"The role of mindfulness in retail trading: The link between mindfulness, overconfidence- and anchoring bias."

Master Thesis

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Abstract

The present research examines the link between mindfulness as a trait and the exhibition of the overconfidence- and anchoring bias in retail trading. On the grounds of existing literature pertaining both phenomena, being mindfulness and cognitive biases, it is assumed that traders who score higher on the Mindfulness Attention Awareness Scale (MAAS) are less susceptible to biases in the decision-making process. Thereby, primary data was employed to compute the MAAS score of retail traders and evaluate the manifestation of the overconfidence- and anchoring bias at a group level (N=232). The results indicate that there is not enough evidence to conclude that traders with higher MAAS scores are less influenced by the overconfidence bias compared to the group of traders with lower MAAS scores. The findings with respect to the anchoring bias, however, appear to be puzzling. It can be observed that traders who score higher in mindfulness manifest a larger anchoring bias than traders in the low MAAS group. Additionally, traders in the high MAAS group tend to anchor heavier on self-generated anchors as opposed to externally-imposed anchors.

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I. Introduction

From academic interest to day-to-day implementation in large corporations on Wall-Street, mindfulness experienced a rise in popularity in the western culture in the last decade. Numerous studies researched the topic from a psychological and neurological perspective, along with its implications on disparate fields such as medicine (Kabat-Zinn & Hanh, 2009), decision-making (Raglan, 2014) and, more novel, behavioural biases (Charoensukmongkol, 2018). Broadly, mindfulness is believed to foster moment-awareness, lower impulsive behaviour, ameliorate stress levels and diminish anxiety. These factors, denoting the ability to control emotions, on the other hand, are portrayed as key in retail trading. According to Warren Buffet, success in investing does not depend on high intelligence quotes, though it is highly relying on the ability to control emotions and urges (Sunder, 2017).

However, investors are subject to an array of biases that arise due to anchoring onto past experiences and former knowledge, in other words, due to the inability of investors to fully isolate the investment option at hand and relying on past methods or trends that are not rationally applicable in the present. This phenomenon is denoted as the anchoring heuristic and is documented to negatively affect trading performance (Tversky & Kahneman, 1974b). In addition to the anchoring bias, De Bondt and Thaler (1985) portray the overconfidence bias as a key negative force shaping trading behaviour. Given the benefits of mindfulness on emotional well-being, along with its cruciality in trading, it raises the question of whether mindfulness could be positively associated with trading performance and rational trading behaviour. Nonetheless, only a scarce number of studies analyzed the link between mindfulness and behavioural biases. At the date of writing, only few studies reviewed the potential impact of mindfulness on overconfidence while no academics laid their focus on the potential connection between mindfulness and the anchoring bias. Therefore, the current research aims to scrutinize the topic and test if mindful traders are less predisposed to the overconfidence- and anchoring bias, thereby, being one of the pioneer works on the topic. On the premises of the existing literature, it is hypothesized that that more mindful traders are less overconfident and do not anchor as heavily on past values as traders who score lower in mindfulness. As such, if a positive link is found, it would reinforce the use of mindfulness practices in trading and serve as a low-cost tool that fosters better trading performance. The importance of such tools is especially significant in 2020, when the pandemic outset by the COVID-19 virus has resulted in a substantial increase in the number of retail traders (Nova, 2020).

The following section offers an overview of the existing literature on the importance of behavioural finance as a pivotal part of conventional economics, focusing on the description of the two biases of interest. Thereupon, mindfulness is introduced as a broad topic, specifically in relation to behavioural biases and the hypotheses are formulated. The following section describes the methodology employed to test the MAAS degree of the participants along with the overconfidence- and anchoring degree of traders at a group level. Next, the empirical findings are reported in section number IV, which is followed by a discussion and conclusive notes.

II. Literature review

2.1 Behavioural Finance: Irrational Behaviour in Trading

Overview

Conventional economic theories explain investment decisions and financial market paradigms by relying on the assumption that investors are rational, act under perfect self-control and satisfy the utilitarian characteristics (Benos, 1998). Traditional finance rests on the premise that information is fully available to all market participants, and therefore, stock prices incorporate all relevant information at any given time (Birau, 2013). Likewise, this perspective supports the idea that, due to unbiased forecasts, the competition between investors who seek to increase their profits will drive market prices to their fundamental values and, therefore, assure the existence of efficient markets (Dedu, Turcan, & Turcan, 2012). However, these assumptions often fail to explain misvaluations that do not arise as a consequence of temporary breaches between demand and supply and further allow misvaluation to persist (Bloomfield, 2006). For instance, a large market peculiarity that cannot be explained by traditional finance is excess volatility (Shiller, 2003).

An additional example where mainstream finance views are challenged is regarding equity undervaluation. Bloomfield (2006) asserts that, in times of high inflation, investors tend to undervalue equities, solely based on the available information in the financial reports. Whilst the nominal interest expense is documented in the income statement, the decrease caused by inflation in the real value of the nominal liabilities is not. Consequently, investors base their valuation on the nominal interest expense, which does not account for inflation. This phenomenon is not explained by conventional finance theories that assume a symmetry of information on the market and a full incorporation of all available information in the prices. However, this is captured by behavioural finance as the framing bias, a concept which underlines that the information presented to an individual and the way it is displayed matters (Bloomfield, 2006).

Behavioural finance drops the assumptions of a perfect market and rational, well-informed participants. Fundamentally, the literature body classifies three primary domains in behavioural finance, namely heuristics, framing and market inefficiencies. Thereby, heuristics refers to the propensity of investors to often base their financial decisions on approximate rules of thumb that lack logical judgment. Framing denotes the cognitive filters that are built of stereotypes and perceptions and allow a quick impression formation upon the receival of new information. At last, market inefficiencies portray the conglomerate of irrational decision-making, misvaluation and return anomalies (Shefrin, 2005).

From a broader spectrum, the two major blocks of behavioural finance are the limits to arbitrage and cognitive psychology. While the latter scrutinizes the irrational patterns in investor behaviour, the concept of limits to arbitrage denotes the inability of market participants to perpetually correct the induced mispricing (Mullainathan & Thaler, 2015). Together, the two branches aim to explain how irrational patterns in behaviour influence financial markets and why the consequences are often tenacious, in other words, not corrected by arbitrageurs, as suggested by the conventional framework in finance (Sewell, 2007). Whereas a broad array of academics explore the facets of limits to arbitrage, the interest of this research paper lies in the cognitive psychology of traders. It denotes the systematic errors in trading behaviour, driven by suboptimal and biased decision-making (Ritter, 2003). The systematic nature of the biases allows for a more accurate prediction of the behaviour of the market participants and, therefore, the research in the cognitive psychology of traders is to be of great importance both for retail traders, as well as for policymakers (Campbell & Sharpe, 2009).

Behavioural Finance in Trading and Investing

Despite behavioural finance as a discipline being still in its infancy, from a relative perspective, there is a vast literature body that documents behavioural patterns in financial decisions. The bases were laid by renown psychologists such as Amos Tversky and Daniel Kahneman, who contrasted economic models of rational behaviour against cognitive models of decision-making under risk and uncertainty. Fundamentally, the deviation from the rational choice is driven by preferences or flawed beliefs that appear due to market participants being poor Bayesians, as they do not adapt their expectations accordingly upon the receival of new information (Bloomfield, 2006).

Further, it is noteworthy that both experienced and beginner investors, along with retail traders and corporate insiders, are affected by cognitive biases. Although biased judgments are documented to negatively affect investing/trading performance, they are not to be related to financial skills or

intelligence, as commonly misinterpreted. Stanovich (2016) sheds light on this aspect by separating intelligence and rationality as stand-alone concepts. Irrational investing behaviour is owed to rationality, or lack thereof, as opposed to intelligence. This explains why a majority of investors undertake biased decisions despite high aptitudes, experience and knowledge in the field.

The deviations from rational decision-making manifest in several ways that are applicable in trading and investing. Previous research in the field has documented an extensive array of factors that affect trading and investing behaviour, the most common ones being disposition effect, mental accounting, overconfidence, anchoring bias and confirmation bias (Jain, Jain, & Jain, 2015). The latter relies on the hypothesis that investors are prone to react differently to good news regarding a company they have positive views on than they would to bad news. Good news is quickly accepted, whereas bad news is deemed implausible and viewed critically. This leads to uninformed investments when traders are confronted with data that aligns with their views; an investment that is not correctly assessed and relied on emotional beliefs (Park, Konana, Gu, Kumar, & Raghunathan, 2012). The disposition effect refers to the tendency of investors to sell winning positions too soon and hold losing positions for too long, which is in line with prospect theory. This arises as investors perceive losses to be of greater impact than winnings (Shefrin & Statman, 1985). The concept of mental accounting states that investors evaluate outcomes not only based on their end value, but also on how the outcome is obtained. In that perspective, under the hedonic editing hypothesis, Thaler (1995) asserts that investors prefer to integrate losses and segregate gains.

The anchoring bias, as well as the overconfidence effect, represent the focus of this research and are elaborately described in the next chapters.

2.2 Overconfidence bias

Overview

The overconfidence effect is one of the most common biases with cognitive roots and occurs when a person's subjective belief in own abilities or knowledge is greater than the objective correctness of personal judgments (Fabre & François-Heude, 2009). Moreover, overconfidence results in individuals not only overestimating themselves, but also undervaluing the complexity of a task or the amount of risk associated with it (Peters, 2003). Oberlechner and Osler (2011) classify this twofold manifestation of overconfidence as, firstly, overestimation of own skills, and secondly, underestimation of uncertainty.

Kahneman (2011) describes the process of decision-making through two systems. The first system denotes a subconscious response to a cue; hence, it does not involve high effort. The second system, on the other hand, is involved when solving problems that require higher effort, as, for instance, when solving numerical problems. The natural propensity of individual minds is to lower the effort they have to undertake; thus, a large portion of decisions are taken involving the first system only, which is more sensitive to biases (Kahneman, 2011). Recurring to the decision-making process described by Kahneman (2011), overconfident individuals undervalue the necessary effort in analysing a financial option (Peters, 2003) and, thus, the decision at hand is made by system one. As system one is deemed as a shortcut built on emotional perception and past experiences, it is more susceptible to biases and heuristics, thus making the investment decision irrationally justified.

The implications of the overconfidence bias have been researched in a plethora of studies such as the one by Biais and Weber (2009), who concluded that a quarter of their sample would act on subjective competence belief. Similarly, in a study carried out by Dittrich, Güth, and MacIejovsky (2005), approximatively two-thirds of the participants were susceptible to the overconfidence bias. A large array of academics observed the manifestations of overconfidence in variate settings. In an analysis of start-ups, Landier and Thesmar (2005) noted that companies with entrepreneurs who overrated their probabilities to success, relative to other entrepreneurs in the same business, are inclined to grow less, be less profitable and, moreover, exit the market sooner. Additionally, Song and Gim (2019) find that overconfidence can negatively impact decision-making on an individual level, as well as lead to a dissident in organizations with overconfident investors as a whole. The latter paper observes that when employees overestimate themselves and their abilities, they tend to underrate the need for further training and lose value in the feedback of managers.

Overconfidence in Trading and Investing

In the field of trading, overconfidence is documented to result in more frequent trades with larger stakes and unreliable assessment, which consequently leads to uncalculated risks (Cheng, 2007). Furthermore, Oberlechner and Osler (2011) assert that overconfident investors are willing to undertake more debt to finance investments they subjectively believe to be undervalued by the market based on a personal forecast of future cash flows. Forbye, a number of studies have provided evidence that overconfidence leads to poorer trading and investing performance. For instance, Camerer and Lovallo (1999) found that overestimation of chances to succeed results not only in higher trading volume, but also in financial losses. Similar findings have been previously documented by Odean (1998), who studied overconfidence in regard to market prices and information distribution.

Additionally, the author found that overconfidence reduces traders' expected utility and, thus, traders are prone to under-diversify their investment portfolio, therefore committing to one of the most common mistakes in trading.

Overconfidence is found to be especially detrimental to investor decision-making as, in cases of positive outcomes, the gains are associated with their own skills and further reinforce the bias persistence. However, in the case of losses, investors owe the negative outcomes to "bad luck" (Peteros & Maleyeff, 2013). Further, Lambert et al. (2012) examined the susceptibility of two groups of participants to overconfidence, namely a group of students and a group of bankers. Their findings suggest that bankers are more overconfident than students in investing decisions, which could be due to experience and knowledge in the field. Therefore, it can be inferred that stock market participants are more prone to overconfidence due to their perceived competence, which, in turn, harms their performance (Park et al., 2012).

On a more analytical premise, behavioural finance differentiates between several manifestations of overconfidence. Previous works in the field disclose two forms of overconfidence crucial in trading behaviour, namely miscalibration and the better-than-the-average bias. This paper aims to scrutinize both manifestations, which are discussed in the following chapters.

2.2.1 Miscalibration

Overview

Miscalibration denotes the propensity of individuals to overestimate the validity of their information and knowledge (Glaser & Weber, 2007) and has been widely documented in a large array of former works in regards to disparate research fields. The first evidence of miscalibration has been documented in cognitive psychology by Slovic, Fischhoff, and Lichtenstein (1986), in whose research, participants had to elicit point estimates and confidence intervals that were later compared to the correct values for a set of numerical questions. Building on previous findings, Soll and Klayman (2004) found a robust tenacity of miscalibration, which is more prominent in the case of elicitation of confidence intervals. It is also noteworthy that the authors find the degree of calibration to be the same in the presence of incentives for accuracy, as well as in their absence. Moreover, the results remain robust in different frequency formats. A number of works have focused on analysing the persistence of miscalibration across time and environmental settings. Gigerenzer (2015) concluded that miscalibration not only results in an overestimation of small risks and underestimation of large risks, but also manifests a systematic nature. Together, these findings suggest that miscalibration is a

systematic cognitive error, the persistence of which is independent of framing. Furthermore, Jonsson and Allwood (2003) state that miscalibration may be an anchored personality characteristic, while De Bruin, Parker, and Fischhoff (2007) provide evidence of stable individual differences in miscalibration, thus portraying the bias as a trait. This view has also been fortified by Soll and Klayman (2004), who claim that miscalibration is a stable trait that persists over time and manifests across different cognitive tasks.

The literature body records a number of debates in regard to miscalibration. Some argue that miscalibration is a facet of optimism (Dawson, 2017), though Hilton et al. (2011) provide evidence to support the absence of correlation between the two concepts. Further, Malmendier and Tate (2005) state that optimism results in individuals overestimating the mean values, whereas miscalibration leads to an underestimation of the volatility. Therefore, miscalibration has gained major interest as a stand-alone bias, which has become a topic of interest in behavioural finance.

Miscalibration in Trading

Malmendier and Tate (2005) investigated the concept of miscalibration and its implications for chief financial officers (CFO) and found that, when asked to provide a forecast for the S&P 500 returns in an upcoming period, only 36% of the CFOs' estimations fell within the expected confidence interval of 80%. This indicates that participants have subjective probability distributions that are too narrow. Further, their findings show that miscalibrated CFOs tend to opt for higher corporate investments, as well as higher leverage. This indicates that miscalibration yields to more aggressive corporate behaviour.

Similar findings have been observed for stock traders (Glaser & Weber, 2007). In the field of trading, Odean (1998a) states that miscalibration can theoretically result in early market entries, as well as excessive trading. Barber and Odean (2000) provide empirical evidence that supports the hypothesis. Additionally, the authors argue that, due to the speculative nature of trading and frequent trades, traders experience greater trading costs which result in poor trading performance. Furthermore, Cheng (2007) suggests that miscalibration leads to longer holding periods, as well as hesitation to realize losses during periods of economic downturns, as investors are unwilling to heed to market signals that confute with their subjective beliefs. Therefore, miscalibration in trading is related to lower returns on investment. The positive correlation between miscalibration and trading frequency, as well as negative correlation between the bias and trading performance, have been widely

documented and reinforced by a multitude of academics such as Barber and Odean (2000) and Park et al. (2012).

In a psychometric study, De Bruin et al. (2007) scrutinize individual characteristics that are crucial in decision-making. The authors find evidence to support the hypothesis that accurate calibration is one of the most significant factors. Therefore, several studies have focused on the cognitive explanation of miscalibration in trading. Kaustia, Alho, and Puttonen (2008) argue that investors are especially prone to miscalibration due to their knowledge and experience in the field. The perceived competence that arises thereby results in overconfidence in the mean and variance of personal signals about future asset returns (Graham et al., 2016). Likewise, Cheng (2007) argues that frequent trades are owed to investors having a subjective illusion of market robustness, along with the belief that positive trends are likely to continue for larger time periods. Additionally, Ben-David, Graham, and Harvey (2013) assert that miscalibration arises due to investors overestimating the accuracy of their forecasts, underestimating the volatility of unsystematic events on the financial market and underestimating the range of potential outcomes. Given the conjoint findings with respect to miscalibration in trading, it can be justified to state that miscalibration negatively affects trading performance.

2.2.2 Better-Than-the-Average Effect

Overview

Complementary to miscalibration, overconfidence is often displayed in the tendency of individuals to evaluate themselves in a more favourable manner than an average peer (Alicke, Vredenburg, Hiatt, & Govorun, 2001; Alicke et al., 1995). This phenomenon has been documented in the existing works as the better-than-the-average effect (BTAE) and is one of the most researched biases in the social-psychological literature. The early interest in the matter is owed to the nature of humans as part of a society, which inevitably translates into interpersonal comparison (Festinger, 1955). According to theorists of the view, an interpersonal comparison is often complemented by overestimation of one's self, for reasons that relate far back to the Darwinian evolution theory. Thereby, the subjective belief of being better than the peers is owed to the "survival of the fittest" tenet (Johnson & Fowler, 2011). Despite the long research history of the bias, modern works still detangle the implications and motives of the BTAE. Indeed, Guenther et al. (2010) argue that the BTAE is one of the pillar findings in social psychology that portrays the greatest manifestation of self-serving, and thus is of perpetual importance.

A number of studies have underlined substantial persistence of the bias in regards to individuals in various environments. For instance, by assessing the self-reported performance of the faculty members in Nebraska, Cross (1977) found that a surprising number of members, namely 90%, consider themselves as above-average teachers. Moreover, two-thirds of the respondents deemed themselves in the top quarter. On the other side of the spectrum, a study focusing on students concluded similar patterns as 70% of the students believed to be above the median in leadership ability, while 85% placed themselves above the median in interpersonal skills (Gilovich, Epley, & Hanko, 2005).

The Better-Than-the-Average Effect in Trading

In the field of trading, individuals that place an excessive degree of confidence on personal judgements compared to a group of traders with similar backgrounds and social status have the propensity to overvalue their skills in identifying stocks with profitable future performance. This tendency is enforced by the necessity to swiftly react to news on the market such that the losses are minimized, and opportunities are acquired for a lower price. Graham et al. (2009) state that such behaviour relies on subjective probabilities that are formed in accordance with socio-demographic characteristics and knowledge in the field. Therefore, these factors lead to the creation of higher-perceived competence of traders in comparison to others, pertaining to the understanding of financial signals. Traders that deem themselves more knowledgeable and skilful tend to anchor heavier on own judgements. Consequently, this results in the belief formation that they can beat the majority of traders and thus the market, which, similarly to miscalibration, leads to excessive trading (Statman, Thorley, & Vorkink, 2006). Furthermore, Glaser and Weber (2007), as well as Oberlechner and Osler (2011), assert that, in fact, the better-than-the-average effect is the facet of overconfidence that drives increasing trading volume, and not miscalibration. Following the previously mentioned works and the profusion of evidence, it is plausible to conclude that the BTAE is detrimental to trading performance.

2.3 Anchoring bias

Overview

The anchoring bias has been defined as one of the fundamental heuristics that influence the decision-making process and manifests in the inability of individuals to provide an estimation that is sufficiently adjusted from an initial value which, consequently, results in different starting-points leading to different estimations (Tversky & Kahneman, 1974b). Generally, the bias occurs irrespectively of whether the anchor is relevant for future assessments or not, which denotes the proclivity of subjects

to anchor on salient but irrelevant figures (Cen, Hilary, Wei, & Zhang, 2012). Furthermore, the construct of the bias is believed to be an automatic- and unconscious occurrence in a cognitive process that hinders individuals from consciously noticing that their behaviour has been conditioned (Wilson, Houston, Etling, & Brekke, 1996). A common instance can be noted in retailing. Customers often anchor to a market price or to a starting price proposed by the salesperson to establish the price they are willing to pay for a good. Any price negotiations, thereafter, rely heavily on the initial value, regardless of the actual worth of the good (Simonson & Drolet, 2004). With that in mind, a study on the willingness to pay for goods, conducted by Bergman, Ellingsen, Johannesson, and Svensson (2010), has shown that, while a greater cognitive ability does lower the anchoring, it does not eradicate its exhibition.

Likewise, a large number of works have scrutinized the topic in regards to decision-making in various environments. One of the earliest mentions originates from psychophysics and manifests in people's tendency to estimate the weights of others by taking an extreme weight as a starting value (Brown, 1953, as cited in Chapman & Johnson, 1999). Succeeding studies provided evidence of the anchoring bias with regards to general knowledge, for instance by asking students to estimate the weight of the Roman Emperor Julius Caesar (Blankenship, Wegener, Petty, Detweiler-Bedell, & Macy, 2008) or the number of days Mars requires to orbit the sun (Epley & Gilovich, 2005), after being provided with an anchor. Other academics observed anchored estimations pertaining to probability estimates (Chapman & Johnson, 1999), legal judgments (Englich & Soder, 2009), and negotiation (Galinsky & Mussweiler, 2001) among other fields.

The Anchoring Bias in Trading

Shiller (1999) suggests that anchoring, along with overconfidence, are two phenomena that result in opinion discrepancies among investors. Furthermore, the author states that the anchoring bias may have a salient impact on the financial market as a whole. More so, Reilly and Brown (2006) claim that the heuristic can be a "source of frustration in the financial environment". To this end, numerous studies provided evidence on the eminence of the anchoring bias in trading and investing. For instance, Chaarlas (2012) found that, out of 519 equity investors of Tamil Nadu (India), 81% were influenced by the anchoring bias. The sizeable persistence of the bias might be due to the large amount of data traders are faced with while having to decide swiftly on a position on the market. Thereby, using the anchoring heuristic, traders tend to reduce the complex decision-making process to an uncomplicated cognitive task that takes considerably less time, causing them to anchor on trivial information while overlooking key data. In many cases, recent figures serve as anchors; a fact that

results in disaster myopia during a bull market as the prices are set neglecting the possibility of a crash (Jain et al., 2015). Ari (2009) states that traders often anchor to buying values after entering a position on the market. Therefore, they postpone selling a losing position, believing it would return to the initial price – which, more often than not, results in much larger losses. According to Brooks (2011), investors might anchor on a recent "high" of a stock that has experienced a considerable depreciation in a short time period. Thereby, investors believe to obtain a profitable stock at a discount price which might not always be the case. As a result, anchoring leads to predictable forecast errors when traders do not adjust their forecasts sufficiently from past information (Campbell & Sharpe, 2009). Furthermore, anchored decisions lead to bypassed investment opportunities, as well as suboptimal entry-timing into the market. Overall, similarly to overconfidence, the anchoring heuristic in trading leads to higher trading volume (Shiller, 1999) and poorer trading performance (Black, 1997).

2.4 Mindfulness

Overview

Mindfulness, as a concept, has been present throughout human history. Its roots can be found in Buddhist practice, in which it is seen as a requirement to reach enlightenment (Vanaya & Lanka, 2011). It is defined as being fully aware of the present while being open-minded and without being held back by experiences of the past. At its core, mindfulness is accepting the truth that is the present without it being blurred by personal judgement and previous experiences (Germer, Siegel, & Fulton, 2005). Within the literature body that is available today, the word "mindfulness" is used to describe several different concepts. While some works like that of Brown & Ryan, (2003) describe mindfulness as a mindset that is based on external factors that a subject has been exposed to throughout its lifetime, others describe mindfulness as a state that can be achieved through mindful practices such as meditation. A study by Erisman & Roemer (2010) found that, even through short, simple mindful practices such as focussing on one's own breathing, the subjects of the study were able to achieve a state of mind in which they had better control over their emotions compared to the control group. In the case of the former, mindfulness could be seen as a trait, while in the latter, it could be deemed a state. Mindful practices such as breathing exercises can be defined as interventions that allow subjects to achieve mindfulness as a state, though, in order to strengthen mindfulness as a trait, it is postulated that long-term practice is required (Davidson, 2010). A study conducted by Kiken et al. (2014) further examined all three concepts of mindfulness and their interconnection. Their findings suggest that regular interventions, as well as frequent experiencing of the mindful state, result in the enhancing of mindfulness as a trait. Furthermore, they concluded that participants do not only have a different level of the trait pre-interventions, but the required intensity of interventions also differ for all individuals

across the trajectory from a "state to trait". In the current research, the focus lies on mindfulness as a trait.

Mindfulness as a Subject of Psychology

Throughout the years, mindfulness as a concept has been the subject of studies in a wide variety of research fields. This is especially the case in the fields of psychology and neurosciences. Some of the earliest works focussed on the use of meditation, which is widely accepted as a mindful intervention, to handle chronic pain. One such study was conducted by Kabat-Zinn (1982), in which 52 patients suffering from chronic pain in several different areas of the body practised mindful meditation over the course of ten weeks, after which the subjects were asked to rate their pain perception compared to at the beginning of the study. It should be noted that none of the patients responded positively to traditional pain relief methods, such as medication. It was found that the patients experienced a significant reduction in pain perception, which is explained by the author as the "'uncoupling' of the sensory dimension of the pain experience from the affective evaluative alarm reaction". It was also found that the subjects experienced a reduction in mood disturbances. Another study by Speca, Carlson, Goodey, & Angen (2000) studied the effects of mindfulness on mood disturbances and stress levels of 90 cancer patients. They, too, found that the vast majority of the subjects experienced a decrease in both mood disturbances and stress levels. Besides, numerous works observed the benefits of mindfulness in coping with depression and anxiety (Hafenbrack et al., 2019), as well as in promoting mental clarity and enhanced focus (Baer, 2003).

Based on the findings of the stipulated academics, it can be concluded that mindfulness impacts the emotional state of a subject in a positive manner. This imposes the question of whether mindfulness has an impact on economic agents, as well as their performance, for instance, in a trading setting.

Mindfulness and Decision-Making

Kirk et al. (2016) have previously stated that, in the case of social and economic exchanges, the ability to regulate one's emotions is a requirement for cooperative decision-making. As previous literature such as the work of Kabat-Zinn & Hanh (2009) has shown that mindful subjects observe emotions and thoughts unbiased, it begged the question of whether it could also impact economic decision-making. It was thus postulated that mindfulness training could prevent the expression of negative emotions within a cooperative environment. Within the scope of this study, it was found that this was, indeed, the case, as participants who underwent mindfulness training were more willing to cooperate under

unfair conditions compared to the control group. Furthermore, through functional Magnetic Resonance Imaging (fMRI), Kirk et al. (2016) found that the group that underwent mindfulness training showed increased activity in the section of the brain associated with social attachment, confirming that mindful practices can impact human behaviour even on a neurological scale.

Other studies confirmed that the impact of mindfulness on decision-making is not limited to decisions that affect the ego. A study by Ruedy and Schweitzer (2010) suggested that mindfulness may positively impact ethical decision-making, as the model by Rest (1986) suggests that, in order for a person to make an ethical decision, one must first become aware of the issue. Indeed, Ruedy and Schweitzer (2010) found that subjects who were deemed high in mindfulness made more decisions in accordance with ethical standards compared to those low in mindfulness. Additionally, Weick and Putnam (2006) state that mindfulness profits decision-making by allowing individuals to focus on the present as opposed to less relevant past- and future events.

2.5 Link between Mindfulness and Behavioural Biases

Given the recent increase of interest in mindfulness in the western culture, several studies focused on the benefits of mindfulness from a psychological and neurological perspective; however, the literature body pertaining the benefits of mindfulness on reducing cognitive biases is very limited. At the date of writing, merely three studies were found in the field. Nonetheless, the connection between the two phenomena seems very likely owing to a number of direct and indirect effects. In the latter scenario, mindfulness may lower prominence of the biases in individuals' behaviour by the effect it exerts on one's mood and emotions. This effect is especially relevant to traders. For instance, according to a study by Lo et al. (2005), traders who exhibit intense positive or negative emotions to monetary gains or losses are more inclined to manifest a lower trading performance. Several academics provided evidence that states such as anger predispose individuals to act upon instincts and intuition (Raglan, 2014). As such, traders would make decisions by involving the previously described System I, which is more susceptible to biases. To this end, Raglan (2014) suggests that mindfulness allows individuals to acknowledge these moods and identify the impact their emotions might have on their decisions. Furthermore, in one of the original studies on the concept of mindfulness, Brown and Ryan (2003b) state that mindfulness is greatly associated with lower negative affect and may reduce anger and aggression. Accordingly, mindfulness might benefit the decision-making process for any individual, though it is especially important in trading when decisions often need to be taken rapidly. Furthermore, Cooper and Kahn (1993) found that traders suffer under higher levels of anxiety than

the general population. Mindfulness, per contra, is documented to help individuals cope with anxiety and lower its exhibition (Hafenbrack, Kinias, & Barsade, 2014).

Biases are cognitive processes people undertake unconsciously, whereas mindfulness promotes the recognition and mitigation of unconscious behavioural patterns that are detrimental to one's performance. On this end, Parikh (2009) suggests that, only when investors are able to control unconscious behaviour and achieve emotional intelligence, they can make rational choices. Furthermore, Parikh states that an additional key element in trading performance denotes the ability to get in touch with past suboptimal behaviour such that it is not reiterated. Thereupon, mindfulness is believed to facilitate the acceptance of one's wrongs as it manifests in non-judgmental awareness. Specifically, the ability to objectively analyze past performance and accept its roots might be linked to mitigating overconfidence (Raglan, 2014). As previously described, overconfident investors tend to owe bad outcomes to "bad luck" (Peteros & Maleyeff, 2013). By accepting past experiences in a non-judgmental way, mindful traders might have a higher propensity to acknowledge their mistakes, and as such, lower the overconfidence bias due to perceived competence.

Thereupon, self-reflection and accepting own wrongs might lead to an undistorted imagine of self which, consequently, may lower the better-than-the-average effect in overconfident traders. Given the previously documented benefits of mindfulness on emotion-control and mood, as well as the alleged direct effects of mindfulness on the BTAE, the following hypothesis is formulated:

H_1: "Traders who score high in mindfulness manifest a lower exhibition of the better-than-the-average effect than traders with low mindfulness scores."

An additional direct benefit was previously documented in a study on gamblers, where mindfulness was found to be negatively associated with overconfidence (Lakey, Campbell, Brown, & Goodie, 2007). Using the Mindfulness Attention Awareness Scale (MAAS) to quantify the mindfulness degree of the subjects, the study suggests that dispositional mindfulness is positively correlated with better calibration, as well as better judgments in risk-involving situations. As such, the authors of the aforementioned paper observed a positive association between mindfulness and accuracy. Therefore, it would be reasonable to assume that mindfulness may lower the second facet of overconfidence, namely miscalibration. Bearing in mind the broad benefits of mindfulness on diminishing overconfidence, as well as fostering accuracy, the second hypothesis is stated as follows:

H_2: "Traders who score high in mindfulness manifest a lower exhibition of miscalibration than traders with low mindfulness scores."

While few academics focused on the link between mindfulness and overconfidence, at the date of writing, no studies researched the connection between mindfulness and the anchoring bias. Nevertheless, given the benefits of mindfulness on lowering cognitive predispositions, it raises the question of whether mindful individuals, traders in particular, would exhibit lower anchoring. The relation between the two phenomena is even more of interest given the manifestation of mindfulness in higher awareness of the moment. As such, mindful investors might be more prone to rely on current, relevant information as opposed to past values as stock highs or entering prices. Therefore, the third hypothesis is postulated:

H_3: "Traders who score high in mindfulness manifest a lower exhibition of the anchoring bias than traders with low mindfulness scores."

Furthermore, the current research employs an additional analysis which differentiates between a self-generated- versus externally-imposed anchors. Therefore, the next hypotheses are stated as follows:

H_4: "Traders who score high in mindfulness manifest a lower exhibition of the anchoring bias than traders with low mindfulness scores given a self-generated anchor."

H_5: "Traders who score high in mindfulness manifest a lower exhibition of the anchoring bias than traders with low mindfulness scores given an externally-imposed anchor."

III. Methodology

The present section of the paper describes the data-collection process, elaborating on the sample selection criteria, sample size, survey outline, as well as the recruitment and incentives in the scope of the survey. Additionally, the following paragraphs describe the method used to quantify the mindfulness degree of participants and the reasoning behind its utilization. The subsequent paragraphs present the method employed to compute the overconfidence- and anchoring bias degree of traders at a group level along with the analyses conducted to test if the biases of interest are more prominent in the group of traders with a low mindfulness degree relative to the group of traders with a high mindfulness degree.

3.1 Sample Size

The present research employs primary data that was collected through an online survey designed for the purpose of the analysis. One of the main concerns denoted the determination of a sample size that would be representative of the population and would minimize both the alpha error (detecting a difference that is not found in the population) and the beta error (omitting a difference existent in the sample) (Bartlett, Kotrlik, & Higgins, 2001). A larger sample size implies a decrease in the specified errors, albeit at a decreasing rate (Taherdoost, 2017). Furthermore, previous academics suggest that the sample size calculation depends on the type of the research, size of the population and the applicable specifications by the researcher, such as the chosen confidence level and margin error. Following the guidelines of one of the largest online survey platforms[1], the following equation was used to assess an approximate number of participants required:

Equation 1

$$S_n = \frac{\frac{z^2 * p(p-1)}{e^2}}{1 + \frac{z^2 * p(p-1)}{e^2 N}}$$

Where S_n denotes the sample size, N – the population size and p – the percentage of occurrence of a state or condition in a sample. Z portrays the z-score, which is dependent on the confidence level chosen by the researcher. In the premises of this research, the population size is equal to 9.6 million (approximate number of retail traders worldwide[2]); Similarly to prior works, a confidence interval of 95% and a margin error of 5% was chosen, such that the respective z-score and the p-value are equal to 1.96 and 0.05 respectively. To maximise the variation in the sample, a p-value of 0.5 was implemented, as suggested in the work of Bartlett et al. (2001). Given the stipulated values and the formula provided above, the survey aimed to collect an approximate of 385 responses. This is in line with prior works such as Taherdoost (2017), who suggest the necessity of a sample of 384 subjects when the inferences are to be made about a population larger than 1 000 000, though, given the limited time and budget available in the premises of the current survey, it is reasonable to expect a smaller sample.

[1] Formula used by the second largest survey platforms - Surveymonkey.

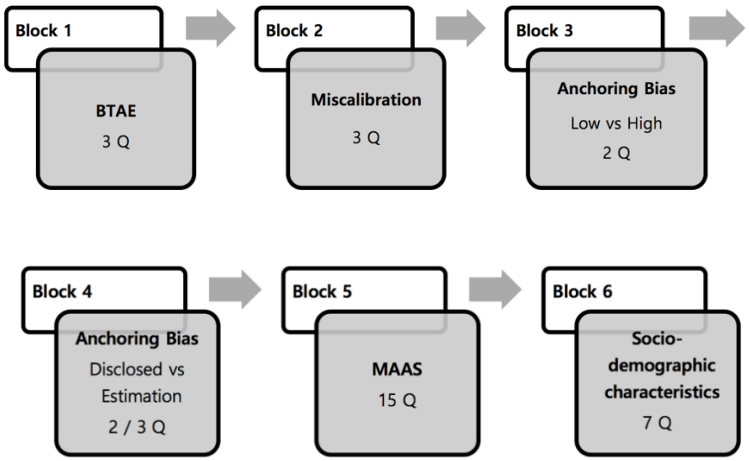
[2] brokernotes.co estimate an approximate of 9.6 million retail traders worldwide.

3.2 Survey Outline

The survey consisted of 32/33 questions depending on the research design in regard to the anchoring bias manipulation the participants have randomly been allocated to. *Figure 1* illustrates the sequence of the survey blocks and the number of corresponding questions.

Figure 1

The Sequence of the Survey Blocks



Note. Figure 1 illustrates the sequence of the blocks in the survey for the purpose of the research. Thereby, the name of each block is followed by the number of questions, denoted as – Q, is included.

The first block of the survey proposed three questions concerning the better-than-the-average effect. The focus of the second block of the survey laid on obtaining data in regard to the miscalibration level of the participants. The third block aimed to gather insights into the anchoring bias, giving a random allocation of the subjects to a low- or high-anchor group. In a similar manner, the fourth block of the questionnaire denoted data collection in relation to the self-generated versus an externally-imposed anchor, whereto the subjects were randomly allocated to one of the groups. Thereafter, the fifth block was constructed to assess the mindfulness degree of the respondents. Lastly, the final block of the survey consisted of socio-demographic and professional questions that assessed the following profile characteristics: gender, age group, years of trading experience, trading performance in terms of loss/gains realized in the prior year, availability of educational background in finance, and the trading proficiency of the participants. The respondents were not informed about the purpose of the thesis. Furthermore, the order of the blocks was designed such that the questions in regard to the

mindfulness degree do not predispose participants to alter their responses in the previous blocks. The questions in respect to each of the bias along with their respective aim are further elaborated on in the following sub-sections and listed in Appendix A.

3.3 Recruitment and Incentives

The respondents were recruited on online forums for retail traders[3], as well as through word of mouth in the trading communities on eToro[4]. The survey was active for nine days, namely from the 04.06.2020 until the 12.06.2020. The only criteria in attending the survey denoted being a retail trader and at least 18 years old. This way, a heterogeneous sample is believed to be obtained that would minimise the error in the analysis as no common characteristics, such as culture, would influence the results. For instance, Cohen et al. (2008) found that investors in the same city and under the same managing firm are likely to manifest similar behaviour in trading. Though these factors could cause homogeneity, they are not of concern, as the groups approached contained members from various countries, age groups and different levels of expertise. In such manner, this research aims to avoid the limitations of the paper of Charoensukmongkol (2018), which analysed the effect of mindfulness on investors in Thailand only and could not be representative of all traders. To encourage participation, a monetary incentive in the form of two Amazon vouchers worth 20 EUR each was proposed. The participants were informed about the reward before the completion of the questionnaire. The winners of the rewards were selected randomly from the sample of the participants that have fully fulfilled the survey and provided a contact E-mail address. However, the truthful completion of the survey relied on the intrinsic motivation of the participants as there were no task-related incentives due to the limited budget. Albeit, the responses are believed to be truthful as the participants were informed that their names would not be disclosed and the sensitive information as trading performance would only be presented in the paper in aggregate values.

3.4 Materials

3.4.1 Mindfulness degree

Previous works on the topic employed a variety of constructs that aim to quantify the mindfulness degree of individuals. The mindfulness assessment method directly reflects the facets of mindfulness

[3] The following forums were selected on the reddit platform due to the possibility to post a survey request: r/Trading; r/Trading212; r/Etoro; r/CryptoCurrency; r/Forex; r/Stocks; r/etorotraders; r/investing; r/investingclub; r/investing_discussions; r/financialindependence; r/FinancialPlanning.

[4] eToro is a social trading and multi-asset brokerage company

that are being scrutinized along with its various definitions. Consequently, due to its complex construct, there is no generally-accepted mindfulness scale (Barajas & Garra, 2014). However, a widely-used scale appears to be the Freiburg Mindfulness Inventory (FMI), which focalizes on beliefs rather than behavioural patterns (Buchheld, Grossman, & Walach, 2001). Given its design based on individuals with high mindfulness score, this approach could be suboptimal for a sample of participants with disparate levels of mindfulness. An additional scale that appears to be eminent in a variety of academic studies is the Kentucky Inventory of Mindfulness Skills (KIMS) (Baer, Smith, & Allen, 2004). Nonetheless, the latter approach consists of three subscales designed to measure different skills, namely: observation, description and acting with awareness. Similarly, this design is deemed unsuitable for the present research as a one-factor construct is preferred in order to provide a single variable, able to capture the trait. Furthermore, a one-scale construct would allow a more comprehensive analysis method.

This paper employs the Mindful Attention Awareness Scale (MAAS) for quantifying the mindfulness degree for several reasons. Firstly, the use of the MAAS is widely accepted in the academic literature (Brown & Ryan, 2003a). Studies such as Barajas and Garra (2014) provide evidence that participants obtain different mindfulness scores independent of mindfulness training, which supports the use of the measure for the current sample given its specific heterogeneity. Furthermore, the MAAS captures the mindfulness degree as a trait, which is the focus of the current research, and allows assessing the attention and awareness of the present of individuals, whether it is induced by mindful practices or personal predispositions (Brown & Ryan, 2003b). Thereby, questions such as "*I find it difficult to stay focused on what's happening in the present."* and *"I do jobs or tasks automatically, without being aware of what I'm doing."* were presented to the subjects; the full list of questions is presented in Appendix B. Given the responses of the subjects, the mindfulness score is computed as discussed in the following subsection of the paper.

3.4.2 Overconfidence

The large array of studies in behavioural finance portray overconfidence as a key component in financial decision-making; however, many argue that identifying a direct and precise measure of the bias is challenging (Baker, Bradley, & Wurgler, 2011) due to the nature of the biases that rely on beliefs and psychological constructs (Malmendier & Tate, 2005). Nonetheless, previous academics have developed a range of scales that attempt to quantify the biases in contemporary analyses. The next subsections describe the measures chosen for the miscalibration bias, as well as for the better-than-

the-average effect; two facets of overconfidence that are believed to influence the trading behaviour of retail traders.

Miscalibration

A vast number of studies employ the notion of miscalibration in relation to behavioural patterns in disparate fields, which denotes the propensity of individuals to overestimate the precision of their information (Biais, Hilton, Mazurier, & Pouget, 2005; Cheng, 2007; Lambert et al., 2012). Numerous academics utilize a variation of the measurement used by Russo and Schoemaker (1992) that measures miscalibration by eliciting confidence intervals to a set of numerical questions. According to the aforementioned authors, the choice of the confidence range, whether it is 90%, 70% or 50%, depends on the issues and the risk involved in the research setting. However, multiple studies in behavioural finance opt for the 90% confidence level, thus, this reference point was also preferred for this study. In line with multiple studies such as De Bruin et al. (2007), the miscalibration of the participants was assessed by asking respondents to provide low and high boundaries for a set of questions, such that they are 90% confident that the true value lies within the specified interval. Similarly to Glaser and Weber (2009), if the response for a question lies outside the boundaries, it is denoted as a "surprise". Thereby, the percentage of surprises for a well-calibrated individual is 10%. The stipulated measure of miscalibration was previously constructed based on a different number of questions. For instance, Deaves et al. (2009) propose the respondents 20 questions, Biais et al. (2005) present ten questions, whereas one of the most quoted studies in behavioural economics performed by Glaser and Weber (2007) display five questions. The present research is one of the first to analyse the manifestation of two facets of overconfidence and the anchoring bias under the consideration of the mindfulness degree of the subjects. Consequently, due to the limited amount of questions that could be included in the survey, to obtain a higher number of responses, a set of three questions was chosen to quantify the level of miscalibration of the participants. Although multiple works support the hypothesis that the psychological construct of overconfidence manifests independently of the context (Biais et al., 2005), the present study employs three questions that are related to the field of finance. In such manner, it is believed to minimize the possibility of offering a competitive advantage to any of the participants in terms of knowledge, as the whole sample consists of active traders. Participants were asked to provide low and high boundaries, such that they are 90% sure that the true value lies within the elicited values (90% confidence interval) for the following three questions: *(1) Number of currencies circulating worldwide; (2) The percentual historical annual return of S&P 500 in 2004*; and *(3) The creation year of the New York Stock Exchange.*

The Better-Than-the-Average Effect

In a similar manner to miscalibration, a variety of studies have implemented several constructs that attempt to quantify the better-than-the-average effect (BTAE). Thereby, some academics employ a direct approach, namely by asking participants to rate themselves compared to an average peer, whereas others question the subjective self-estimation of own performance of the participants as well as their subjective estimation of the performance of an average peer. Thereafter, the difference between the two estimations denotes the better-than-the-average measure. This method is disclosed as an indirect approach (Alicke et al., 2001). As a direct approach allows a straightforward quantification of the measure and can be inferred by utilizing one single question, it was preferred in the current analysis.

Furthermore, the construct of the measure is highly dependent on the context. For instance, Langer (1975) and Weinstein (1980) find that individuals that are "more committed to the outcomes" and "manifest an illusion of control over the situation" are more predisposed to overconfidence. This is applicable to the premises of the current study, as the trading outcome of the participants is directly correlated with their financial well-being. Therefore, following a study on overconfidence in the Tunisian stock market (Zaiane & Abaoub, 2010), the survey designed for the purpose of this research employs two questions that test the BTAE in a general setting, as well as in the context of trading performance. The former manifestation is captured by the following question:

"Suppose that you are related to a group of people who have a similar background and social status as you. Generally, when compared to them, you will most probably feel that you are: (1) Better than the average; (2) around the same; (3) not as good as the average".

Overconfidence, in the context of trading performance, was assessed by the following question:

"Compared to the investors you are acquainted with, you believe your investment performance is: (1) Better than the average; (2) around the same; (3) not as good as the average".

Besides the stipulated approach for identifying the BTAE at a group level, this paper employs an additional proxy that is widely used in the literature. Several researchers, such as Graham et al. (2009), quantify the better-than-the-average effect as the degree to which individuals believe they can "beat the market". In the premises of their research, the authors denote this facet of overconfidence as the margin by which an investor believes that his portfolio return will exceed the market return over the following 12 months. While their measure is specifically meaningful when employing a regression

analysis, a more straightforward approach is preferred for the comparative nature of the current research. Therefore, similarly to Zaiane et al. (2010), the respondents of the present research were questioned the following:

"When considering the next three months, do you have confidence in beating the market as a whole?" A multiple-choice list with the following options was displayed: *(1) Yes, very much; (2) Yes, I have some confidence; and (3) No, I have no confidence at all*.

3.4.3 Anchoring Bias Manipulations

The plethora of studies on the effect of the anchoring bias mostly engages the same or a similar measurement approach as the classic study by Tversky and Kahneman (1974). In the premises of their research, the participants were provided with a random number generated by spinning a fortune wheel. Thereafter, the respondents were asked to estimate whether the number of African countries in the United Nations were smaller or higher than the arbitrarily generated number. Furthermore, the participants were then asked to elicit an exact estimation for this unknown amount. Consequently, the authors analysed how skewed the elicited values are from the provided anchor and found a surprising clustering around the initial value. Numerous studies have researched the matter in a financial setting, specifically in regard to trading and investing. The present research paper closely resembles the approach undertaken by Kaustia et al. (2008) who analysed the existence of the anchoring bias in a comparative manner between a group of students relative to a group of professionals. In a similar manner, the anchoring bias is scrutinized in two settings: Firstly, the bias is analysed in the whole sample by providing a low versus high anchor (*Design 1*). Secondly, the effect of the bias is researched in the context of a self-generated- versus externally-imposed anchor (*Design 2*).

Design 1

Similarly to Kaustia et al. (2008), the participants of the survey were randomly allocated to a "low anchor" (LA) group and "high anchor" (HA) group. In the LA group, the subjects were informed that in Japan, the average stock market return between 1995 and 1999 was lower than 1%. Conversely, the participants in the HA group were notified that between the same period, (1995 – 1999), Sweden experienced an average market return higher than 24%. Thereby, the values of 1% and 24% served as low-, and high anchors, respectively. The subjects in both groups were then asked to state whether they think the average market return in the European countries for the following five years (2000 –

2004) was higher or lower than the initially provided anchor. Thereafter, the subjects had to estimate what they believe the average market return of the EU countries accounted for.

Design 2

Besides the classic design aiming to examine the persistence of the anchoring bias in a group, Kaustia et al. (2008) inspected whether the bias is higher when the anchor is self-generated relative to when the anchor is externally-imposed. Likewise, this study aims to analyse this phenomenon for two groups of traders, namely those with a low mindfulness score relative to traders with a high MAAS score. Thereby, the respondents were randomly assigned to a "disclosed" group or the "estimation" group. In the former, the participants were informed that the average stock market return of Singapore between 1989 and 1998 was 4.79%. The subjects in the "estimation" group were asked to estimate the average stock market return for Singapore for the same period. The value of 4.79% denoted the externally-imposed anchor, whereas the provided value by the respondents in the second group served as a self-generated anchor. Thereafter the subjects of both groups were asked to posit if they believe the average stock market return of Singapore for the following ten years (1999 – 2008) to be higher or lower than the respective anchor. Further, the respondents had to estimate the latter average return.

3.5 Measures and Planned Analyses

Whilst the previous chapters described the materials used to capture the biases of interest, the following section reports the construct of the measures along with the methodology employed to test whether there is an association between the mindfulness degree and the manifestation of the biases.

3.5.1 Mindfulness score

Following the MAAS framework described in the previous subsection, the mindfulness variable is computed as a single reflective, latent variable based on the responses of an individual on 15 questions in regard to day-to-day experiences such as: "It seems I am running on automatic without much awareness of what I'm doing" and "I find it difficult to stay focused on what's happening in the present" (for the complete list of questions see Appendix B). For each of the questions, the respondents were faced with a choice on a six-point Likert scale ranging from "1-almost always" to "6-almost never". As follows, the initial mindfulness measure was computed as the arithmetic average of the responses to the aforementioned 15 questions. Thereby, a higher score denotes a higher mindfulness degree. Given the purpose of the research, it was chosen to divide the sample of

respondents into two subgroups based on their mindfulness degree, such that a maximum number of participants would be allocated to each group, whilst allowing a comparison. Thereby, a common statistical method, namely dichotomization, was preferred for splitting the sample into “low” and “high” mindfulness degree groups. As the mean is more susceptible to outliers, a median split was favoured for its robustness (Iacobucci, Posavac, Kardes, Schneider, & Popovich, 2015).

3.5.2 Miscalibration

The measure employed to test for the miscalibration bias is denoted by the amount of “surprises” subjects display. Given the three questions stipulated earlier, the participants could manifest a level of miscalibration equal to 0 % - if all true values lie within the specified interval, 33% - if the true value for one question lies outside the interval, 66% or 100% if two or three true values respectively lie outside the provided boundaries. In line with Deaves et al. (2009), at a group level, a larger percentage of “surprises” corresponds with a larger degree of miscalibration and denotes the miscalibration variable in the premises of the current research. Similarly to the aforementioned study by Glaser and Weber (2007), it would be impossible for a respondent to obtain a 10% amount of “surprises”; however, the stipulated measure allows an indication of the miscalibration level, more so in a comparative manner between two groups. The mean miscalibration degree of the participants in the low mindfulness score group was compared to the mean miscalibration of the group manifesting a high mindfulness score. Forbye, a parametric test, namely the independent samples t-test, is implemented to test the statistical significance of the difference between the mean amount of “surprises” in each of the MAAS degree groups.

Furthermore, a large array of studies such as the one by Soll and Klayman (2004) state that overconfidence manifests in individuals providing narrow confidence intervals. In order to test if the interval length differs on average between the two groups divided by their mindfulness score, the Mann-Whitney U (MWU) test was performed. The use of the latter, non-parametric test was preferred over the common t-test due to the ununiform distribution of the interval lengths provided by the survey participants. In such a manner, the robustness of the results is insured, as the outliers do not corrupt the results. The interval length denotes the absolute distance between the high and low boundaries provided by the respondents.

3.5.3 Better-Than-the-Average Effect

Festinger's original formulation of social comparison theory states that, in most cases, individuals cannot correctly evaluate themselves in comparison to an objective standard (Leon Festinger, 1954). Nonetheless, one can factually be better than the reference point. Therefore, the relative evaluation of self as being above the average is not a bias in itself (Hoffrage, 2016). Hence, previous academics such as Cross (1977) focus on the persistence of the bias at a group level. The first two questions of the present survey in relation to BTAE gained insights into how subjects evaluate themselves in comparison to an average peer in two settings. Following a common criterion in psychology, if the percentage of participants claiming to be "better than the average" is significantly higher than the percentage of those who believe to be "below the average", then this phenomenon signalizes overconfidence in general cases in the sample (Zaiane & Abaoub, 2010).

The current research focuses not only on the existence of the better-than-the-average effect in retail trading, a phenomenon that was previously documented, but also on the persistence of the bias in the group of traders with a low mindfulness degree relative to the group of traders with a high mindfulness degree; thus, the percentage of participants that believe to be "better than the average" in both groups shall be compared and discussed in the results section of the paper. To test the statistical significance of the difference in the number of subjects who (1) believe are better than the average and (2) are not as good as the average, an independent samples t-test was conducted.

Additionally, the third question in relation to the BTAE aimed to scrutinize whether the subjects had confidence in beating the market. Similarly to Zaiane et al. (2010), if the percentage of investors who have confidence in beating the market is significantly higher than those who claim to have no confidence in beating the market, then this signalises existence of the bias in relation to the market. Accordingly, the percentage of subjects who had confidence in beating the market denotes the sum of the participants that responded "Yes, very much" and "Yes, I have some confidence". Expanding on the latter methodology, the distribution of the responses is compared between the low MAAS degree group and high MAAS degree group. To test whether traders with a lower mindfulness degree are more overconfident at a group level relative to traders with a high mindfulness degree, and such have higher confidence in "beating the market", the MWU test was performed.

3.5.4 Anchoring Bias

In the premises of *Design 1,* participants estimated the average market return in the European countries for five years (2000 – 2004). Prior to that, half of the sample was given a low anchor, whereas

the rest of the subjects were provided with a high anchor. The analysis method follows the guidelines of Kaustia et al. (2008). A comparison of the estimation means of the two groups, namely "low" (LA)- and "high" (HA) anchor group, was performed to assess whether the difference between the two is statistically and economically significant. Furthermore, the clustering of the mean estimations to the respective anchor is analysed to identify the anchoring bias; in other words, how close the elicited values are to the respective anchor per MAAS group. If the mean estimation of the subjects in the LA group is significantly smaller than the mean estimation elicited by the participants in the HA group, the anchoring bias is proved to exist at a group level. Furthermore, Kaustia et al. (2008) analyse the bias in respect to two groups of participants: students and financial market professionals. Similarly, this paper analyses the difference between the estimation means in the two groups (LA / HA) for two groups of interest: those with a high- versus low mindfulness degree. Thereby, the independent samples t-test is employed to test the statistical difference in the estimation means. If the anchoring bias persists in a group, a statistically significant difference between the LA and HA groups is expected to be seen. Furthermore, given the literature findings, it is assumed that traders with a lower mindfulness degree are on average more anchored. This can be observed if the difference between the estimation means (LA and HA groups) is higher in the low MAAS group compared to the high MAAS group.

Design 2 scrutinized the manifestation of the anchoring bias in the estimation- versus disclosed groups. In a similar fashion to the study of reference, namely Kaustia et al. (2008), the present research inspects the mean estimations of the subjects per group (estimation/disclosed) and their proximity to the respective anchor. Whilst the true value of 4.79% served as an anchor in the disclosed group, the mean of self-reported values in regards to the average stock market return of Singapore for the ten years between 1989 and 1998, served as a reference in the estimation group. In accordance with Kaustia et al. (2008), the independent samples t-test was performed to analyse the statistical significance of the difference in estimations between the two groups. The reference study scrutinized the manifestation of the anchoring bias in two groups of subjects: students and professionals. In a similar manner, the present analysis was conducted for the low- as well as high MAAS groups. Similarly to the latter stipulated study, if the difference between the mean estimations in disclosed and estimation groups is larger in one of the MAAS groups, this signalises that the respective MAAS group exhibits a higher anchoring bias. Furthermore, the authors observe the proximity of the mean estimations in each group to the respective reference point, such that If the estimated value is closer to the anchor, it indicates a stronger anchoring effect. A similar observation is discussed in the results sub-section of the current paper.

IV. Empirical Findings

4.1 Profile of the Respondents

While 504 participants were registered on the survey platform, 240 of the respondents have completed the survey. This denotes a completion rate of 40%, which is considered above the average[5] according to the findings of the platform "SurveyAnyPlace" (Lindemann, 2019). This attrition could be owing to the optimal completion time, which, on average, accounted for five minutes and twenty-five seconds. Broadly, a response time of thirteen minutes or less is considered to be beneficial in obtaining a good response rate (Fan & Yan, 2010).

Furthermore, it should be noted that, after cleaning the data for irrational entries, the number of participants in the anchoring bias analysis accounted for 232, while the sample analysed in regard to the overconfidence bias accounted for 223 subjects. Thereby, irrational entries denoted responses that are factually impossible. For instance, if the question requested an entry of a year, it could only take values in four digits format, such that entries of less or more digits were omitted. Additionally, if in the premise of the miscalibration bias, the low boundaries were larger than the high boundaries provided by the subjects, then the observation was excluded from the analysis. *Table 1* offers an overview of the characteristics of the participants in the sample. Noteworthy is that 84.8% of the subjects analysed in relation to the overconfidence bias and 84% in regard to the anchoring bias respectively are males. This is in line with prior studies such as Barber and Odean (2001) who document that men trade more than women. Besides, it can be noted that approximatively 82% of participants in both samples are between the age of 18 and 34 years. Additionally, 66.4% of respondents, in both samples, have trading experience of up to two years. Furthermore, only six participants in the overconfidence bias analysis and seven in the anchoring bias analysis respectively, are professional traders. In addition, the majority of the subjects do not possess an educational background in finance, namely 71.3% of participants in the sample constructed for the overconfidence bias, and 70.7% of the sample analysed with respect to the anchoring bias.

[5] The average completion rate of 33% was disclosed by surveyanyplace.com based on an analysis in regards to all surveys distributed on their platform.

Table 1

Profile of the Subjects in the Overconfidence bias sample and Anchoring Bias Sample

Variable	Overconfidence Bias: N=223				Anchoring Bias N=232			
	Abs. Freq.	Cum. Freq.	Percent.	Cum. Percent.	Abs. Freq.	Cum. Freq.	Percent.	Cum. Percent.
Gender:								
Male	189	189	84.8	84.8	195	195	84	84
Female	34	223	15.2	100	37	232	16	100
Age group:								
18 – 24	79	79	35.4	35.4	85	85	36.6	36.6
25 – 34	105	184	47.1	82.5	107	192	46.1	82.7
35 – 44	26	210	11.7	94.2	27	219	11.6	94.3
45 – 54	12	222	5.4	99.6	12	231	5.2	99.5
55 – 64	1	223	0.4	100	1	232	0.5	100
Trading experience:								
Less than 1 year	78	78	35	35	80	80	34.5	34.5
1– 2 years	70	148	31.4	66.4	74	154	31.9	66.4
3– 4 years	33	181	14.8	81.2	33	187	14.2	80.6
5– 6 years	16	197	7.2	88.4	18	205	7.8	88.4
7– 10 years	11	108	4.9	93.3	11	216	4.7	93.1
Over 10 years	15	223	6.7	100	16	232	6.9	100
Professional trader:								
Yes	6	6	2.7	2.7	7	7	3	3
No	217	223	97.3	100	225	232	97	100
Financial Education:								
Yes	64	64	28.7	28.7	68	68	29.3	29.3
No	159	223	71.3	100	164	232	70.7	100
Trading Performance in the prior year:								
Loss	43	43	19.3	19.3	43	43	18.5	18.5
Break-even	29	72	13	32.3	30	73	12.9	31.4
Gain	151	223	67.7	100	159	232	68.6	100

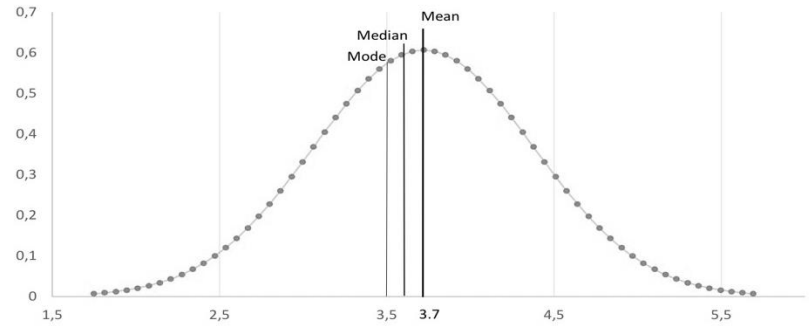
Note. Table 1 summarizes the absolute- and cumulative frequencies (Abs. Freq./Cum. Freq.) along with the percentage and cumulative percentual values (Percent. / Cum. Percent) of the categorical variables that describe the sample of participants in the analyses for the overconfidence bias as well as in the anchoring bias. As the analyses are not interdependent, the data was cleaned of incorrect, incomplete or unusable entries for each analysis individually, hence the unequal number of subjects in each sample.

4.2 Mindfulness Degree of the Sample

The mindfulness degree of the participants was constructed as a latent variable based on the responses to 15 questions, such that the value of the variable could range from one, denoting a low mindfulness degree, to six, signalizing a high mindfulness degree respectively. *Figure 2* portrays the distribution of the mindfulness score in the full sample of 232 traders, which was analysed in regard to the anchoring bias.

Figure 2

MAAS Score Distribution



Note. Figure 2 plots the distribution of the MAAS score based on the sample of 232 respondents. A similar distribution is to be found in the sample of 223 traders that were registered in the overconfidence bias analysis. Thereby, the mean in the second sample denoted 3.7 and the standard deviation – 0.6 units.

It can be noted that the data set follows a normal distribution with a mean score equal to 3.7 and a standard deviation equal to 0.66, such that 95% of the respondents display a score between 2.5 and 5. The mean score of 3.7 signifies that, on average, retail traders exhibit a medium level of dispositional mindfulness, such that they experience "a feeling of running on automatic" or are not fully aware of the present somewhat frequently (Brown & Ryan, 2003a). This is in line with prior findings regarding the MAAS score such as Brown and Ryan (2003), who observed a mean score of 3.85 in the sample of students and a mean score of 3.92 in the general population.

The internal reliability of the scale was assessed by computing the Cronbach Alpha coefficient, which accounted for 0.8. Broadly, an alpha coefficient larger than 0.7 is considered acceptable in empirical analyses, whilst a coefficient of 0.8 is deemed as good (Gliem & Gliem, 2003). As previously described in the methodology part of the paper, using a median dichotomisation, the participants of the survey were split into two groups in regards to the mindfulness score, namely "low" and "high" mindfulness level groups. For consistency reasons, the dichotomization of the variable was done based on the

larger sample, namely the one consisting of 232 subjects, such that those allocated to a "low" mindfulness score group in the anchoring bias analysis remain in the same group for the second analysis concerning the overconfidence bias. Thereby, a median split was performed to classify the respondents into the two groups. No recorded values were attached to the median of 3.66, such that 116 subjects were allocated to the first group and 116 subjects – to the second group, respectively. The socio-demographic characteristics of the subjects in both MAAS groups follow a similar pattern as the total sample, such that the samples are relatively similar. Thereby, Table 7 offers an overview of the socio-demographic characteristics and can be seen in Appendix C.

4.3 Overconfidence Bias

4.3.1 Miscalibration

The sample of respondents consisted of 223 participants, of which 112 subjects were allocated to the "low" MAAS score group and 111 to the "high" MAAS score group, respectively. The methodology section of the paper offers an in-depth explanation for the chosen parameters and points out two analyses that aim to compare the existence of the miscalibration in the low versus the high mindfulness groups. The first analysis focuses on the percentual amount of true values that lie outside the respondents' 90% confidence intervals for the three questions at a group level, which are denoted as "surprises". Secondly, the mean interval length of the respondents in each group is compared using a Mann-Whitney U test. *Table 2* offers an overview of the number of correctly specified intervals (accurate intervals) for each of the questions in the former analysis. It can be noted that approximatively 50% of the whole sample provided an accurate interval, in other words, elicited an interval such that the true value lied within the interval, in relation to the first two questions. However, only 27.4% of the subjects in the whole sample provided a correct interval for the third question. Taken together, the sample as a whole displayed a mean amount of surprises equal to 58% across the three questions, which may indicate the predisposition of traders to miscalibration.

Table 2

Number of Accurate versus Inaccurate Responses per low- and high MAAS group

	Low MASS Degree		High MAAS Degree		Whole Sample	
	Abs. Freq.	Percentage (%)	Abs. Freq.	Percentage (%)	Abs. Freq.	Percentage (%)
Question 1. *"The number of currencies circulating worldwide"*						
Accurate	53	47.3	48	43.2	101	45.3
Inaccurate	59	52.7	63	56.8	122	54.7
Total	112	100	111	100	223	100
Question 2. *" The percentual historical annual return of S&P 500 in 2004" in %*						
Accurate	57	50.9	56	50.4	113	50.7
Inaccurate	55	49.1	55	49.6	110	49.3
Total	112	100	111	100	223	100
Question 3. " Creation year of the New York stock exchange"						
Accurate	31	27.7	30	27	61	27.4
Inaccurate	81	72.3	81	73	162	72.6
Total	112	100	111	100	223	100
Mean values across the 3 questions						
Accurate	47	42	44.7	40.2	91.7	41.1
Inaccurate	65	58	66.3	59.8	131.3	58.9
Total	112	100	111	100	223	100

Note. Table 2 summarizes the absolute frequencies (Abs. Freq.) along with the percentual values (Percentage) of the number of accurate intervals specified by the whole sample as well as per MAAS group for each of the three questions in relation to miscalibration individually. Thereby, accurate intervals constitute the intervals specified by the respondents for which the true values were between the denotes low- and high boundaries. Inaccurate intervals are those for which the true value did not lie within the interval. As the dichotomization of the MAAS variable was performed based on the whole sample of 232 participants, the number of subjects in the MAAS groups vary moderately.

However, it can be noted that for each question individually, the correct response rate does not differ substantially depending on the mindfulness degree of the participants. The mean amount of "surprises" across the three questions in the group with a low MAAS score accounted for 58% while the second group displayed a mean rate of 59.72%. The independent samples t-test indicates that the difference of 1.72 percentage points is statistically insignificant at 10% ($p > 0.1$), such that there is not enough evidence to reject the null hypothesis stating that the mean percentage of "surprises", and thus the miscalibration level in the two groups is statistically different. *Table 3* offers an overview of the descriptive statistics in relation to the second analysis, which compares the interval lengths elicited by the subjects.

Table 3

Descriptive Statistics of the Interval Lengths per low- and high MAAS group

	Obs.	Mean	St. d.	Median	Variance	Skewness	Min	Max
Question 1. *"The number of currencies circulating worldwide."*								
Low MAAS score	112	8.9e+29	9.4e+30	87.5	8.9e+61	10.4	9	1e+32
High MAAS score	111	9e+30	9.5e+31	60	9e+63	10.4	0	1e+33
Whole sample	223	4.9e+30	6.7e+31	80	4.5e+63	14.6	0	1e+33
Question 2. *" The percentual historical annual return of S&P 500 in 2004" in %*								
Low MAAS score	112	25.6	104.9	7	11 004.39	9.7	0.5	1100
High MAAS score	111	54.5	427.1	6	182 442.2	10.3	0	4 500
Whole sample	223	40	310	6	96 111	13.6	0	4 500
Question 3. "Creation year of the New York stock exchange."								
Low MAAS score	112	61.2	98.8	40	9 757.9	7.6	0	990
High MAAS score	111	46.3	37.3	30	1 393.1	1.3	0	200
Whole sample	223	53.8	75	39	5 625.2	8.9	0	990

Note. Table 3 summarizes the number of observations, mean, standard deviation, variance, skewness, minimum and maximum value of the interval lengths provided by the subjects for each question. The values are provided for the whole sample as well as per mindfulness degree group. Thereby, the interval length is equal to the upper boundary minus the lower boundary elicited by the participants.

It can be noted that the mean interval lengths differ per mindfulness degree groups across the three questions; however, given the presence of outliers, an interpretation of the median is more reasonable. Thereby, it can be observed that the median interval across all three questions is higher in the low MAAS group compared to the high MAAS group. The MWU test was performed to test if these differences are statistically significant. The p-value higher than 10% delivered by the MWU test for each of the questions indicates that the respondents do not provide consistently different interval lengths depending on their mindfulness degree. Thus, there is not enough evidence to support the hypothesis that traders with a low mindfulness degree provide different interval lengths then traders with a high MAAS score.

Several academics point out that the existence of the bias might depend on the difficulty level of the questions, such that subjects are more predisposed to display overconfidence in hard tasks compared to easy ones. This phenomenon was characterized as the hard-easy effect (Larrick, Burson, & Soll, 2007). It might be the case that in the present research, the difficulty of the provided questions affected the results. To evaluate whether the results might be affected by the hard-easy effect, a comparison of the correct response rate for each question per MAAS score group was performed. This

approach is in line with Suantak, Bolger, and Ferrell (1996). The results display a similar percentage of correct responses for all of the three proposed questions. In the context of the first question, namely *"The number of currencies circulating worldwide"*, 53 respondents in the low MAAS group and 48 subjects in the high MAAS group elicited an interval such that the value of 180[6] fell within the interval. In regard to "*The percentual historical annual return of S&P 500 in 2004"*, 57 participants in the first group provided an interval length such that the true value of 10.88% was within the interval, compared to 56 subjects in the second group. Lastly, 31 subjects in the low MAAS group, compared to 30 subjects in the high MAAS group respectively, specified a correct interval in the following context: "*Creation year of the New York stock exchange*", such that the true value of 1817[7] was included. Consequently, there is no reason to believe that the results were conditioned by the hard-easy effect. Hence, there is not enough evidence to support the first hypothesis, namely that traders who score higher in mindfulness would display a lower manifestation of miscalibration at a group level.

4.3.2 The Better-than-the-Average Effect

The analysis of the better-than-the-average effect employs the same sample utilized in the premises of the miscalibration bias analysis and consists of 223 subjects. *Table 4* offers an overview of the results for each mindfulness degree group, as well as for the whole sample in regards to each of the three settings named previously. Firstly, it can be noted that the better-than-the-average effect is persistent at a group level, both in a general setting *(Question 1),* as well as in regards to trading performance *(Question 2).* In the former setting, 37.2% of subjects believe to be better than the average, whilst only 7% deem themselves not as good as the average. Therefore, following Zaiane et al., (2010), there is enough evidence to suggest the existence of the bias at a group level as the percentage of traders in the "better than the average" response group is substantially higher than the percentage of traders in the "not as good as the average" response group.

[6] The number of 180 currencies is in line with the list of currencies circulating worldwide provided on Wikipedia

[7] The exchange started as a meeting of 24 stockbrokers under a buttonwood tree in 1792 and is now known as the Wall Street in New York City. However, it was formally constituted as the New York Stock and Exchange Board in 1817 according to Britannica.

Table 4

Results of Better-than-the-average analysis

Research setting	"Low" MAAS score		"High" MAAS score		Sample N=223	
	Abs. Freq.	(%)	Abs. Freq.	(%)	Abs. Freq.	(%)
Q1: General setting						
Better than the average	49	43.8	34	30.6	83	37.2
About the same	55	49.1	69	62.2	124	55.6
Not as good as the average	8	7.1	8	7.2	16	7.2
Total	112	100	111	100	223	100
Q2: Trading performance						
Better than the average	34	30.4	43	38.8	77	34.5
About the same	57	50.9	44	39.6	101	45.3
Not as good as the average	21	18.7	24	21.6	45	20.2
Total	112	100	111	100	223	100
Q3: Confidence in beating the market						
Yes, very much	20	17.8	17	15.3	37	16.6
Yes, some confidence	60	53.6	60	54.1	120	53.8
No, no confidence	32	28.6	34	30.6	66	29.6
Total	112	100	111	100	223	100

Note. Question 1 (Q1): "Suppose that you are related to a group of people who have a similar background and social status as you. Generally, when compared to them, you will most probably feel that you are: (1) Better than the average; (2) around the same; (3) not as good as the average"; Question 2 (Q2): " Compared to the investors you are acquainted with, you believe your investment performance is: (1) Better than the average; (2) around the same; (3) not as good as the average". Question 3 (Q3): "When considering the next three months, do you have confidence in beating the market as a whole?"

A similar manifestation can be observed for the whole sample when individuals compare themselves to peers with respect to trading performance. Thereby, 34.5% rated themselves as better than the average while fewer, namely 20%, consider themselves not as good as the average. In a similar manner, the BTAE can be observed at a group level. Similarly to Zaiane et al. (2010), further overconfidence at a group level is found by analysing the proxy of "beating the market". Therein, 70.4% of traders have "some confidence" or "very much" in obtaining a higher return than the market return in the following three months. This is notably higher than the number of traders who do not believe they can beat the market, which is an additional manifestation of the bias. The value of 70.4% is especially noteworthy when considering that historically, the highest percentage of traders that

beat the market in a year accounted for 8%[8]. The striking persistence of the bias is in line with multiple studies that analysed the BTAE and proved its tenacity (Biais et al., 2005; Deaves et al., 2009; Graham et al., 2016).

While scrutinizing the manifestation of the bias in a comparative manner between the two MAAS score groups, the following can be observed: In a general setting (Q1), 43.8% of traders with a low MAAS score and 30.6 % of traders with a high MAAS score believe to be better than the average, whilst only 7.1% in the low MAAS group and 7.2% in the high MAAS group state to be below the average. Although the difference between those asserting to be better and those stating to be worse than the average is higher in the low MAAS group, the difference is statistically insignificant according to the MWU test ($p > 0.1$).

Furthermore, the sample displays similar patterns in a comparative setting based on trading performance. 30.4% of the respondents in the low mindfulness degree group compared to 38.8% in the high mindfulness degree group consider to be better than the average. However, the MWU test suggests that the difference is statistically insignificant ($p > 0.1$). The persistence of the bias is undeniable in both groups with respect to "beating the market". Thereby, in the low MAAS group, 71.3% have "some confidence" or "very much" in beating the market, whilst a similar optimism is displayed by 69.4% of the subjects in the high MAAS group. The MWU test indicates that the difference between the percentage of traders who asserted to have confidence in obtaining a higher return or not, based on MAAS degree group, is economically and statistically insignificant ($p > 0.1$). Given the stated above, there is not enough evidence to support the hypothesis that traders with a higher mindfulness degree exhibit a lower persistence of the BTAE at a group level.

4.4 Anchoring bias

The sample analysed in both designs of the anchoring bias consisted of 232 participants, such that 116 subjects were allocated per "low" and "high" MAAS score groups, respectively.

[8]According to the scholar Mark J. Perry , 95% of the professionals fail to beat the market. Furthermore, the historical high of the percentage of traders that beat the market is as high as 8%.

Design 1

Design 1 aimed to test the persistence of the anchoring bias in both MAAS degree groups and utilized a low and a high anchor to scrutinize whether the participants are prone to provide values skewed towards the initial value. The analysis was performed for the total sample, as well as per MAAS degree group. The allocation of the subjects to one of the anchors was randomly generated, such that in the low MAAS group, 55 respondents were informed about the low average stock market return between 1995 and 1999 in Japan, namely 1% (low anchor), whereas 61 subjects were provided with a high anchor of 24%, which denotes the average market return in Sweden for the same time frame. Similarly, in the high MAAS score group, the allocation resulted in the following distribution: low anchor – 62 subjects; high anchor – 54 subjects. *Table 5* offers an overview of the mean estimations of the average market return for European countries per anchoring group and mindfulness score, along with the respective difference between the means and its statistical significance.

Table 5

Results of the Anchoring Bias Analysis with Low versus High Anchor

	Anchoring group		**Diff.**
	Low anchor (1%)	**High anchor (24%)**	
Panel A. Full Sample			
	6.81	13.90	7.09***
	(N = 117)	(N = 115)	(t = 5.22)
Panel B. Sample Partitioned Based on MAAS Score Group			
Low MAAS score	8.78	15.60	5.82***
	(N = 55)	(N = 61)	(t = 2.76)
High MAAS score	5.06	13.12	8.05***
	(N = 62)	(N = 54)	(t = 4.73)
**** Significance at 0.01 level*			

Note. Table 5 reports the mean estimates for the average market return in the European countries for the five years period between 2000 and 2004 made by subjects in the whole sample (N = 232), as well as per MAAS score group. Diff. denotes the sample difference. Thereby, the standard two-sample t-test is provided in the parenthesis.

Similarly to the findings of Kaustia et al., (2008), the whole sample exhibits anchoring to the respective initial values, such that the mean estimation in the "low" anchor group accounted for 6.81%, whilst the mean estimation in the "high" anchoring group resulted in a higher value, namely 13.9%. The results of the independent samples t-test indicate that the difference of 7.09% is statistically significant at a 99% confidence level ($p < 0.01$). Therefore, it can be inferred that subjects in the full

sample anchor strongly to the initial value. The results for each of the MAAS score groups closely resemble the pattern. *Table 5* conveys that in the low MAAS group, the mean estimation of the subjects allocated to the "low" anchoring group was equal to 8.78%. Contrary, those in the "high" anchoring group displayed an average estimation of 15.6%. Thus, the statistically significant difference of 5.82% ($p < 0.01$) between the means signifies the subsistence of the anchoring bias. Similarly, in the high MAAS score group, a statistically significant difference of 8.05% ($p < 0.01$) can be noted. Despite the tenacity of the bias in both groups, it can be observed that in the high MAAS score group, the subjects are more anchored to the provided initial values such that they provide estimates closer to the anchor on average. This contradicts the anticipated results, namely that on average, individuals with a higher mindfulness degree would be less anchored.

Design 2

The second research design is employed to test whether respondents are more anchored when the initial value is self-generated (estimation group) versus externally-imposed (disclosed group). Similarly to *design 1*, the analysis is conducted for the whole sample as a whole, as well as for each mindfulness degree group independently. The 232 subjects were randomly allocated to one of the formerly mentioned groups, such that a sample of 109 participants was analysed in regards to the self-generated anchor and a sample 123 participants in regards to the externally-imposed anchor. The subjects in the disclosed group were informed that the average stock market return of Singapore for the ten years period between 1989 and 1998 was 4.79%, whereas, in the estimation group, the subjects were solicited to estimate this value. Thereafter, the subjects in both groups were asked to provide an estimation of the average stock market return of Singapore for the following ten years (1999 – 2008). *Table 6* presents the mean estimations of the average market return of Singapore per anchoring group and mindfulness score, along with the respective difference in the means and its statistical significance.

Table 6

Results of the Anchoring Bias Analysis in Estimation versus Disclosed Groups

	Anchoring group		Diff.
	Estimation group (13.98)	**Disclosed group (4.79)**	
Panel A. Full Sample			
	14.45	10.33	4.12
	(N = 109)	(N = 123)	(t = 1.64)
Panel B. Sample Partitioned Based on MAAS Score Group			
Low MAAS score	14.46	12.68	1.78
	(N = 54)	(N = 62)	(t = 0.51)
High MAAS score	14.44	7.95	6.49*
	(N = 55)	(N = 61)	(t = 1.79)
**Significance at 0.1 level*			

Note. Table 6 reports the mean estimates for the average market return of Singapore for the ten years between 1999 and 2008 made by subjects in the whole sample (N = 232), as well as per MAAS score group. Diff. denotes the sample difference. Thereby, the standard two-sample t-test is provided in the parenthesis. Further, the mean estimation of the average stock market return of Singapore for the ten-year period between 1989 and 1998 in the estimation group denoted 13.98%, which served as a self-generated anchor.

Prior works in the field claimed that individuals tend to be more anchored to self-generated values than to externally-imposed ones (Davies, 1997; Mussweiler & Strack, 1999). In the present research, it can be noted that the mean estimation of the average stock market return of Singapore for the ten years between 1989 and 1998 accounted for 13.98% in the estimation group. Thereby, the estimation of the average stock market return of Singapore for the following ten years denoted 14.45% for the whole group, and 14.46% in the low MAAS score group. The stipulated values are strongly skewed towards the anchor. However, the difference between the means provided by subjects in the estimation group and in the disclosed mode, both in the whole sample, as well as in the low MAAS group, are statistically insignificant at 10% ($p > 0.1$). Therefore, there is not enough evidence to assert that the manifestation of the anchoring bias differs depending on whether the anchor is self-generated or externally-imposed. A statistically-significant difference between the mean estimations in the estimation group and in the disclosed mode is observed in the high MAAS group. Therein, the substantial difference of 6.49% is statistically significant at 10%. Firstly, this supports the findings of *Design 1*, particularly that traders with a higher mindfulness degree tend to be more anchored than traders with low mindfulness degree, on average. Furthermore, in the high MAAS group, the close

value of 14.44% in the estimation group to the anchor value of 13.98, portrays a higher anchoring to self-generated anchors than to externally-imposed values ($p < 0.1$).

V. Discussion and conclusive notes

Several findings of the current research come to support prior observations aforementioned in the literature review. Namely, on average, the sample disclosed a mean mindfulness score similar to that in the original study of Brown and Ryan (2003b). Furthermore, in line with previous academic observations, traders exhibited miscalibration bias, as well as the better-than-the-average effect at a group level. However, the present research fails to support the hypotheses that these facets of overconfidence could manifest less in the group of traders with higher mindfulness degree. These results could have been obtained due to several reasons. Firstly, as stated by Kahneman, awareness of one's overconfidence may diminish its impact on decision-making; however, the bias is deeply rooted in the "mind construct" such that a vast number of other things need to be changed first in order to lower its exhibition (Shariatmadari, 2005). Therefore, it might be the case that the awareness of the bias might not be enough in fostering rational decisions in trading, where decisions need to be taken swiftly and, thus, the appeal for involving System I in the decision-making process is higher than in general cases. Furthermore, the impact of the bias on behavioural patterns is twofold: directly and indirectly. The indirect association between bias exhibition in trading and the moods and emotions traders undergo is not directly observed in the premises of the current research. It might be that traders who scored low in mindfulness are not affected by mood disturbances. Therefore, the impact of moods on the trading performance of traders in the "low" MAAS group might be the same as in the "high" MAAS group. This phenomenon may serve as a reasonable focal point for future research. Lastly, one of the potential reasons for the lack of evidence to support the formulated hypotheses with respect to overconfidence may be owed to the insufficient sample size. Although the survey was completed by as many as 232 respondents, the recommended sample size accounted for 384 subjects. Similar research with a larger sample size might be beneficial for obtaining more conclusive insights on the matter. Albeit, the present research delivers novel findings with respect to the link between mindfulness and the anchoring bias in trading. Despite the expected negative relationship between the two phenomena, it could be observed that traders in the high MAAS groups are more anchored on average then traders in the low MAAS group. Furthermore, traders who score high in mindfulness tend to anchor heavier on self-generated anchors. Given the limited resources on the topic and the contra-intuitive results, the findings appear to be puzzling. However, one potential explanation thereby might lie in the phenomenon of "moment-awareness" fostered by mindfulness. As previously

stated, mindful individuals are more inclined to focus on present internal and external factors. While the hypothesis that mindful traders would be less anchored rested on the premises that they would be able to acknowledge their feelings in the moment and recognize the bias, it may have been the case that mindful traders were more aware of external factors and information at the moment of completing the survey. Therefore, it could be the case that mindful traders paid more attention to the anchor that was provided very shortly before they had to make an estimation, whereas traders with lower mindfulness scores did not rely on the initial value as much and considered other factors such as past experiences in decision-making.

Several academics argue that the dichotomization of a variable based on a median-split is sub-optimal and delivers corrupted results by increasing Type I and Type II errors (McClelland, Lynch, Irwin, Spiller, & Fitzsimons, 2015). However, this method has been preferred in order to maximize the sample size per mindfulness group, given the limited number of subjects in the survey. Nonetheless, to control for the previously stated concerns by the latter mentioned authors, the same analyses have been performed while dividing the sample into "low", "medium", and "high" MAAS groups, using the 33rd and 66th percentiles as boundaries. It could be observed that the results remain unchanged. Therefore, it is plausible to assume that the results portrayed in the current research are reliable and adds to the existing literature body by being a pioneer in researching the link between mindfulness as a state and anchoring in retail trading, allowing it to serve as an indication for further research on the topic.

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Appendix A

This survey is a part of a research for the completion of my Master Degree at the Erasmus University of Rotterdam. The survey will take approximatively 7 minutes and the results are completely anonymous. A reward in the form of 2 Amazon vouchers worth 20 EUR will be randomly allocated to 2 participants that have provided an E-mail address and fully completed the survey. Should you have any questions, please email me at 547626du@eur.nl Thank you for your input!

Question 1: Suppose that you are related to a group of people who have a similar background and social status as you. Generally, when compared to them, you will most probably feel that you are:

1. Better than the average
2. About the same
3. Not as good as the average

Question 2: Compared to the investors you are acquainted with, you believe your investment performance is :

1. Better than the average
2. About the same
3. Not as good as the average

Question 3: When considering the next three months, do you have confidence in having a higher return on investment than the average market return?

1. Yes. Very much.
2. Yes. I have some confidence.
3. No. I have no confidence at all

Please note that the following questions do not measure your IQ or expertise. You are expected to provide an estimation without any research. Below, you are asked to set an upper- and lower bound, such that your response should lie with 90% chance within the interval.

Question 4: Number of currencies circulating worldwide

1. At least (free text)
2. At most (free text)

Question 5: The historical annual return of S&P 500 in 2004 (in percent)

1. At least (free text)
2. At most (free text)

Question 6: Creation year of the New York stock exchange

1. At least in (free text)
2. Latest in (free text)

Anchoring bias: High anchor mode

Question 7: In Sweden, the average stock market return (arithmetic average) during 1995-1999 was over 24%. How do you think the average development among the EU countries is likely to compare to that number during the following 5 years (2000 - 2004)?

Will the return be higher or lower than 24% per year? (free text)

Question 8: Estimate the average annual stock market return in the EU countries during 2000-2004 in %. (free text)

Anchoring bias: low anchor mode

Question 7: In Japan, the average stock market return (arithmetic average) during 1995-1999 was under 1 %. How do you think the average development among the EU countries is likely to compare to that number during the following 5 years (2000 - 2004)?

Will the return be higher or lower than 1% per year? (free text)

Question 8: Estimate the average annual stock market return in the EU countries during 2000-2004 in %. (free text)

Anchoring estimation mode

Question 9: Estimate the average annual stock market (arithmetic average) return of Singapore for a 10 years period between 1989 and 1998 in %. (free text)

Question 10: Do you believe the average return for the following 10 years (1999-2008) is higher or smaller?

1. Smaller
2. Higher

Question 11: Estimate the average annual stock market (arithmetic average) return of Singapore for the following 10 years period (1999-2008) in %. (free text)

Anchoring bias: disclosed mode

Question 9: The average annual stock market return of Singapore for a 10 years period between 1989 and 1998 was 4,79 %.

Do you believe the average return for the following 10 years is higher or smaller?

1. Smaller
2. Higher

Question 10: Estimate the average annual stock market (arithmetic average) return of Singapore for the following 10 years period (1999-2008) in %. (free text)

Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item.

Please see Appendix B for the 15 questions included in the MAAS

Question 26/27: What is your age?

1. 18-24
2. 25-34

…….

6. 65 and over

Question 27/28: What is you gender?

1. Male
2. Female
3. Other

Question 28/29: Do you have a finance-related educational background?

1. Yes
2. No

Question 29/30: How much trading experience do you possess?

1. Less than 1 year
2. 1 year
3. 2 years

….

11. more than 10 years

Question 30/31: Are you a professional trader?

1. Yes
2. No

Question 31/32: Identify the level of loss/gain made in the last year of trading/investing:

1. More than 30% loss

…

8. 0% - breakeven

……

15. More than 30% gain

Question 32/33: Please provide your email address if you wish to participate in the lottery according 2 Amazon vouchers worth 20 EUR each (free text)

Appendix B

MAAS Scale

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1 Almost Always

2 Very Frequently

3 Somewhat Frequently

4 Somewhat Infrequently

5 Very Infrequently

6 Almost Never

Questions:

1. I could be experiencing some emotion and not be conscious of it until sometime later.
2. I break or spill things because of carelessness, not paying attention, or thinking of something else.
3. I find it difficult to stay focused on what's happening in the present.
4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.
5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.
6. I forget a person's name almost as soon as I've been told it for the first time.
7. It seems I am "running on automatic," without much awareness of what I'm doing.
8. I rush through activities without being really attentive to them.
9. I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there. I do jobs or tasks automatically, without being aware of what I'm doing.
10. I find myself listening to someone with one ear, doing something else at the same time.
11. I drive places on "automatic pilot" and then wonder why I went there.
12. I find myself preoccupied with the future or the past. I find myself doing things without paying attention.
13. I snack without being aware that I'm eating.

Scoring information:

To score the scale, simply compute a mean of the 15 items. Higher scores reflect higher levels of dispositional mindfulness.

Reference:

Brown, K.W. & Ryan, R.M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. Journal of Personality and Social Psychology, 84, 822-848.

Appendix C

Table 7 Respondents' Profile Per Mindfulness Degree Group

Variable	Low MAAS				High MAAS			
	Abs. Freq.	**Cum. Freq.**	**Percent.**	**Cum. Percent.**	**Abs. Freq.**	**Cum. Freq.**	**Percent.**	**Cum. Percent.**
Gender:								
Male	94	94	81.1	81.1	101	101	84	84
Female	22	116	18.9	100	15	116	16	100
Age group:								
18 – 24	49	49	42.2	42.2	36	36	31	31
25 – 34	53	102	45.7	87.9	54	90	46.5	77.5
35 – 44	11	113	9.5	97.4	16	106	13.8	91.3
45 – 54	3	116	2.6	100	9	115	7.8	99.1
55 – 64	0	116	0	100	1	116	0.9	100
Trading experience:								
Less than 1 year	40	40	34.5	34.5	40	40	34.5	34.5
1– 2 years	36	76	31	65.5	38	78	32.8	67.3
3– 4 years	19	95	16.4	81.9	14	92	12	79.3
5– 6 years	11	106	9.5	91.4	7	99	6	85.3
7– 10 years	5	111	4.3	95.7	6	105	5.2	90.5
Over 10 years	5	116	4.3	100	11	116	9.5	100
Professional trader:								
Yes	2	2	1.7	2.7	5	5	4.3	4.3
No	114	116	98.3	100	111	116	95.7	100
Financial Education:								
Yes	38	38	32.7	32.7	30	30	25.9	25.9
No	78	116	67.3	100	86	116	74.1	100
Trading Performance in the prior year:								
Loss	26	26	22.4	22.4	17	17	14.7	14.7
Break-even	10	36	8.6	31	20	37	17.2	31.9
Gain	80	116	70.6	100	79	116	68.1	100

Note. Table 7 summarizes the absolute- and cumulative frequencies (Abs. Freq./Cum. Freq.) along with the percentage and cumulative percentual values (Percent. / Cum. Percent) of the categorical variables that describe the sample of participants in the low- and high MAAS groups.