people to overestimate their skills, expertise, and accuracy in their judgment and forecasting (Brenner, Koehler, Liberman, & Tversky, 1996).Three different approaches have been used to explain overconfidence. These three types of overconfidence all occur under various circumstances, are brought on by various factors and will be explained in detail in the following(Moore & Schatz, 2017).

Overestimation

Overestimation is assumed to be mainly driven by wishful thinking; people tend to overstate the possibility of desired results for their own interests (Sharot, 2011). Chance et al. (2011) assert that it is not always in one’s self-interest to overestimate the likelihood of desirable outcomes. Athletes, students, and contenders who are overconfident may lack the ability to adequately prepare for the test, resulting in lower performance than they would have otherwise

(Vancouver, More, & Yoder, 2008). Further, the difficulty of the tasks seems to influence people’s predictions. According to research, individuals frequently underrate their performance when a task is simple and overestimate their performance on hard tasks. For example, smokers drastically underestimate their probability of developing lung cancer (Clark & Friesen, 2009).

Overplacement

Overplacement, referring to an individual’s belief to be “better-than-average” is almost universal (Chamorro-Premuzic , 2013). Many people have business ideas, but it's difficult to predict whether they will be successful. Those who place their skills and possibilities over others are more likely to compete in new markets (Cain, Moore, & Haran, 2015). The same applies for job seekers who are overconfident and more likely to submit applications. Students who are overconfident are more inclined to enrol in challenging courses of study. Runners who are overconfident are more drawn to competing (Krawczyk & Wilamowski, 2016). As in overestimation, the degree of overplacement is dependent on the tasks’ difficulty. On difficult tasks, people are more likely to overestimate their own performance compared to others, but when it comes to easy tasks, people are more likely to underestimate the performance of others (Moore & Small, 2007).

Overprecision

Overprecision describes the phenomenon of being overly confident that one’s opinion is right (Alpert & Raiffa, 2004). When asking people to give answers on a subject with a 90% confidence interval that there answer is right, less than 50% can hit that rate, displaying an excessive level of confidence in their views (Moore, Tenney, & Haran, 2016). These results hold true across all levels of expertise (Atir, Rosenzweig, & Dunning, 2015). Research has found it difficult to test the phenomenon in real-life scenarios as it requires to conduct all the ways one may be incorrect, which can be challenging to contemplate when there are numerous ways to be wrong (Moore D. , 2022).

The experimental design of this study is designed to test skill and the attitude to that skill in a simple math task. Therefore, overestimation and overplacement are the main two faces of overconfidence bias that will be tested. In the findings, overconfidence bias will be evaluated and discussed as a whole.

2.2.3. Overconfidence bias – individual or social?

Having presented the three faces of overconfidence bias, it is useful to elaborate how overconfidence bias manifests itself as a function of social and individual attributes.

Social Environment

In one study, Clark and Friesen (2009) asked participants to give a forecast of their performance on two unfamiliar tasks. The outcome showed that overconfidence bias can be almost eliminated on an individual level when monetary incentives and feedback are included in the decision-making process. Comparing the results of this experiment to a study set in a social environment, where participants of an experiment could observe decisions of other participants, Proeger and Meub (2013) found that people remain overconfident. Even so that underconfident participants tend to be more confident in their choices when they observed that their decision is in line with others(Proeger & Meub, 2013).

Individual Differences

Proeger and Meub (2013) have not considered personality differences among individuals in their experiment which, according to (Mohammed & Schwall, 2012), do have an impact on the exhibit of overconfidence bias. Most of the research that examines the influence of cognitive biases on decision-making are based on experimental studies and group comparisons, which could create the misleading impression that everyone is equally sensitive to cognitive biases, as participants are treated as identical individuals (Gilovich, Griffin, & Kahneman, 2002).

However individual differences including personality (Schaefer, Williams, Goodie, & Campbell, 2004), gender (Niederle & Vesterlund, 2007), narcissism (Ames & Kammrath, 2004) and cognitive abilities (Kleitman & Stankov, 2007) have been found to create differences in the exhibit of overconfidence bias.

This indicates that the social context of a person as well as their individual personality traits must be considered when measuring the exhibit of overconfidence bias.

2.2.4. The role of overconfidence bias in managerial decision-making

According to utility theory, individuals are endlessly rational, hold correct and useful knowledge, and use logic to make decisions that produce the best outcomes (Tversky, 1975). Simon (1956) criticized this notion, arguing that rationality in decision-making is constrained and affected by both internal and external elements. Tversky and Kahnmann (1979) followed this thought and introduced an alternative theory called Prospect Theory. This theory states that individuals rely mainly on their own judgements and only utilize a portion of the information at their disposal. Moreover, even when processing the available information, people occasionally disregard facts and react on impulse or follow what they are convinced to be true using heuristics and cognitive shortcuts (Garcia, 2013).
Overconfidence plays a central part in the formulation of people's decisions, particularly in situations with bigger degrees of difficulty and ambiguity (Shipman & Mumford, 2011). Several studies have looked at the frequency of cognitive prejudices in the decision-making process, emphasising the importance of overconfidence in influencing a company's performance (Donuhe, Özer, & Zheng, 2020). Overconfidence is one of the most studied behavioural biases among economists as it appears to be connected to several decision-making processes(Weber & Merkle, 2011). A meta-analysis conducted by Grežo (2021) supports this

statement. He found that overconfidence has a minor but consequential effect on financial decision-making (Grežo, 2021). In the areas of business, accounting and management overconfidence guides people to make harmful choices (Fellner & Krügel, 2012) that could diminish a firm's worth (Ahmed & Duellman, 2013), because of this prejudice, people may not be aware of the dangers involved in the choice they are about to make. (Kumar & Goyal, 2015). With the knowledge that humans can't be fully rational thinkers, a study by Musso, et al. (2021) underlines that in the field of management, overconfidence as well as intuition, are important aspects in the decision-making process.

2.2.5. Can overconfidence be useful?

The phrase "believe in yourself" has proven to be good advice many times over. Being bold and optimistic in the decisions one makes helps to overcome the fear of failure in competitive settings (Burson, Faro, & Rottenstreich, 2010) but overconfidence also leads people to be more persuasive and influential (Radzevick & Moore, 2011). Those who are more overconfident are more likely to rise to positions of prestige and power in organisations. While choosing confident leaders may be valid if there is a link between confidence and ability, there is a significant threat in choosing overconfident principals. (Anderson, Beer, Srivastava, Spataro, & Chatman, 2006).

2.3. Gender, Age & Education

To answer the previously stated question "Does overconfidence vary consistently among individuals?", the influence of age, gender and education on overconfidence bias will be discussed in the following chapters.

2.3.1. Gender

Social cognitive theory of Gender Development

Studies show that women collectively steer away from fields concerning science, technology, engineering, and mathematics (Denice, 2020). This is alarming because research has found no gender differences in skills and talents in these fields (Kersey, Braham, Csumitta, Libertus, & Cantlon, 2018). So, why is it that one gender is more prone to something, if there is no difference in their skill set?

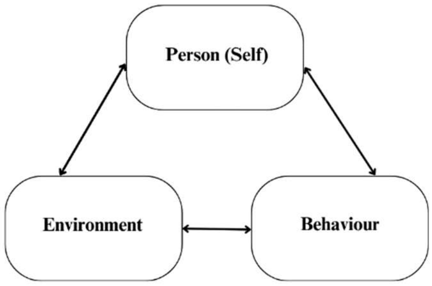


Figure 1 *The triadic reciprocal causation model (Bussey & Bandura, 1999)*

Bussey and Bandura (1999) explain gender development and the following gender differences in the setting of social cognitive theory. The theory states that development is based on three things: Person (Self), Environment and Behaviour.

This triangle is called the triadic reciprocal causation model and displays how these factors influence each other. In terms of gender development this means that a person's gender beliefs (self) may have an impact on how they express their gender (behaviour). Their actions are then affected on how people react to them in their immediate surrounding (environment), which can further sculpt their ideas and beliefs (self). This leads to characteristics, that are commonly linked to one gender, being rewarded greater by society (Epstein, 1997). Peers and parents strongly influence the development of gender roles, for example by focusing the purpose of boy toys on educational material, while the rooms of girls are filled with domestic items and dolls (Etaugh & Liss, 1997). Furthermore, emotional support is offered more willingly to young females whereas parents address anger a lot more when talking to their sons. More boys tend to pursue careers in science and maths as they are encouraged and supported from their parents, peers, and teachers to pursue their interests, as these interests fit the socially constructed gender roles. Boys and girls are equally capable, but girls tend to lack confidence because of the absence of encouragement they receive (Kågesten, et al., 2016). Social Cognitive Theory helps to explain how gender develops and ultimately why gender differences exist in certain fields of expertise.

Gender differences in the exhibit of cognitive biases

Gender differences, according to Social Cognitive Theory, stem from the social upbringing and influence the way one gender behaves and thinks, which ultimately leads to gender differences in the exhibit of cognitive biases. Berthet (2021) measured individual differences in cognitive biases and found significant gender differences in overconfidence bias and outcome bias, whereas framing bias showed no significant differences between males and females.

Nouri and AhmadiKafshani (2019) conducted in-depth interviews with female and male entrepreneurs to find an answer to the question “Do female and male entrepreneurs differ in their proneness to heuristics and biases?” Their findings show that businessmen displayed both optimistic overconfidence and overestimation of their expertise, but the businesswomen were more prone to optimistic overconfidence. In comparison to their female counterparts, the study's businessmen tended to be significantly more overconfident. Even though both male and female business owners were exposed to the illusion of control, the effects of this bias manifested themselves in various ways. Male business owners underestimated market competition due to the illusion of control, whereas female business owners underestimated the effects of their company's activities on their family and marital relationships (Nouri & AhmadKafeshani, 2019). Traut-Mattausch, Jonas, Frey and Zanna (2011) investigated gender differences for confirmation bias. The results showed that women exhibited less confirmation bias when making a decision that affected both them and their partner (interdependent decision) as opposed to one that solely affected them (independent decision). Hence, while making an independent decision, female decision-makers are driven to defend their preference, whereas when making an interdependent choice, they are motivated to be as accurate as possible. Men, on the other hand, displayed less confirmation bias when they made an independent choice as opposed to an interdependent one. This behaviour can be influenced by the stereotype threat that is discussed by Spencer, Steele and Quinn (1999). Stereotypes are partly the product of shared social norms involving what we expect certain people to do in specific situations. A person has a stereotype threat when they are conscious of a false belief and about their social cluster and are worried about confirming it (Spencer, Steele, & Quinn, 1999). Villanueva-Moyas and Expositos (2021) indicated that the threat posed by gender stereotypes has an impact on how women make decisions. This can even result in women taking more unfavourable decisions (Woodrow, et al., 2019), as they are distressed about verifying unfavourable assumptions about their social cluster when they carry out an assignment because they are aware of the behavioural biases concerning their gender (Steele & Aronson, 1995). They report monitoring their performance in situations where stereotypes are threatened, thinking more about the stereotype (Beilock, Rydell, & McConnell, 2007), feeling self-conscious (Steele & Aronson, 1995), or being disorganised (Spencer, Logel, & Davies, Stereotype threat, 2016).

Gender Differences in managerial decision-making

As this study lays a special focus on managerial decision-making processes that are influenced by overconfidence bias, gender differences in this field are being explored in the following.

Gender differences in decision-making have been recorded in the literature (Byrne & Worthy, 2015). Men use specific information to inform their decisions and digest information selectively (Byrne & Worthy, 2016). On the other hand, women would consider all environmental information and pay special attention to every detail (e.g., advantage and effects of a choice), but males typically ignore environmental information (such as repercussions or risks of an activity) to achieve their aims. As a result, males do not mind making judgements that carry significant risks if they accomplish their goal in contrast to women who weigh the dangers of these options and appear to let them determine their ultimate choice (Lozano, et al., 2017). A study conducted by Apesteguia, Azmat and Iriberri (2012) showcases these different thinking processes. The team performance experiment measured the outcome of the business simulation based on the gender composition of each team. Groups only composed of women were not as aggressive in their pricing strategies, spend little on R&D, and more on social projects. These decision result from the team being aware of their actions and the consequences these decision carry (integrated information process). Overall, solely women teams were outperformed by all the other ones (Apesteguia, Azmat, & Iriberri, 2012).

Gender Differences in competition

Niederle and Vesterlund (2007) have used a competition scheme to conduct gender differences in overconfidence bias. As this study will lean on this data collection method, the matter will be investigated in theory first. Starting with Lackner and Sonnabend (2020) who found clear evidence concerning gender differences in competition when conducting an experiment in a high-stakes environment. Male contestants reacted strongly to an increase in competition, and task-based goals had a positive effect on their performance. Azmat, Calsamiglia and Iriberri (2016) discovered that female students do better than male students, but these differences are considerably higher when the stakes are low. As soon as stakes increase, the performance of male students increases. On the contrary, if the rewards from competing are substantial women are willing to compete as much as males are, and they win just as many competitions (Petrie & Segal, 2017). Croson and Gneezy (2009) support these findings with their literature review on gender differences in economic experiments that had the following conclusion:

We found that women are indeed more risk-averse than men. We found that the social preferences of women are more situationally specific than those of men; women are neither more nor less socially oriented, but their social preferences are more malleable. Finally, we found that women are more averse to competition than men (Croson & Gneezy, 2009, p.448).

Croson and Greezy (2009) discovered a considerable bias in the literature body on gender differences regarding the fact that papers are prone to issue research that found difference than studies that did not.

2.3.2. Age

Age differences in the exhibit of cognitive biases

Most of the studies on cognitive biases focuses on students between 18 and 30, however biases have also been studied in different age groups (Stanovich, Toplak, & West, 2008). In general, older adults seem to make more judgements and decisions based on affective information, and they seem to exhibit a positive effect, particularly when processing information before making a choice. Although it has been difficult to discern whether the positivity impact results from an age-related positivity bias (heavy weighting of affirmative information) or a negativity bias (smaller weighing of unfavourable information) (Peters, Dieckmann, & Weller, 2010). Added to that, two affective processes that show age-related variations are the sunk-cost fallacy (to keep working on something we've already invested time, money, or other resources in, even though changing our minds would be better) and the framing effect (when responses vary depending on whether something is presented as favourable or bad) (Strough, Metha, McFall, & Schuller, 2008). From childhood to later adulthood, the sunk cost fallacy seems to diminish while reasonable decisions concerning sunk costs seem to grow. It is argued that when automaticity and cognitive pragmatics rise and content is more heavily relied upon, cognitive mechanics become less important in adulthood (Strough, Karns, & Schlosnagle, 2011). Many pieces of research on framing effects and age indicate that the effect is significantly stronger in older people (Weller, Levin, & Denburg, 2010).

Regarding the general dual-process hypothesis, research that studied people between 18 to 88 years old shows that as individuals aged, they tend to use both intuitive and logical decision-making techniques. (Bruine de Bruin, Parker, & Fischhoff, 2007). Another survey of undergraduates who ranged from 19 to 50 years old indicates, that adults were less likely to apply intuitive decision-making approach as they aged (Loo, 2000). The two research results are at odds with dual-process theories of ageing, which contend that as humans age, intuition rises to make up for cognitive deficits (Peters, Hess, Västfjäll, & Auman, 2007). In one study, Taylor (1975) investigated how management information processing and decision-making are influenced by age. This factor is related to the decision-making ability within the average range of management ages. It was discovered that older decision-makers relied more on system 2 thinking and had lower levels of choice confidence (Taylor, 1975).

Influence of age in gender differences concerning cognitive biases

With gender being the focus in this thesis, literature on the influence of age in gender differences concerning cognitive biases has been collected. Delany (2014) as well as Sanz de Acedo Lizzarraga, Sanz de Acedo Baquadano and Cardelle-Elawar (2007) investigated age and gender differences in decision-making processes. The studies reveal that the decision-making of the participants in their experiment differ significantly by gender and by age. Their differences in behaviour were related to the contrasting ways in which they weight the relevance of the task, the importance of the decision maker and influence of environmental factors. Overall, the younger generation felt emotional and social pressure in their decision, while the importance of a rational decision only occurred at a later age. Furthermore, the results show that emotions keep being an important part of female decision-makers as they appear to be more aware of the unsureness and consequences of their decision. Contrary to that males develop to assign more relevance to the analysis of the essential information and gain more motivation from the process as they also feel the pressure to perform more intensely. In conclusion, Sanz de Acedo Liarraga et al. (2007) state that at a young age there are close to no gender differences in the exhibit of cognitive biases, whereas both genders tend to think more rational with progressing age, women still rely partly on intuition and emotions.

2.3.3. Education

Differences in levels of education in the exhibit of cognitive biases

A growing corpus of research, that was systematically reviewed by Fan (2017), indicates that the level of education appears to be positively correlated with individual rationality and decision-making capacity. In a recent study that examined how HR teams may employ cognitive biases, particularly framing effects, to build pension structures and communication rules, Maloney and McCarthy (2016) indicates that personal education and financial literacy play a significant role to achieve more beneficial results and increase the effectiveness of decision-making processes. Arcidiacono (2011, p. 521) proposes that "...it is mainly those who have a lower income or a lower education level who are more likely to fall prey to framing" and into a biased thinking pattern (Arcidiacono, 2011).

A study from Health Science Education measured the recurrence of biases across three levels of training (Crowly, et al., 2013). They discovered statistically significant differences in peoples habit of satisficing according to training level. Satisficing explains the propensity of individuals to settle for "good enough" option when making decisions, rather than seeking the best possible option. Those who had received more training were more likely to satisfice and make decisions on limited time, information, and cognitive abilities (Crowly, et al., 2013). Roth, Robbert and Straus (2015) investigated the sunk-cost fallacy in economic decision-making. While they found a high influence of the sunk cost effect among young students, their results reject the notion that economic education or other forms of high familiarity with economic decision-making can successfully minimize this bias. On the contrary, in another study, rational decision-making concerning sunken costs was shown to be favourably connected with training level, which was calculated by the number of management accounting college courses finished, but not with experience level, which was calculated by the number of years spent working in the financial sector (Fennema & Perkins, 2008).

Influence of education in gender differences concerning cognitive biases

In a study by Fan (2017), the risky-choice framing effect is used in an experiment to look at human rationality and gender differences at a Chinese college. The findings expose the limits of conventional framing effects by demonstrating that the pupils' decisions were largely unbiased and to some degree guided by the arithmetic skills they had attained via higher education. Furthermore, no differences in gender have been revealed.

When level of education is the same, differences between men and women in decision making appear less grand, especially when focusing on smaller professional subgroups. For example, gender differences in financial risk professions are less pronounced and frequently non-existent within this demographic (Atkinson, Baird, & Frye, 2003). Atkinson, Baird, and Frye (2003) explored the performance and financial decisions of male and female managers with the same level of education of investment funds. They discover that the performance, risk, and other attributes of male and female-managed funds are not notably different. These findings demonstrate that distinctions in investment behaviour, often ascribed to gender differences, could be rather rooted in investment knowledge and wealth constraints.

2.4. Relations between overconfidence bias and the factors of gender, age, and education

2.4.1. Overconfidence and gender

There is a lot of empirical evidence found in the literature that the factor of gender influences the exhibit of overconfidence bias. Lewellen et al. (1977), Lundeberg et al. (1994), Beyer and Bowden (1997), Lenney (1977), Barber and Odean (2001), Prosad et al. (2015), and Kumar and Goyal (2016) are a few researches that were carried out to assess the influence of gender in the exhibit of overconfidence bias. Typically, these studies find that men exhibit more overconfidence than women do. Results from a study by Veldhiuzen (2022) suggest that gender variations in risk attitudes and confidence in skills and knowledge are what ultimately drive the gender gap.

H1: There are gender differences in the exhibit of overconfidence bias.

H2: Men are more overconfident than women.

2.4.2. Overconfidence and age differences

The number of empirical evidence is getting smaller, compared to gender and level of education, when it comes to the matter of age differences in overconfidence. In studies on ageing, there is a variation of findings. For instance, Forbes (2005) and Pliske and Mutter (1996) both found a negative association between overconfidence and age when employing general knowledge questions. Perlmutter (1978), in contrast, found no association between age and overconfidence. Lastly, Crawford and Stankov (1996) found a relationship between age and overconfidence that was positive. More evidence of a positive relationship between advanced age and a higher exhibit of overconfidence was found by Hansson, Rönnland, Nilsson and Juslin (2008). While age differences in the exhibit of overconfidence bias have been found in previous studies, the outcomes are more related to gender and age rather than age alone, this is also demonstrated by Tehrani and Gharenkoolchian (2012). Furthermore, a study by Tejos, Deemen, Rodriguez and Gomez (2019) measured overconfidence bias in a stock market in a micro world-based setting. The results indicate that overconfidence bias can be described by gender, career, and education level, while age and nationality are not notable constants. Based on the literature review above, the following hypothesis are being proposed.

H3: There are age differences in the exhibit of overconfidence bias.

H4: Higher levels of overconfidence are associated positively with increasing age.

H5: The impact of gender is higher on overconfidence bias than the impact of age.

2.4.3. Overconfidence and education level

Mishra and Metilda (2015) hypothesised that well educated and experienced investors are more susceptible to overconfidence bias than less knowledgeable and experienced investors. According to Zaidi & Tauni (2012), investors' prior experiences and education influence their behaviour and lead to overconfidence. Especially CEOs and COOs that must make decisions in a competitive market tend to follow their original overconfident tendency more strongly (Kim & Na, 2022). Kansal and Singh (2018) found that overconfidence rises with task frequency but looking at the business sector there is no association between gender and decision-making processes. So, it can be claimed that either men or women who trade more regularly report having more overconfidence. These findings are consistent with earlier research by Lundenberg et al. (1994), Deavas et al. (2009), and Biais et al. (2005). Furthermore, Du, Xiao and Zhao (2020) suggest that education influences people’s perceptions of gender roles and result in more equal gender role attitudes. The conclusion of this study implies that education helps to minimize gender differences in attitudes to risk and skill.

H6: The exhibit of overconfidence bias is influenced by the level of education.

H7: Higher levels of overconfidence are associated positively with higher levels of education.

H8: The impact of education is higher on overconfidence bias than the impact of gender.

2.5. Summary

Ultimately, a thorough analysis of the connections between overconfidence bias and the variables of gender, age, and education has been provided. According to the literature, men tend to exhibit higher levels of overconfidence than women. The relationship between overconfidence and age is less clear and while some research has found a positive relationship between age and overconfidence the results are not consistent. The influence of education has been identified as stronger throughout several papers, suggesting diminishing gender differences in the exhibit of overconfidence bias as level of education rises. The literature review lays a foundation for further data collection and implications of the findings and will contribute to the overall conclusion.

3. Methodology

3.1. Introduction

The aim of this chapter is to create a method were information for the research questions constructed by the literature review can be gathered. Furthermore, ethical considerations as well as the process of data analysis are described.

3.2. Sampling

The overall research setting gives a population frame that is limited to the Austrian population. To reach statistical feasibility, the researcher chose a sample of 80 subjects for the experiment that were drawn from the stated country. The decision for this sample size is rooted in the narrow population chosen, the sample size determined by the similar study of Niederle and Vesterlund (2007), and the calculation of the power analysis using the G*Power 3.1 tool. The sample had to fulfil certain criteria concerning gender, age, and level of education to participate in the experiment. Participants had to identify with the female or male gender. Furthermore, participants had to be of a certain age or reach a certain level of education. As differences in cognitive biases seem to become clearer with greater age gaps (Bruine de Bruin, Parker, & Fischhoff, 2007) the determined age groups are 18-30 and 50-65. These age groups circle the years when people typically work in Austria and must make managerial and business decisions, with which the researcher is concerned in this study. Education as a variable was defined by using "Statistik Austria": the first level of education is a high school diploma, which is achieved by 30.4% of the population, and the second one is an academic degree, which is achieved by 19.7% (Statistik Austria, 2023). The six criteria points - female, male, high school diploma, academic degree, 18-30 years old (juniors), and 50-65 years (seniors), old were aimed at being equally distributed among the participants. Meaning that, for example, 40 subjects are female or 40 have an academic degree. To ensure a variable of variability, the stratified sampling method was used, where sub-groups for gender, age, and education were created and random samples were drawn from those subgroups. As the recruitment target was reached, the researcher checked the distribution for each criterion. It was found that the distribution among juniors and seniors was not even. Because of that, the recruitment target was adapted, and more seniors were added to balance the differences. With 159 people starting the experiment, the final number of people who completed the experiment reached 94. Concerning gender, the distribution was almost equal, with 46 males and 48 females. 50 participants had an academic degree, 41 had a high school diploma, and 3 of the subjects reached none of the educational levels. Furthermore, 24 of the female participants had an academic degree and 24 had a high school diploma, while 26 men had an academic degree and 17 had a high school diploma. The average age of the sample was 34.53, with a standard deviation of 13.79. 58 of the sample were juniors, with 31 being male and 27 being females while 33 were seniors, with 14 being male and 19 being female. Furthermore, 24 of the participants with an academic degree were juniors and 26 were seniors while 31 of participants with a high school diploma were juniors and 10 were seniors.

3.3. Experimental Tasks

The researcher applied an experimental design based on the previous work by Niederle and Vesterlund (2007). Overall, there were 4 tasks in the experiment, and it took participants an average of 20 minutes to complete it. For each task, participants must continue as many sets of two-digit number sequences as possible within a 4-minute timeframe. Participants were allowed to note down numbers on scratch paper but were not permitted to use calculators. The number sequences were assorted randomly for every participant. Participants completed tasks under two different reward systems: first, an individual performance compensation scheme (individual game) that isn't competitive, and later, a tournament compensation scheme (group game) that is competitive. The first task presented the individual game where participants could win 10 cents per correct answer, and the second task introduced the subjects to the group game where participants were randomly put into groups of 4, and the group member with the highest number of problems solved could win 40 cents per correct answer. In the third task, participants were asked to predict their performance for the next task and either choose the group or the individual game. Finally, the participant could decide in the fourth task if he or she wants to enter an individual or group game for a previous performance. For this task, there were no more number sequences to solve as the performance the participants had to base the decision on was drawn from Task 1. Furthermore, participants were not aware if their performance was better or worse than the performance of other participants in their group until after the experiment. A detailed description of all four tasks can be found in Appendix 2.

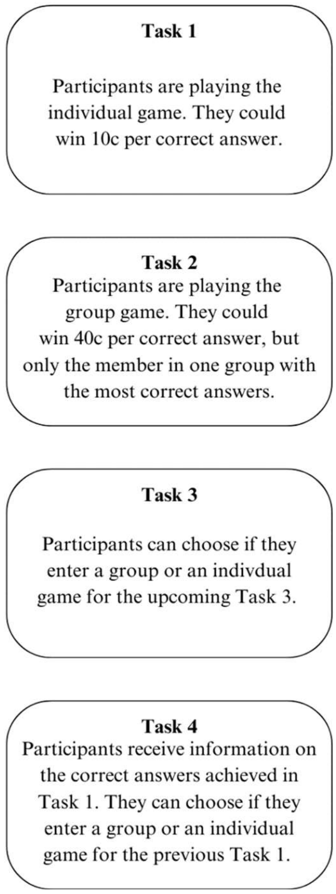


Figure 2 *Flowchart for Task 1,2,3&4*

This four-minute number sequence exercise was chosen since it calls for both ability and effort. Furthermore, a recent cross-national meta-analysis from Ghasemi and Burley (2019) suggests that there are no gender differences in easy math tasks. To determine if other variables than performance influence the decision-making process, a gender-neutral task is crucial. A monetary value to win was consciously chosen as it adds an element of risk to the compensation decision. Overall, for people who participated in the experiment, there was a lot of uncertainty. They did not receive specific information on who they were in a group with, how many number sequences they solved, or how many number sequences they were to solve. This uncertainty was consciously placed, as we use biases to reduce uncertainty and speed up decision-making processes. As this uncertainty revolved around estimating one's skills and accuracy in judgment and forecasting, it fell into the area of overconfidence bias. To go into more detail behind the structure of the experiment, the first two tasks displayed if there were general differences between the categories (gender, age, and education) in playing an individual or group game and showcased if there was a learning curve. The tournament choice in Task 3 was constructed to evaluate how participants estimate their future performance and if they base their decision on recent performance or other variables. With the choice in Task 4, the researcher could compare if the decision to enter a group game was driven by the motivation to compete in the future (Task 3) or if there was a general belief in performing better (Task 4). This structure gave the researcher the basis to analyze and compare categories and detect if the choice to compete is driven by performance or other variables.

3.4. Data Collection

Participants were asked to complete the experiment online. Participation was not dependent on a certain time or place. The experiment was built on an online tool called Gorilla. The program was designed to build experiments that collect behavioral data and record all requested information about participants. Multiple pilots were run by the researcher to test the experiment and make it user-friendly and easy to understand. These pilots were not included in the data analysis. Before the experiment, participants were briefed by the researcher that the experiment would take 20 minutes and that concentration and focus were required. Every participant received the same information before the experiment. By adding a test round at the beginning of the experiment, an equal understanding of the tasks among the participants was established. To ensure equal circumstances, participants who did not complete the experiment in one sitting were excluded. The experiment built by the researcher can be found in the open library at Gorilla (Gorilla, 2023).

3.5. Data Analysis

In this study, nominal, ordinal, and numerical data were collected and further structured using SPSS. First, the raw data was tested for normality, which was rejected by a p-value of 0.001. With this knowledge, the researcher refined the choice of statistical tests to use for the descriptive part of the analysis to identify patterns and trends in the sample. Furthermore, the variable gender was compared on performance and tournament choice using logistic regression to establish a deeper understanding of the decision-making process in the experiment and identify gender differences.

To reject or retain the null hypothesis created in the literature review, an OC Score (Over-Confidence Score) has been generated. First, the participants were separated into three groups. The first group resembled participants who made the "right" decision, meaning they either entered the tournament and won it as well as the subjects that did not enter the tournament with no possibility to win it. This group was assigned the value 1.

The second group consists of participants who entered the tournament without winning it. The mean of correct answers necessary to win a tournament in Task 3 was 7.6, and in Task 4 it was 7.1 (calculated out of correct answers achieved by people who won or could have won a tournament in Task 3 and Task 4). For the second group, the achieved correct answers by each participant were subtracted by the mean (e.g., Correct Answers-7.6) to detect the percentage deviation from that answer to the mean (e.g., 7.6/100*(Correct Answers-7.6)). Each Task was calculated separately and added to the value 1, the complete Formula is demonstrated below.

Formula (Task 3): 1+7.6/100(Correct Answers-7.6)*

So, every participant with a value over 1 overestimated their performance. In the third group are all participants who could have won a tournament but did not enter. Like group 2, the number of correct answers, and the percentage deviation from the answer to the mean was calculated with the exception that the calculation was subtracted from the value 1, as shown below.

Formula (Task 4): 1-7.1/100(Correct Answers-7.1)*

So, every participant with a value under 1 underestimated their performance. The further away the value is from one, the more the participants overestimated or underestimated their chance of winning a tournament. Considering that the focus of this analysis is on the differences within the overconfidence bias; the OC Score was only accounted to the participants that have overestimated their performance on either the third or the fourth Task. If a participant has overestimated their performance in both Tasks, the median of these values will be calculated. The sample size that received an OC Score has shrunk to 23. Recent studies have applied bootstrapping methods to increase estimated accuracy and power calculations that depend greatly on standard deviation and variance (Wang, 2019). In former studies, sample sizes of less than 20 have been bootstrapped (Ratick & Schwarz, 2019). To increase the power of the tests, the sample size was bootstrapped to 1000 for the statistical tests that were conducted on the OC Score.

A test for normality revealed that the OC Score is parametric. By running independent t-tests on the OC Score, differences in means in gender, age groups, and levels of education could be identified. Furthermore, a linear regression on gender and OC Score was conducted to get a deeper understanding of the effect. To find indications in the variance of the OC Score, the researcher conducted an ANCOVA, each with the covariant gender and individually with the independent variables' level of education and age groups. Before running the test, the researcher made sure that all assumptions for ANCOVA were met. Overall, the researcher aimed for a confidence interval of 95% and rejected the null hypothesis at an alpha level of 0.05.

3.6. Ethical Considerations

This study was remote and did not include direct contact with the participants. Every participant had to read and accept a consent form at the beginning of the experiment. If the consent form was not accepted, the experiment could not be continued, and all data was deleted. This form included a description of the study, what will be required of the participant, and information on how the data will be used. The consent form can be found in the Appendix 1. As participants were able to win a reward during the process of the experiment, they were given the option to hand out their email addresses. It was addressed on multiple points that the data was only used to receive the reward and that this private information was still optional and not necessary for the experiment. The researcher deleted the email addresses of the participants after sending the reward. Other than that, the data collection was anonymous, and only a blind ID was used in the data analysis. Furthermore, data security was ensured by only using SPSS offline to analyse the data and avoiding uploading information on third-party websites.

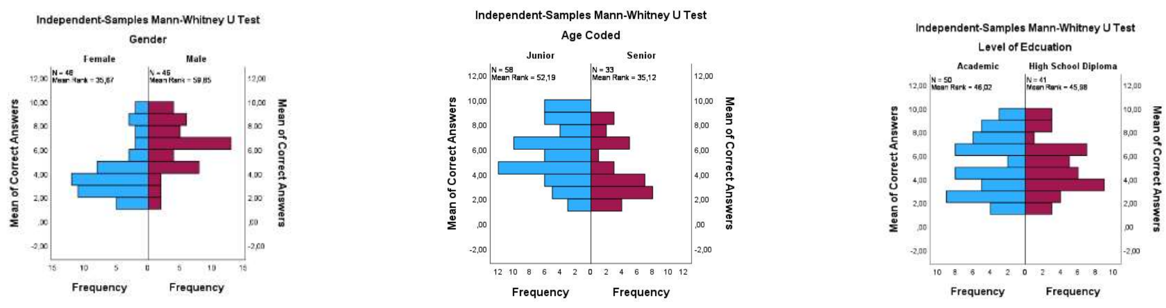
4. Results

4.1. Descriptive Statistics

The overall mean of solved number sequences per participant is 5.83 per Task with a standard deviation of 2.37, but there are significant differences among the categories. Table 1 demonstrates that on average, female participants solved 5.83 problems per Task while male ones solved 5.97. With a p-value of <.001 for Task 1 and Task 2 and a p-vale of 0.003 for Task 3, a statistical difference among the male and female performance can be detected using a Mann-Whitney U Test. Furthermore, the average hit rate of juniors (age 18-30) was 5.86 while the one among seniors (age 50-65) was 5.67. This difference in performance has a p-value of 0.003 and is therefore considered as significant. Lastly, subjects with an academic degree had a mean of correct answers of 5.79 while participants with the highest education of a high school diploma had an average of 5.86. With a p-value of 0.994, the null hypothesis can be retained meaning that there is no significant difference in performance across the categories of e

Table 1

Mean of Correct Answers for Gender, Age and Education



A Spearman Rank correlation indicates that there is a strong correlation between the performance of participants in Task 1 and Task 2 as well as Task 2 and Task 3 (r = 0.63). The positive rho suggests a positive monotonic relationship, meaning that the performance of a participant in Task 1 seems to be correlated to the performance of the same participant in Task 2. This information is crucial for further analysis as the researcher is considering means of correct answers in other statistical tests.

Concerning Task 3, 18 male participants decided to enter a group game while 28 chose the individual game. Contrary to that, 7 women entered a group game while 41 decided to play an individual game. In Task 4, 10 of the male participants decided on a group game, based on a previous performance they were given information on, while 36 decided to play an individual game. The ratio of female participants, with 41 playing the individual game and 7 in group game, stayed the same in Task 4. Table 2 gives information on the game choices made across categories of age and education.

Table 2

Game Choices Age & Education

		Task 3		Task 4	
		Individual	Group	Individual	Group
Age	Junior	40	18	49	9
	Senior	27	6	25	8
Education	High School.	30	11	36	5
	Academic	36	14	39	11

In Task 3, where participants had to decide if they would like to enter a group or individual game for the next performance, 10 out of 94 won a tournament. 9 of those 10 were male while one was female. 37 male participants did not win the tournament, but 9 out of them entered a tournament and another 9 would have won the tournament if they had decided on a group game. On the other hand, 47 female participants did not win a tournament, but 6 of them tried it by choosing a group game and a further 10 would have won if they had decided on a group game. Even though there are differences in performance for participants who decided to play an individual game or a group game, these differences are not significant (Table 3&4).

Table 3

Male participants tested for difference in performance according to tournament choice.

Null Hypothesis	Test	Sig.	Decision
The distribution of Correct Answers 3 is the same across categories of Task 3 Choice	Independent-Samples Mann-Whitney U Test	0.198	Retain the null hypothesis.

Note. Correct Answers and Task Choice from male participants only

Table 4

Female participants tested for difference in performance according to tournament choice.

Null Hypothesis	Test	Sig.	Decision
The distribution of Correct Answers 3 is the same across categories of Task 3 Choice	Independent-Samples Mann-Whitney U Test	0.606	Retain the null hypothesis.

Note. Correct Answers and Task Choice from female participants only

In Task 4 subjects had to decide if they would like to enter a group game or an individual one, based on the correctly solved number sequences they achieved in Task 1. Seven male participants and zero female participants won the tournament. 39 male subjects did not win, while 3 of them joined the group game and did not win and 12 would have won if they decided to play one. 48 female subjects lost while 8 of them tried to win a tournament and another 7 would have won if they had decided on a group game.

The main variable used in this analysis is the OC Score. A higher score indicates a higher overestimation of performance. The following table demonstrates the mean of each category, divided by gender.

Table 5

Average OC Score for each category

	Female	Male
Junior	1,256183333	1,1736
Senior	1,372266667	1,149975
Academic Degree	1,360671429	1,1586
High School Diploma	1,2492	1,1727

4.2. Comparative Statistics

4.2.1. Task 3

To consider both covariates, gender, and performance, in the decision-making process of entering a tournament (Task 3), a logistic regression was applied. The indicator of performance is the mean of correct answers the participant achieved in Task 1 and Task 2 (Table 6: Mean of Correct Answers 1&2), before having the choice of entering a tournament or not.

Table 6

Influence on Tournament Choice Task 3(1)

	B	S.E.	Wald	Df	Sig.	Exp(B)
Gender	-.822	.566	2.178	1	.140	.440
Mean of Correct Answers 1&2	.225	.100	5.071	1	.024	1.253
Constant	-1.112	1.148	.939	1	.0.332	.329

With a p-value below alpha (p=0.024) and a high Wald statistic (5.071), the table suggests that the coefficient for performance is statistically significant. On the other hand, gender has a p-value of 0.140 and a relatively low Wald Statistic of 2.178, which indicates that the coefficient of gender is not statistically significant. These numbers suggest that, after considering the previous performance variable, gender has no significant effect on the choice when entering a tournament in Task 3 while the previous performance of Task 1&2 does.

Table 7

Influence on Tournament Choice Task 3(2)

	B	S.E.	Wald	Df	Sig.	Exp(B)
Correct Answers 3	.133	0.95	1.946	1	.163	1.142
Gender	-1.138	0.526	4.687	1	0.30	.320
Constant	-.137	1.030	.018	1	.894	.872

When inspecting the performance of Task 3 as covariant to gender on the dependent variable of tournament choice in Task 3 the log-odds shift. It appears that gender has a greater impact on the choice with a significant p-value of 0.03 than the performance the participants predict. As in the moment of choosing a game in Task 3, the performance is a vague prediction of the participant.

To further investigate the gender differences in entering a tournament and compare observed frequencies, a chi-square test has been conducted. The test revealed that the choice of entering an individual or group game is dependent on gender (p-value:0.007). The result is statistically significant so the alternative hypothesis can be rejected which implies that there is a significant association between gender and compensation preferences. Furthermore, as a 2x2 table has been used, the phi coefficient is to be considered which represents -.278. This value indicates a mild tendency for one variable to increase as the other decreases (Sharpe, 2019). The male gender is coded with 1 while the female is coded with 2, a negative association describes a mild tendency that as gender is female, the likelihood of entering an individual game is higher and as gender is male, the likelihood of entering a group game is higher.

Table 8

Gender-based tendency on tournament choice Task 3

		Value	Significance
Nominal by Nominal	Phi	-.278	.007
	Cramer' V	.278	.007
N of Valid Cases	94		

Note. Chi Square test, Gender and Choice in Task 3.

4.2.2. Task 4

The numbers change when the choice of entering a tournament is based on a performance that has happened in the past, as it is in Task 4. The variable performance is now presented by the number sequences solved in Task 1 as participants base their performance specifically on this outcome.

Table 9

Influence on Tournament Choice Task 4

	B	S.E.	Wald	Df	Sig.	Exp(B)
Gender	-.329	.575	.328	1	.567	.720
Correct Answers 1	.092	.111	.690	1	.406	1.097
Constant	-1.486	1.178	1.590	1	.207	.226

Note. Correct Answers 1 represents the performance in Task 1.

Neither the coefficient for gender (p=0.567) nor the coefficient for performance "correct answers 1" (p=0.406) showed a significant effect on the choice made in Task 4. The lack of statistical significance suggests that the variables do not have a significant impact on the choice made in Task 4 when the basis of the tournament relies on a performance in the past. A chi-square test supports that suggestion as there was no significant effect (p=0.368) found between gender and choosing a tournament after the performance has been completed. Furthermore, the phi coefficient (-0.093) in Task 4 does not indicate any kind of association (Sharpe, 2019).

Table 10

Gender-based tendency on tournament choice Task 4

		Value	Significance
Nominal by Nominal	Phi	-.093	.368
	Cramer' V	.093	.368
N of Valid Cases	94		

Note. Chi Square Test, Gender & Choice in Task 4.

4.3. Gender and OC Scores

In this thesis, the researcher is concerned about the topic of overconfidence. The focus of the first RQ, "To what extent does gender explain overconfidence bias?" is asking about the differences within the overconfidence bias. The OC Score has 23 samples, of which 11 are male and 12 are female. This sample will be bootstrapped to 1000 for the following statistical tests. Added to that, a test reveals that the null hypothesis of the data being normally distributed can be retained (this test was not bootstrapped).

A Pearson correlation suggests that there is a significant relationship between gender and the OC Score. The coefficient indicates a strong relationship (0.609) between the two variables with a p-value of 0.002 and narrow confidence intervals that do not involve zero.

Table 11

Correlation between OC Score and Gender

				Gender	OC Score
Gender	Pearson			1	.609
	Sig. (2-tailed)				.002
	N			23	23
	Bootstrap	Bias		0	.002
		Std. Error		0	.110
		BCa 95%	Lower		.353
			Upper		.799

Note. Person Correlation.

H1: There are gender differences in the exhibit of overconfidence bias.

H0(1): There are no gender differences in the exhibit of overconfidence bias.

An independent-sample t-test was conducted to compare the OC Score for males and females. There were significant differences in the score ($t = -3.521$, $p = 0.001$/bootstrapped) in the mean score for females ($M = 1.314$, $SD = 0.108$) being higher than the mean score for males ($M = 1.165$, $SD = 0.094$). The magnitude of the differences in the mean (mean difference = 0.149, 95 %, CI: -0.228 to -0.074) was significant. Hence, the hypotheses for equal variances among the group could be rejected, and H1 was supported.

H2: Men are more overconfident than women.

H0(2): The level of overconfidence is the same for men and women.

The study seeks to investigate the effect of gender on overconfidence bias. The dependent variable (OC Score) was regressed on the predicting variable of gender. As the residuals of the regression show heteroskedasticity, a wild bootstrap has been applied. The independent variable significantly predicted the OC Score with a p-value of 0.002. Furthermore, the R Square (0.371) suggests that the model explains 37.1% of the variance in the OC Score. The results revealed that gender has a significant and positive impact on the OC Score (B = 0.149, p = 0.003) meaning that for every unit increase in gender (1-male, 2-female) the OC Score increases by 0.149 which is a reference to the mean already calculated in the independent t-test. Hence, H0 must be rejected.

Table 12

Linear Regression on Gender & OC Score

					BCa 95%	
	B	Bias.	Std. Error	Sig. (2-tailed)	Lower.	Upper
(Constant)	1.016	-.005	-.062	<.001	.902	1.116
Gender	0.149	.004	0.41	.003	.065	.242

Note. Bootstrap for Coefficients (1000 wild bootstrap samples). R Square is 0.371.

4.4. Age and OC Scores

To seek the effect of age differences on the OC Score, an independent t-test has been applied. Out of 23 participants that have achieved an OC Score, 13 of them were Juniors (18-30) and 10 of them were Seniors (50-65).

H3: There are age differences in the exhibit of overconfidence bias.

H0(3): There are no age differences in the exhibit of overconfidence bias.

An independent t-test (Table 13) was conducted. The mean (=1.212) of juniors with a standard deviation of 0.102 is lower than the mean (=1.283) of seniors with a standard deviation of 0.1454. These numbers indicate that there could be age differences in OC Scores. H0 assumes equal variances across seniors and juniors with a t-value of -1.390 and was retained by a bootstrapped p-value of 0.194. Hence, H0 had to be retained.

Table 13

Independent T-Test for OC Score & Age

	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI Lower.	Upper
Equal variances assumed	.880	.359	-1.390	21	.090	-.0716346	.0515380	-.1788138	.0355446

Note." Equal variances not assumed" did reach no significance (no numbers were displayed).

H4: Higher levels of overconfidence are associated positively with increasing age.

H0(4): The level of overconfidence across age groups is the same.

The medians of juniors and seniors indicate that higher OC Scores are associated positively with increasing age. However, the p-value (=0.090, Table 13) of the independent t-test does not suggest that this effect is significant. Furthermore, the p-value (0=0.194, Table 14) increases when bootstrapping the sample. Hence, H0 had to be retained.

Table 14

Bootstrapped Results for Independent T-Test OC Score & Age

		Mean Difference.	Bias	Std. Error	Sig. (2-tailed)	95% BCa Lower	Upper
OC Score	Equal variance assumed	-.0716346	-.0007672	.0519671	.194	-.1663472	.0328876
	Equal variance not assumed	-.0716346	-.0007672	.0519671	.204	-.1663472	.0328876

Note. Bootstrap results are based on 1000 bootstrap samples.

H5: The impact of gender is higher on overconfidence bias than the impact of age.

H0(5): The impact of gender on overconfidence bias is not higher than the impact of age.

To look for the effect of overconfidence bias concerning age and gender, an ANCOVA has been planned. Before that, the researcher made sure that all the assumptions for an ANCOVA were met. The dependent variable is normally distributed across age groups and gender and there is homogeneity of variance (Test of Homogeneity of Variance, p = 0.359). A Pearson Correlation (Coefficient = 0.106) reveals that there is no interaction between the independent variable (age) and the covariate (gender) (p-value = 0.317). The assumption of homogeneity of regression slopes between age and gender has been violated with a p-value of 0.002. This means that the relationship between the covariate and the dependent variables differs significantly across age groups. As an alternative for ANCOVA, the researcher conducted a two-way ANOVA twice by splitting the age groups up for each test. The results of the first ANOVA, with the independent variables juniors and gender, are not significant. Gender has a p-value of 0.153 and the table indicates that this variable can explain 17.6% of the variance in the OC Score. Contrary to that, when conducting an ANOVA with the independent variables' seniors and gender, gender does have a significant effect on the model. With a p-value of 0.007, the results suggest that gender explains 62.3% of the model, considering seniors. The homogeneity of regression slopes could have been rejected in the first place, due to this difference in effect.

At last, an ANOVA with the independent variables gender and age (juniors & seniors) has been conducted that displays the magnitude of differences across gender and age on the OC Score (Table 15). Considering all the information, the null was rejected.

Table 15

ANOVA with independent variables Gender and Age (Juniors & Seniors)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Square
Correct Model	.170	3	.057	6.151	.004	.493
Intercept	33.769	1	33.769	3673.686	<.001	.995
Gender	.128	1	.128	13.925	.001	.423
Agecoded	.012	1	.012	1.281	.272	.063
Gender*Agecoded	.027	1	.027	2.924	.104	.133
Error	.175	19	.009			
Total	35.875	23				
Corrected Total	0.344	22				

Note. R Squared = .493 (Adjusted R Square = .143). Test of Between-Subjects, Dependent Variable: OC Score.

4.5. Levels of Education and OC Scores

A similar procedure has been applied to the variable of level of education. To seek the effect across levels of education on the OC Score, an independent t-test has been applied. Out of 23 participants who achieved an OC Score, 13 of them had an academic degree (academics) and 10 of them had a High School Diploma (graduates).

H6: The exhibit of overconfidence bias is influenced by the level of education.

H0(6): There are no differences in the exhibit of overconfidence bias across levels of education.

An independent t-test (Table 16) was conducted. The mean (=1.267) of academics with a standard deviation of 0.144 is higher than the mean (=1.210) of graduates with a standard deviation of 0.924. These numbers indicate that there could be differences across levels of education. H0 assumes equal variances with a t-value of 0.240 and was retained by a bootstrapped p-value of 0.294. Hence, H0 had to be retained.

Table 16

Independent T-Test for OC Score & Education

	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% CI Lower.	Upper
Equal variances assumed	1.461	.240	-1.077	21	.294	.0564577	.0524285	-.0525732	.1654886

Note." Equal variances not assumed" did reach no significance (no numbers were displayed).

H7: Higher levels of overconfidence are associated positively with higher levels of education.

H0(4): The level of overconfidence bias across levels of education is the same.

The medians of academics and graduates indicate that higher OC Scores are associated positively with higher levels of education. However, the p-value (=0.294) of the independent t-test does not suggest that this effect is significant. Even though the p-value (=0.257) decreases when bootstrapping the sample. Altogether, H7 had to be rejected and H0 retained.

Table 17

Bootstrapped Results for Independent T-Test on OC Score & Education

		Mean Difference.	Bias	Std. Error	Sig. (2-tailed)	95% BCa Lower	Upper
OC Score	Equal variance assumed	-.0564577	-.0020666	.0488145	.257	-.0445498	.1441067
	Equal variance not assumed	-.0564577	-.0020666	.0488145	.268	-.0445498	.1441067

Note. Bootstrap results are based on 1000 bootstrap samples.

H8: The impact of education is higher on overconfidence bias than the impact of gender.

H0(8): The impact of education on overconfidence bias is not higher than the impact of gender.
As in the chapter concerning age, the researcher ensured that the assumptions for an ANCOVA were met. The data for the dependent variable was normally distributed across all independent variables and no outliers were found. Added to that, the assumption of the variance being equally distributed was met and there was no correlation found between gender and level of education. There is no statistical significance ($p = 0.992$) between the levels of the independent variable and the covariant gender. The requirements for homogeneity of regression were met by retaining the null with a p-value of 0.142, indicating that there is no effect between the factors of levels of education and gender. As the assumption for ANCOVA were met, the test was run with OC Score as the dependent variable, level of education as the independent variable and gender as the covariate (Table 18). The test had an R Square of 0.413 indicating that approximately 41.3% of the variance in OC Score can be explained by the combination of gender and education. The dependent variable education seems not to be statistically significant ($p = 0.244$) on the OC Score when controlling for gender. Furthermore, the effect size of 0.067 indicates that 6.7% can be attributed to the level of education when gender is considered. Contrary, gender has a p-value of 0.002, suggesting that the covariant has a significant effect on the OC Score even when controlling for education. Furthermore, 38.1% of the variance in the dependent variable can be attributed to gender.

Table 18

ANCOVA on dependent variable OC Score, independent variable Education, and covariate Gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Square
Correct Model	.142	2	.071	7.049	.005	.413
Intercept	2.307	1	2.307	228.461	<.001	0.920
Gender	.124	1	.124	12.314	.002	.381
Education	.015	1	.015	1.442	.244	.067
Error	.202	20	.010			
Total	35.872	23				
Corrected Total	0.344	22				

Note. R Squared = .413 (Adjusted R Square = .355). Test of Between-Subjects, Dependent Variable: OC Score.

As a control test, the researcher has conducted a one-way ANOVA with the OC Score as the dependent variable and education as the independent variable, not considering gender, to examine if the effect of level of education differs. The results suggest a decrease in effect size for the level of education alone with a p-value of 0.294 and a partial eta square of 0.052. Hence, the null was retained.

5. Discussion

5.1. Findings

This study sets out to assess overconfidence bias across genders, levels of education, and age groups. For that, the researcher let participants carry out simple math tasks and collected information on their performance and their confidence to compete with that performance in a tournament. With this information, the OC Score has been calculated and represents an indicator of how far a participant overestimated their performance.

Overall, men performed better in the tasks and joined more tournaments. On the question of tournament choice, this study found that the choice of entering a tournament is mainly based on performance rather than gender. Only in Task 3, where participants had to forecast future performance, the variable gender seemed to be a predictor for tournament choice rather than the actual performance. The results of this study indicate a mild tendency between gender and tournament choice, with women preferring the individual game and men favoring the group game. On the question of gender differences, the experiment showed significant variance across males and females in the exhibit of overconfidence bias. Perhaps the most striking finding is that men did not show more overconfidence than women, as within the OC Score, women had higher values on average than men. On the topic of age, the study did not detect any evidence of differences across age groups in the scale of the OC Score. Added to that, when comparing the predictor variables gender and age, the impact of gender on the OC Score was greater. Furthermore, there have also been no differences in the OC Score found across levels of education, and when comparing the predictors of gender and education, gender is shown to have a greater impact on the OC Score.

5.1.1. RQ1 – To what extent does gender explain overconfidence bias?

As mentioned in the literature review, several papers suggest that the factor of gender influences the exhibit of overconfidence bias. The studies go back to the 1970s (Lewellen, Lease, & Schlarbaum, 1977) to the modern days (Kumar & Goyal, 2016), all confirming the effect of gender. The findings of this study are consistent with the literature and support the argument that overconfidence bias is associated with gender and, that the relationship between the two variables is strong. In the case of this experiment, 37.1% of the variance in the OC Score can be related to gender. This number suggests that over 1/3 of the overestimation in performance displayed in the current study can be attributed to the factor of gender. These numbers reflect the results of Trejos, Deemen, Rodriguez and Gomez (2019) who also found that 32.6% of the variance in overconfidence can be attributed to the variable gender. However, the findings of the current study do not support the research of Trejos, Deemen, Rodriguez and Gomez (2019) in the matter of the male gender being the primary driver of overconfidence bias. A surprising variable that was found to be significantly associated with the OC Score was the female gender. This outcome stands in contrast to the common claim in the literature and will be discussed in the following.

To create a deeper understanding of this outcome, the underlying factors were explored. Overall, 28 times throughout the experiment, male participants chose to enter a tournament, while only 14 female participants did the same. As a comparison, 64 times men chose the individual game and women 82 times. A possible explanation for that gender difference is the general risk aversion of women found in previous studies. Croson and Gneezy (2009) state in their paper that women are more averse to competition than men. According to Byrne and Worthy (2016), women would consider all environmental information, while men would ignore environmental situations (such as the risk of an activity). This leads to men making decisions, like entering a tournament, that carry risk, in contrast to women who weigh the dangers of these options and appear to let them determine their ultimate choice (Lozano, et al., 2017). The observation of gender differences in tournament choice in the current study are similar to the findings of Apesteguia, Azmat and Irriberri (2012) who measured the relationship between gender and decision making in a business simulation. In the simulation, women were shown to be less aggressive and risk-averse in their strategies. Another explanation for the discrepancy in performance choice could be found in the theoretical base and literature review of this thesis, social cognitive theory. From a young age, men are more encouraged to pursue their interest in science and math. Even though girls are equally capable, they tend to lack confidence because of the absence of encouragement they receive from their environment (Kågesten, et al., 2016). This may explain why, despite the performance, a mild but significant tendency could be observed for women to prefer the individual game and for men to favor the group game.

An indicator of overconfidence is not entering a tournament alone but entering a tournament without winning it. While the number of men (28) entering a tournament is higher (women = 14), the number of men (11) who overestimated their performance is less compared to the number of women (12). These numbers indicate that overall, male participants (mean of correct answers: 5.97) performed significantly better than female ones (mean of correct answers: 5.83). The statistically significant difference in performance remains in all Tasks. This discrepancy in performance could be attributed to gender differences in competition, as found by (Lackner & Sonnabend, 2020). In a contest, male participants reacted strongly to an increase in competition, and task-based goals had a positive impact on their performance. Furthermore, Azmat, Iriberri and Calsamigla (2016) found that when stakes are low, there is little difference in performance, but with higher stakes, the performance of male contestants increases. In the current experiment, the differences in performance across tournament versus no tournament are wider for men (difference in mean rank = 5.15, $p = 0.198$) than for women (difference in mean rank = 3.01, $p = 0.606$), however, none of these differences are statistically significant. It is possible that the competitive frame of the experiment discouraged female participants from the start, which led to worse performances compared to the performances of male participants.

It has been mentioned that women are more averse to competition than men. While in Task 3 the decision involved a future competition, Task 4 asked for a tournament choice that does not require further competition as it is about a performance that has already happened. Five women entered a tournament in Task 3 without winning it, and 7, entered a tournament in Task 4 without winning it. Even though fewer women entered a tournament in the first place, the ones that did tended to overestimate their performance more than their male counterparts, suggesting that women who entered a tournament are less likely to win it than men and therefore achieve higher values on average on the OC Score scale. This finding is contrary to the main body of literature that has been referenced in the current study, which found that men exhibit more overconfidence than women. Veldhuizen (2022) shows that gender variations in risk and confidence in skills are what drive the gender gap in overconfidence bias. While these factors could be an explanation why fewer women entered a tournament, it does not explain the ones who did exceeded every man in their overconfidence. There are several possible explanations for this result.

Comparing the tournament entries of Task 3 and 4, these observations may support the hypothesis that as the factor of future competition is eliminated (as in Task 4), more women tend to display optimistic overconfidence. Optimistic overconfidence leads people to overestimate the likelihood of beneficial outcomes and underestimate the likelihood of damaging outcomes (Griffin & Varey, 1996). A recent study by Nouri and AhmadiKafshani (2019) suggests that businesswomen are more prone to optimistic overconfidence than businessmen, while men are more prone to overestimating their expertise. Furthermore, an experiment conducted by Ludwig, Fellner-Röhling and Thoma (2017) shows that women downgrade their self-assessment when feeling observed. A circumstance in the experiment that made female participants more confident in believing their abilities was to have less comparison to a standard norm. Reflecting on the experiment in the current study, participants had little knowledge about their performance or the performance of others. This changed in Task 4, as they received information on their achievement which reduced the uncertainty on the personal side and might have led to personal encouragement, as in the study of Ludwig, Fellner-Röhling and Thoma (2017) this shift in circumstances encouraged women to think more highly of themselves.

Next to optimistic overconfidence, another explanation that has been mentioned in the literature review is stereotype threat. Villanueva-Moyas and Expositos (2021) suggest that the threat posed by gender stereotypes has an impact on how women make decisions, proposing that they are more concerned about confirming unfavourable assumptions about their social group (Steele & Aronson, 1995). The threat posed by gender stereotypes can lead to women making more unfavourable decisions (Woodrow, et al., 2019). It may therefore be the case that some female participants in the current study were aware of the behavioural biases concerning their gender, which led them to make unfavourable decisions to refute the stereotype.

Coming back to the research question, gender can explain overconfidence bias to a statistically significant extent, the data suggest that over a third of the variance can be attributed to gender, even though the observed overconfidence across gender stands in contrast to what has been proposed by the literature. In addition to that, the impact of gender on overconfidence bias expands when age increases, concluding that the extent of explanation given by gender is also dependent on other social factors.

5.1.2. RQ2 – Do age differences explain overconfidence bias over and above gender?

The current study revealed no age differences in the exhibit of overconfidence. Even though, the mean OC Score of seniors was higher than that of juniors, the results were not significant. By the present results, previous studies have not demonstrated a consistent relationship between age and overconfidence bias. The dual-process theory of ageing proposes that as humans age, intuition rises to make up for cognitive deficits (Peters, Hess, Västfjäll, & Auman, 2007). Contrary to that, other studies have shown that logical decision-making techniques do not decrease with age (Bruine de Bruin, Parker, & Fischhoff, 2007). Nevertheless, the findings of the current study broadly support the work of other studies. After collecting data from 210 managers, the researcher Osmani (2018) suggests that overconfidence is independent of age. Moreover, the findings of a lifespan study provide little evidence that overestimating one's performance or placing one's performance above that of others is correlated with age (Prims & Moore, 2017). It could be argued that the inconsistency in results is to some degree rooted in the fact that while older decision-makers rely more on system 2 thinking, their level of choice confidence decreases (Taylor, 1975).

Results of a study conducted by Tejos, Deemen, Rodriguez and Gomey (2019) indicate that while overconfidence bias can be described by gender, age is not a significant variable. The findings of this previous work corroborate the result of the current study, as overall, age is no significant predictor of overconfidence bias while gender is. By taking a closer look at the division of age and gender, a linear model revealed that the OC Scores of juniors can't be predicted by their age group or their gender. More compelling is that the variance in OC Scores of seniors can also not be reasoned by age but very much by gender. These results reflect those of Sanz de Acedo Liarraga et al. (2007) whose research suggests that at a young age, there are close to no gender differences in the display of cognitive biases, whereas both genders shift towards more rational thinking with age, women continue to partially rely on intuition and emotions. Further studies show that age differences in the exhibit of overconfidence bias are more linked to gender and age than age alone (Tehrani & Gharehkoolchian, 2012). Added to that, the observation of the experiment shows that female senior participants have the highest OC Scores on average. Concluding, the present study raises the possibility that the effect of gender on overconfidence bias seems to increase with age.

Referring to the research question, age cannot explain overconfidence bias over and above gender. Although indications have been found that the effect of gender on overconfidence could increase with age.

5.1.3. RQ3 – Do levels of education explain overconfidence bias over and above gender?

In the current study, levels of education were found to cause no differences in the exhibit of overconfidence bias. Even though, the mean OC Score of academics was higher than that of graduates, the results were not significant. This outcome is contrary to that of Fan (2017) who found that education has a positive relationship with rationality. It seems possible that this discrepancy is since in former studies, education and work experience were put together when tested on cognitive bias, whereas in the current study, the variable of level of education was tested in isolation. A study by Arcidiacono (2011) claims that people with lower income or lower education level are more likely to apply biased thinking patterns. In contrast, highly educated and experienced investors are suggested to fall prey to overconfidence bias more easily (Mishra & Metilda, 2015). Zaidi and Tauni (2012) explain that prior experience and education lead to overconfidence. Furthermore, a study on economic decision making, suggests that economic education or increased familiarity with economic decision-making cannot decrease biases (Roth, Robbert, & Straus, 2015). While the results of these studies from the literature review are not consistent, none of them tested the level of education on overconfidence as a singular variable. It could be argued that the relationship between overconfidence bias and education found in previous studies is because it has been combined with experience.

Kansal and Sigh (2018) describe a rise in overconfidence bias as task frequency increases that is independent of gender. As described, studies on educated investors have also found no gender differences (Mishra & Metilda, 2015). However, in the current study, the researcher was testing the level of education as a predictor of the OC Score, while controlling for gender. The results did not show any significance for levels of education, but there were significant gender differences in the exhibit of overconfidence bias. The presented study may have underestimated the role of experience when it comes to the relationship between overconfidence bias and level of education.

To answer the research question, no, level of education alone cannot explain overconfidence over and above gender.

5.2. Implications

5.2.1. Theoretical Implications

Overall, this study strengthens the idea that gender strongly influences the exhibit of overconfidence bias. Moreover, the outcome suggests that this influence goes over and above the effect of age and level of education. Although gender differences have been affirmed, this study has raised an important question about the nature of this distinction as its findings challenge the assertion that men are more overconfident than women. While more men might be risk-willing and confident in their choices overall, the women who display the same behaviour show higher levels of overconfidence. It is argued that overconfidence exhibited by women could also be driven by stereotype threats and optimistic overconfidence.

Considering the variable of age, the results of this research support the idea that age can increase the effect of gender differences in exhibiting overconfidence bias. This has been shown as women have generally displayed higher levels of overconfidence, and this effect has expanded with increasing age. Prior to this study, the literature has made implications for this effect, which have been confirmed by the present results. This paper contributes to our understanding of overconfidence bias and how the interplay of different variables influences its display. While overconfidence is seemingly not influenced by different age groups or levels of education alone, the study sheds new light on how these factors interact with gender to exhibit overconfidence bias.

The empirical findings in this research provide a new understanding of the influence of education level on the exhibit of overconfidence bias. With the data sourced from the experiment as well as the literature review, the researcher questions the relationship between overconfidence and the variable education, as previous studies have mostly combined education with experience when testing for overconfidence bias. Taken together, the results suggest that the exhibit of overconfidence bias could be more influenced by experience than level of education.

5.2.2. Practical Implications

As the literature review has discussed decision-making processes in a managerial context, there are several changes the results of this study combined with the literature indicate. One of the main findings in this study challenges the belief that men are uniformly more overconfident than women. Furthermore, they show that decisions that involve risk are not only driven by confidence or overconfidence but can also be influenced by stereotype threats or optimism. There is, therefore, a definite need for managers and decision-makers to be aware of the biases that drive our daily managerial decision processes. A reasonable approach to tackle this issue could be to encourage diversity in decision-making roles. Further down the line, businesses can benefit from a more inclusive management that ensures a variety of perspectives, which could lead to better business strategies and risk management.

Other findings of this experiment suggest that age and education cannot reduce gender differences in the exhibit of overconfidence bias. The literature suggests that experience is a variable that may have an impact on those discrepancies. This information can be used to develop targeted training programmes that could level the exposure to experience across employees. Furthermore, continued efforts by companies to foster a work environment where employees feel comfortable expressing their ideas without being hindered by gender-related biases or stereotypes could ultimately promote their growing process.

The literature as well as this study have shown that biases influence our managerial decision-making processes. While it is beneficial to consider gender, age, and education in the exhibit of biases, the researcher does not want to emphasize that everything can be broken down to these factors, as many other elements can contribute to the matter that have not been studied in this research.

5.3. Limitations

Several limitations need to be noted regarding the present study. First, the generalizability of the results is restricted by the sample size. Even though the application of an online experiment has helped the researcher to broaden the target group, the sample size can always be bigger. Despite extra efforts made by the researcher to raise the number of seniors, this group's modest number of cases limited its involvement. While it was beneficial for the sample size to put the experiment online, it restricted the process of observing participants during the experiment. The emotional condition of participants can influence the decision-making process (Nouri & AhmadKafeshani, 2019) as well as their attitude toward the experiment. As a measure the researcher excluded participants who did not complete the experiment in one sitting, but the mentioned conditions could not be recorded. Furthermore, the current study is limited by the fact that it only examined the female and male genders. In contemporary discussions, the term "gender" refers to a spectrum of identities beyond just male and female. As proper samples had to be conducted for each gender to draw significant conclusions, the researcher decided on that limitation consciously. Lastly, the scope of the study was limited by its experimental design. While the data collection went smoothly overall, the researcher did not anticipate that so many cases would have to be excluded during the analysis of the OC Score. Withstanding the relatively limited sample size, the data revealed significant findings that could add to our understanding of overconfidence bias. However, these results must be handled with care and may not be applicable to a wider population.

5.4. Suggestions for future research

Several questions remain to be answered. One natural progression of this work is to explore the effects of experience rather than level of education on overconfidence bias. The experience could be placed in a certain field of expertise and weighed up by the number of years worked in that field. The significant and surprising finding, that across people who exhibit overconfidence, the female participants reached higher levels than the male participants, could be a fruitful area for further work. A study that applies a post-analysis that tests participants on stereotype threats and optimism would be intriguing. On the topic of gender, the variable could be explored to a greater extent before assessing it for overconfidence bias. Measures like the Bem Sex Role Inventory rates participants' degrees of adherence to masculine and feminine gender roles. By applying the inventory to future research, a more nuanced understanding of the relationship between gender and overconfidence bias could be established. Added to that, opening the research to more forms of gender would help to create a greater degree of inclusivity as well as accuracy on the matter. Finally, with some methodological improvements, a repetition of the present study could produce further vital outcomes. By improving the experimental design to gather more information on the OC Score, for example, by asking participants how many number sequences they think they solved correctly, the findings would have more explanatory power as more participants would be rated with an OC Score. Overall, larger randomized controlled trials could provide more definitive evidence.

6. Conclusion

The present research sets out to study the extent to which gender can explain overconfidence bias. With that, the variable's level of education and age were chosen to measure if their impact would be greater on overconfidence bias than the impact of gender. A quantitative analysis revealed that gender can explain overconfidence bias over and above the influences of age and education. The two variables were not able to explain any variance in overconfidence. The results of the investigation show that men are more confident and willing to take risks in the setting of a competition. One of the more significant findings to emerge from this study is that the women in competition overestimated their performance far more than their male counterparts, leading to the fact that they exhibited higher levels of overconfidence on average. The researcher does not draw out the conclusion that the decision-making process for female participants in tournament entry could have been influenced by optimism and stereotype threat rather than overconfidence. Furthermore, this study has found that generally, an increase in age has led to a greater gap in gender differences concerning the exhibit of overconfidence bias. The significance of this finding has been supported by past research. Even though levels of education did not emerge as reliable predictors of overconfidence, the literature gave indications that experience might be more vital in the matter. Moreover, it seems that experience can reduce gender differences in the exhibit of overconfidence bias.

The literature review revealed that we are not born with predetermined settings that are dependent on being male or female. Rather, our social environment has constructed an idea of how to be a woman or man, and this idea includes gender-related behavior, fields of interest, life goals, and more. This study proposed to question the influence of gender on our decision-making processes and to see how far the influence of socially constructed gender roles reaches. To question the impact of gender, the social factors age, and education have been added to the research. Even though this study could not contradict gender differences in overconfidence bias, the importance of questioning if a distinction even must be made remains. The broad body of research takes gender as a given difference, and while this study might have been a small step to raise awareness on this matter, the researcher of this thesis hopes that many more will follow to question the status quo.

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Appendix 1 - Instructions

Consent Form

Dear participant,

as part of my Master's degree at the University of Malta I am conducting an online experiment about your confidence towards your skills.

You can participate in my experiment if:

* you are a resident of Austria

* you identify as female or male

* you are between the age of 18-30 or 50-65

* or you have a high school diploma or academic degree.

This experiment is anonymous and will take approximately 20 minutes to finish. Participation is entirely voluntary, and participants can withdraw from the study at any point. All data collected will be used strictly for this study and will only be accessed by the researcher and the supervisor. This study is being supervised by Dr. Vincent Cassar. At the end of the experiment, you will receive a small monetary reward. For this reason, only you will be asked to provide your email address (it will still be optional). After receiving your reward this information will be deleted. Your identity will remain anonymous for the data analysis and published study.

If you have any further queries, feel free to contact me at jasmin.schiel.22@um.edu.mt.

Thank you very much for your participation, Jasmin Schiel

I have read and understood the above and hereby give my consent to take part in this experiment in full knowledge that data is being recorded. *(Click "I Agree")*

Appendix 2 - Tasks

Intro

Welcome!

This experiment consists of four tasks. Each task takes less than five minutes. In every task you will be asked to continue number sequences.

1. Task < 5 min. Example for number sequence e.g.: 1 2 3 4 5 6 ... ?, Result: **7**

2. Task < 5 min. e.g.: 2 4 6 8 10 12 ... **14**

3. Task (same as 1 & 2)

4. Task (same as 1, 2 & 3)

Reward? Yes!

There are two ways to gain a small amount of money.

1. Individual Performance: for every number sequence you solve you get 10 cents per correct answer. The more problems you solve, the more money you can earn on your own.

2. Group Performance: you will randomly be assorted to a group of 4 participants that have done this experiment under the same conditions as you. If you solve the most number sequences correctly in your group, you'll get 40 cents per correct answer. But if someone else in your group has solved more than you, you won't get anything.

Every task is conditioned with one of these two reward systems.

1. Task: Individual Performance

2. Task: Group Performance

3. etc.

At the end of the experiment, we'll choose one of the tasks you played (either by yourself or in a group) randomly. Your reward will be based on how well you did in that task.

Task 1 – Individual Performance

This task is about your individual performance (10c per right answer). The use of a calculator is not permitted, but you can use some scratch paper.

Click "Next" to start Task 1 - you have 4 minutes!

Example: 3 6 7 14 15 30 ... ?, Result: 31 (x2, +1)

Task 2 – Tournament

You will randomly be assorted to a group of 4 participants that have done this experiment under the same conditions as you. You'll get 40 cents per correct answer, but only if you are group best. If someone else in your group has solved more problems than you, you won't get anything.

Click "Next" to start Task 2 - you have 4 min!

Task 3 – Choose reward system

For the following number sequences you are given the choice to be rewarded on your individual performance (10c per correct answer) or group performance (40c per correct answer if you are group best). If you choose group performance, it will be the same group as in Task 2.

Click "Next" to make the choice!

Tasks 4 – Last Task

No more number sequences to solve! We go back to the first task of this experiment.

This is how many problems you solved correctly in Task 1: *(number inserted here)*

If you think you were better than the rest of your group in Task 1, choose Group Performance.

If you think there are people in your group who were better than you in Task 1, choose Individual Performance.

Make your choice between individual performance and group performance.