Vertti Metsola

Cognitive Biases in Venture Capital: The Role of Experience in Overconfidence and Sunk Cost Effects

The School of Accounting and Finance
Bachelors' thesis in Finance
Accounting and Finance

Vaasa 2025

VAASAN YLIOPISTO
Laskentatoimen ja rahoituksen yksikkö
Tekijä: Vertti Metsola
Tutkielman nimi: Cognitive Biases in Venture Capital: The Role of Experience in Overconfidence and Sunk Cost Effects
Tutkinto: Kauppatieteiden kandidaatti
Oppiaine: Rahoitus
Työn ohjaaja: Gustav Finne
Vuosi: 2025 **Sivumäärä:** 37

TIIVISTELMÄ:
Tämän tutkielman tarkoitus on tutkia uponneiden kustannusten ja liiallisen itsevarmuuden merkitystä ja relevanssia pääomasijoittamisen päätöksenteossa sekä kuinka kokemus voi vaikuttaa näiden ilmiöiden esiintymiseen. Hyödyntäen käyttäytymisrahoituksen ja talousteorian kirjallisuutta tarkastelemme, kuinka korkean riskin ja suuren volatiliteetin sijoitusympäristössä psykologiset tekijät voivat vaikuttaa rationaaliseen päätöksentekoon. Uponneet kustannukset voivat lisätä todennäköisyyttä jatkosijoituksiin aikaisempien sitoumusten vuoksi, kun taas ylellinen itsevarmuus voi johtaa yksilöitä yliarvioimaan päätöksentekonsa tarkkuutta ja kyvykkyyttä.

Tutkielmassa tarkastellaan myös, kuinka kokemus eri muodoissa voi joko vahvistaa tai lieventää näiden vinoumien vaikutuksia. Analyysi olemassa olevasta teoreettisesta ja empiirisestä kirjallisuudesta osoittaa, että vaikkakin kokemus voi kehittää kykyä tunnistaa kaavamaisia ilmiöitä ja tehdä rationaalisia päätöksiä, voi se myös altistaa yksilöitä yliarvioimaan tarkkuuttaan.

Tutkielman tulokset viittaavat siihen, kuinka liiallinen itsevarmuus sekä uponneet kustannukset johtavat pääomasijoittamisen parissa irrationaalisiin päätöksiin ja tämän myötä aleneviin tuottoihin. Tämän myötä kriittinen ja huolellinen itsetarkastelu ja tietoisuus mainituista vinoumista on keskeistä, jotta yksilö voi vähentää alttiuttaan vinoumien vaikutuksille, jotka voivat johtaa kasvaviin kustannuksiin pääomasijoituksissa.

AVAINSANAT: Venture capital, VC, sunk cost, sunk-cost fallacy, overconfidence, experience, cognitive bias, entrepreneur

Contents

1 Introduction

Venture capital (VC) has been a crucial source of funding for various innovative companies for over 30 years, as many of the leading companies in their market sectors by market capitalization have benefited from the support of VC, including companies like Amazon, Apple, Facebook, Google, Netflix and more (Gompers et. Al, 2020). From 1999-2009 over 60% of United states of America -based IPOs (Initial Public Offering) were backed by VC with only 2 distinct years in which less than 50% of IPOs were backed by VC companies (Kaplan and Lerner, 2010). Although these venture capital companies have consistently represented only approximately 0.15% of the total stock market of the U.S, considering their significant impact on the IPO market, understanding their operating principles becomes crucial.

Venture capital is described as a source of private equity financing for early-stage, high-potential companies unable to access traditional funding methods due to their higher risks (Cochrane, 2005). Most VC funds additionally provide mentoring or monitoring role to the firm they are providing equity towards. It is also mentioned that due to illiquidity of private equity and the additional roles VC funds might have on their investments, investors might require a higher average return for their investments compared to regular stock markets. On the other hand, VC funds often require 2-3% annual fees and 20-30% of the profits from IPOs and mergers & acquisitions (M&A), which could lead to lower returns compared to the stock market.

Given the crucial role of venture capital in driving innovation and economic growth, making informed and profitable investment decisions is essential. However, as nearly 75% of venture backed startups fail to achieve their intended outcomes, it can raise questions about the decision-making processes of venture capital funds (Gage, 2012). To better understand the decision-making processes, this study will focus on potentially influencing cognitive bias, such as Sunk cost effect, which refers to the tendency of an individual to continue an endeavor when an investment has been made in the form of money, time or effort (Arkes and Blumer, 1985). Another cognitive bias this study will focus on is

Overconfidence, which can manifest as tendency to make riskier decisions (Odean, 1998). Existing literature also suggests that the decision-making processes may vary depending on the age, expertise and reputation of the VC fund (Khanna and Mathews, 2022). As unestablished, i.e. VC funds that have not guided startup to successful outcomes, tend to compete more aggressively for new startups compared to established funds while also usually offering more affordable services, their decision-making processes may also be affected by these factors.

Venture capital investments differ from regular public markets by essentially obtaining a stake in entrepreneur's idea, nurturing the venture and eventually exiting with the help of an investment banker (Zider, 1998). This results in the tendency for venture capital investments to be less liquid and more long-term and expensive. Moreover, as these investments present active contact with the entrepreneur and therefore include subjective evaluation of the venture team, the cognitive bias may have significant influence on the decision-making processes of the venture capital fund. For this reason, it is crucial to understand the effects overconfidence and sunk costs have on venture capital investments, as they might significantly impact performance in a subjective environment, leading to suboptimal choices and lower profits.

As the relationship between experience and both overconfidence and sunk cost bias in venture capital landscape have limited amount of existing literature, researching and understanding the complex relationships mentioned can have multiple real-life benefits, as recognizing behavioral factors and the effects experience has on them may lead to more profitable and less risky venture choices. By researching how vulnerability to certain biases may affect the capability of objective reasoning in venture capital decision making, this thesis aims to provide insight to recognize and mitigate the potentially harmful distortions caused by overconfidence and sunk costs.

1.1 Purpose of the study

The purpose of this study is to examine the decision-making processes within venture capital investments, focusing on two key factors that may influence the success or failure of funded startups: cognitive biases and investor experience. Venture capitalists operate in high-risk environments with limited information as Hall and Woodward (2010) find that approximately 75% of venture capital -backed startups result in zero-value exits, meaning no financial return for the investors. As the decisions of investors are often influenced by cognitive bias, the study aims to examine the extent to which cognitive bias, overconfidence and sunk cost fallacy, negatively impact investment outcomes, potentially increasing the likelihood of venture-backed startup failing. By analyzing these biases, the study aims to seek psychological factors that may negatively affect decision making of VCs. Hence, the hypothesis is:

H_1= Overconfidence and sunk cost fallacy are associated with lower returns in venture capital investments.

Given that cognitive biases can impair objective judgement, it is also crucial to examine additional factors that might influence the outcome of these investments. It is often suggested that more experienced professionals may possess more capabilities to produce objective decisions. Ericsson et al. (2007) conclude that individuals are unable to improve their ability to make decisions without practice, analysis, reflection and by learning from past errors. Therefore, more experienced VCs might be able to identify biases negatively affecting their decision-making processes and avoid suboptimal investments by avoiding these biases, leading to improved outcomes. This leads to the second hypothesis of this study that is:

H_2= The negative effects of overconfidence and sunk cost fallacy on venture capital returns are reduced for more experienced investors.

1.2 Structure of the study

This thesis is structured to examine the effects of overconfidence and sunk costs on venture capital investments, and how experience might alter the effects. The first chapter lays the foundation for the thesis by introducing the topic and providing purpose and structure of the study. The second chapter introduces theoretical background for sunk costs and overconfidence, as well as varying levels of experience present in the venture capital industry and insight to previous research. The third chapter provides related theoretical background about agency theory and bounded rationality, further strengthening the whole theoretical foundation. The fourth and fifth chapters provide literature reviews on the effects related cognitive bias have on venture capital decision-making processes and how experience might alter the impact of cognitive bias related to the subject. The sixth chapter consists of conclusions of the thesis, as well as discussion about possible limitations.

2 Venture capital landscape

As cognitive biases and experience may impact the way venture capitals make decisions on investments, it is easier to understand after producing a foundation for the study. As VCs are usually categorized either as established or unestablished, it is important to understand the differences between the two, and how it may affect decision making.

It is also important to understand the effects behavioral finance and bias related to it have on venture capital investments. As individuals tend to unconsciously display and act on certain biases and fallacies, the significancy of these effects and how experience moderates them is therefore highly important to address.

2.1 Established and unestablished VCs

Although there is not a precise definition for established VCs, there are many factors and variables that can lead VC to be considered as established. Often those VCs that have proven their capabilities and reputation for skill are considered established (Khanna and Mathews, 2022). These established VCs typically have a proven track record of successful exits, Whether through IPOs, acquisitions or other profitable exits. As these VCs have often been longer in the industry compared to the unestablished, they are often viewed capable of having a deeper understanding of market dynamics. These VCs are considered valuable because they are seen capable of providing value-adding services such as mentoring, oversight, professionalization.

characteristics of established VCs is also explained indirectly by Gompers (1996), as he explains incentives of newer or “unestablished” VC firms to build a reputation. It is described that with already proven track record and reputation, established VCs are not pressured to rush investments to go public, enabling them to focus on maximizing their profits. With less need to attract investors, established VCs are also more prone to making rational and strategic decisions on company’s readiness and market conditions, therefore reducing the chance for suboptimal timing of IPOs.

It is important to recognize that being an "unestablished" VC does not necessarily equate to being unskilled; rather, it often means that the firm's level of skill and track record are not yet well-known (Khanna & Mathews, 2022). Unestablished VC can become established only if it shepherds a startup into a successful outcome, leading to more aggressive competition for new startups. In addition, reliability imposes a higher cost on established VCs, as their reputation creates higher demand than compared to unestablished, which leads to some startups to partner with cheaper, unestablished VCs.

2.1.1 Experience of VCs

Due to differences in levels of skill among VCs, there is incentive for unestablished firms to find alternative factors to attract startups. Established VCs, with high demand due to their expertise and reputation, face higher costs to maintain reliability. As VC funds that have not established their skills tend to have fewer options and therefore lower cost to reliability, they tend to compete with reliability as well as cost (Khanna & Mathews, 2022).

It was also found that even if a project was promising, after 2000, older VC funds are significantly more likely to abandon promising projects compared to younger ones (Kandel et al., 2011). However, similar results were not found to apply towards corporate VC funds with no life span limit as well as VC funds in pre-2000 period. Therefore, as older funds are more likely to be established, these results also suggest that established VCs tend to be more unreliable.

When talking about skill, existing literature connects certain traits and habits to high-quality venture capitals (Bengtsson and Sensoy, 2011). One trait associated with high-quality VCs is that they tend to accept less strict safety measures when protecting themselves from their investments, while instead prioritizing obtaining a larger share of possible profits.

The tendency to accept more lenient safety measures is further seen in existing literature. Ewens et al. (2018) find that more experienced VCs are more likely to adopt “spray and pray” pattern, where they provide smaller funding and a lesser amount of mentoring to a broader number of startups and abandoning most of them in later rounds of funding. This observation can also support the fact that established VCs are considered less reliable.

2.2 Cognitive biases

2.2.1 Overconfidence

Considering the behaviour of venture capitalists, Amor and Kooli (2024) describe venture capitalists as risk-taking, optimistic and enthusiastic individuals, and that VC industry is not immune to overconfidence. Given that cognitive biases have a significant role to play in decision-making, overconfidence is highlighted as a particularly influential factor in venture capital. Based on earlier, it can be concluded that overconfidence exists in VC industry and is relevant for this study.

In literature, overconfidence has been described as an overly strong or overly precise belief in one’s abilities or knowledge, especially when compared to an objective measure of reality (Meikle et al., 2016). Meikle et al. also explain how overconfidence can also be divided into different types, describing them as Overestimation, overprecision and overplacement.

Overestimation is discussed by Moore and Healy (2008), who describe overconfidence as overestimation of individuals’ true capability, performance or probability of prosperity. On the other hand, if an individual believes themselves to be better compared to others. As an example, if a student guesses her score to be highest in the class when in reality, she was average, can this be described as overplacement. Overprecision is a form of overconfidence where individuals are excessively certain about the accuracy of their

beliefs, often underestimating the range of possible errors in their estimates. Studies show that when people set confidence intervals around their answers, they tend to make them too narrow, reflecting an unwarranted level of certainty in their knowledge.

Additionally, Moore and Healy (2008) also found with empirical study where they recruited 82 students to take different trivia quizzes with possible compensation depending on their success on these quizzes, that when difficulty of a task increases, the amount of overestimation also increases, while the amount of overplacement decreases.

The relevancy of overconfidence in corporate investments is also researched by Ben-David et al. (2013). They surveyed U.S based Chief Financial Officers from June 2001 to March 2011 on a quarterly basis, asking them to predict one- and 10-year market-wide stock returns in addition to providing an 80% confidence interval for their predictions. It was found that the predictions fell in their 80% confidence intervals only 36.3% of the time. Furthermore, they stated that based on evidence, CFO overprecision appears to be related to corporate decision making. Furthermore, Zacharakis and Shepherd (2001) surveyed 53 VCs, 51 of which results were published, of whom each made 50 investment decisions based on 4 to 8 information factors depending on the treatment group. These factors were subjected to three different treatment groups. The first treatment group provided information for “Base Cognitive cues”, including variables such as market familiarity and leadership ability measured in average number of years in industry and in management roles for the team respectively. It also includes variables such as fund market size and growth in the past years. Second Treatment group answered to same questions as the first treatment group, but also in addition to questions labeled as “Additional Cognitive Cues”, including variables such as track record by number of past start-up experiences in the team, competitors by the number of direct competitors and competitor strength by their market share. Final treatment group answered to survey labeled as “Task Cues”, that had variables such as Completeness of team which is measured by percentage of key positions that were filled before first major outside funding, Product superiority by measuring how well product compares to existing products, time to

development measured in number of months from initiation of development to the initial sale, and Buyers concentration measured in the number of potential customers for the first to years of sales.

Zacharakis and Shepherd (2001) found that 96% of the VCs had a higher confidence level compared to their accuracy rate and that across all VCs the mean overconfidence was 2.91. Additionally, these results were visualized with the help of a graph, indicating how in a linear graph with confidence -% as Y-axis indicator and accuracy -% as X-axis indicator only two VCs were "under" the graph and therefore underconfident, while the rest of the surveyed VC's were overconfident. As the Perfect Calibration Line represents the appropriate level of confidence and ANOVA (Analysis of Variance) indicated that VCs' confidence is significantly higher compared to accuracy, it provided support for the hypothesis that VCs are overconfident.

Examples of overconfidence being present in VC investments can be found in already existing literature, As Theranos founder Elizabeth Holmes told investors of Theranos about her capabilities of conducting hundreds of blood tests with only a drop of blood (Moore, 2021). Her confident claims did not overcome the scientific and technological barriers for success, but it did persist even in the face of setbacks. As investors did not disappear although warning signs were present, the presence of overconfidence in the founders' credibility is seen.

2.2.2 Sunk cost fallacy

Challenging traditional economic theory stating that only incremental costs and benefits should impact decisions while historical or "sunk" costs should not, Thaler (1980) suggests that consumers tend to increase their use of a good or service if they have paid for the right to use it. Calling this hypothesis *sunk cost effect*, Thaler states that people paying for a membership of a tennis club are more likely to enjoy tennis compared to ones that have not. This hypothesis is based on empirical evidence as well as on existing

literature, including Kahneman and Tversky's (1979). Thaler (1980) also explains how risk-seeking behaviour and larger losses increase the effect of sunk-cost fallacy.

While criticizing expected utility theory, Kahneman and Tversky (1979) Present an alternative model called prospect theory, which explains that individuals prefer potential gains and losses to a certain point instead of absolute outcomes, often exhibiting aversion towards the losses of prior investments. Surveying university students and faculty as foundation for the theory, the responses of these surveys were also utilized by Thaler as a base for sunk cost effect -hypothesis.

The sunk cost fallacy is described as a tendency to pursue inferior alternatives solely based on having previously invested remarkable, but non-recoverable amount of resources on them (Olivola, 2018). Evidence of this fallacy appears when individuals recognize that they would choose more appealing options if they had not already made investments that lead to sunk costs. For example, participants in the study conducted in the article were significantly more likely to invest an additional hypothetical $1 million to develop a fuel-efficient plane if they had already invested $99 million into development of the plane, compared to a situation where the $99 million had been invested in other, unrelated projects.

Examples of sunk cost effect taking place in practice exist in large quantities (Arkes and Blumer, 1985). An example of this is the immensely expensive Tennesee-Tombigbee Waterway Project that took place during late 1981. The project was scheduled for Congressional review, but proponents of the project insisted that it would be a waste of taxpayers' money to stop the project as a great deal had already been spent on it. To put it in a relevant context, the sunk costs provided a strong incentive to continue the already unprofitable project. The sunk cost effect is additionally described as a greater tendency to continue an endeavor once an investment in money, effort or time has been made. This highlights the fact that sunk costs are not only tied to monetary losses, but also losses on other resources.

3 Agency theory and Bounded rationality

3.1 Agency Theory

In existing literature, research and formulation of Jensen & Meckling (1976), alongside Fama (1980, 1991) and Fama & Jensen (1983) has often been viewed as the foundation to agency theory. Jensen and Meckling examine the actions of individuals' principal-agent relationships, where one party (the principal(s)) delegate decision-making authority and enlist role to perform certain services to another party (the agent(s)). It is stated that if both parties in principal-agent relationship aim to maximize their utility, may this lead agents to act in a way that is not in the best interest of the principals, as agents tend to have objectives differing from the ones of the principals'.

Jensen & Meckling (1976) state that the misalignment of goals between principals and agents leads to costs associated with monitoring and controlling as limiting divergences between the parties is possible by establishing incentives for the agents to operate in a manner that is preferable for principals as well as by increasing monitoring of agents to prevent errant decisions by them. Fama (1980) also discusses how economists are concerned about the problems with incentives when decisions are made by managers with no equity in the firm's securities. Furthermore, Fama and Jensen (1983) highlight that the control of agency problems in decision-making is specifically important as the managers responsible for implementing and initiating the decisions are not particularly financially affected by their decisions. They suggest that almost by definition, an effective system for decisions requires that control of decisions is separated to some degree from the management of decisions.

Fama and Jensen (1983) view the expenses caused by creating and enforcing contracts as a cause for the presence of agency problems. These include the expenses of monitoring, structuring and bonding sets of contracts among agents with misaligning interests.

Eisenhardt (1989) states that Agency theory is focused upon two problems that might occur in agency relationships. The first problem is present when goals or preferences of principals and agents misalign, and it is costly and challenging for principals to confirm the exact actions and motives of agents. Due to these factors, principals cannot confirm that agents behave in the personal interests of the former. The second problem concerns risk sharing in an environment, where principals and agents have differing views towards risk. As a result, the principals and the agents may have different opinions on the preferable actions caused by the varying risk preferences. Furthermore, according to agency theory, attitude towards risk affects how principals react when uncertainty is present. Risk-neutral principals tend to be comparably less affected by uncertainty of outcomes, while on the contrary risk-averse and new ventures have limited amounts of resources, resulting in greater reactions towards uncertainty.

In venture capital investments, where venture capitalists act as principals as they provide funding and resources to startups/entrepreneurs (agents), is relevancy of this theory observable as VCs might prioritize generating growth and profits while startups or entrepreneurs might prioritize alternative objectives such as maintaining control or pursuing high-risk projects.

Causing additional expenses to principals, the existence and significancy of agency costs is based on factors such as the costs borne by principal to monitor the behavior of the agent and the costs incurred by the agent to signal their commitment to act in the interest of principals (Jensen & Meckling, 1976).

3.2 Bounded rationality

The traditional economic theory of perfect rationality of “economic man” makes an assumption that when identifying the optimal course of action, the man has all the relevant aspects of knowledge around his environment (Simon, 1955). He is presumed to be capable of processing information flawlessly with a stable system of preferences to reach the optimal options among alternative choices.

Research of Simon (1955) is considered to be foundation for bounded rationality –model. He suggests that individuals are unable to choose the objectively optimal choice, as they operate under cognitive, informational, and temporal limitations, instead accepting and choosing an option that they view to be “good enough”.

Simon (1979) further suggests that several procedures have been discovered, which transform intractable decision problems into tractable ones using rather general applicability and wide use, that fall into the general rubric of “bounded rationality”. These procedures include ones such as looking for satisfactory choices instead of optimal ones, replacing abstract and significant goals with tangible and lesser goals, of which achievements can be measured and observed. Dividing the decision-making task among many specialists who coordinate their work utilizing the structure of communications and authority relations also fall into this category. As in practice individuals need to make decisions with limited information, and under time and cognitive constraints, the in-principle optimal choices become unattainable and are replaced by attainable, satisfactory choices.

Bounded rationality is further suggested to be central concern in economic and financial decision-making (Conlisk, 1996). There are hundreds of studies done by psychologists as well as experimental economists regarding the reasoning of individuals and their tendency to make the suboptimal decision. These suboptimal results are suggested to be caused by using irrelevant information, such as sunk costs, or displaying overconfidence, among large number of other variables and factors.

Relevancy of bounded rationality towards VC investments is seen from Busenitz & Barney (1997), as they suggest that those who make greater use of biases and heuristics in their decision-making are more likely to find themselves in entrepreneurial context, Such as VC landscape.

4 Effects of cognitive biases on VC performance

How cognitive biases such as overconfidence and sunk cost fallacy affect venture capital investments have been researched moderately. However, cognitive biases are challenging to be measured mathematically and as a result, existing literature approaches the subject with various methods. This section includes previous research on the subject, as well as a minor amount of previous research with less relation to the subject.

4.1 Venture capital performance in an overconfident environment.

In existing literature, overconfidence is seen as a possibly negative factor affecting decision-making. Odean (1998) presents how overconfident investors, although risk-averse, tend to make riskier and more aggressive decisions. As Amor and Kooli (2024) further handle the findings of Odean (1998), they suggest that investments made by VC firms in early and seed stages are correlated with overconfidence.

It has been observed that overconfidence among traders leads to higher trading activity, greater market liquidity, but lower overall profits for overconfident traders (Odean, 1998). Although this necessarily does not lead to overconfident traders losing their wealth and leaving the marketplace, overconfidence among traders leads to biased judgements that may lead to lower returns.

When examining the effects of overconfidence on venture capital investments, Amor and Kooli (2024) constructed an overconfidence index with seven components: VC venturing experience, the percentage of early-stage investments, the percentage of seed-stage investments, prior fundraising flows, prior investment rate, prior success rate, and the fraction of female executives. Each component is scored on a percentile basis where a score of 0.01 was attributed to the bottom 1% and a score of 1 to the top 1% of the highest value. When summed up, these scores provide an index ranging from 0 to 7 with higher values indicating greater levels of overconfidence.

Researching the effects of overconfidence on VC performance, Amor and Kooli (2024) conducted an experiment with methods explained on page 12 and provided the results statistically and verbally. Statistical results were divided into two different analyses: Univariate analysis and Multivariate analysis. In the univariate analysis of VC overconfidence and investment performance, a percentile analysis was made by comparing percentile of successful exits of VC firms with great amount of overconfidence in comparison to firms with low level of overconfidence. The analysis suggests that VC firms with low level of overconfidence have a probability of 30% to achieve a successful exit, while VC firms deemed overconfident have only a 9% chance of a successful exit. It is also found that overconfident VC firms are more likely to exit through IPOs and significantly less likely to exit through M&As. Quintile analysis in the univariate analysis additionally suggests a negative correlation between overconfidence and likelihood of successful exit for VC firm. As a result, the univariate analysis suggests that VC overconfidence significantly and negatively affects the performance of VC investments. The results of multivariate analysis suggest that the level of VC overconfidence is negatively correlated with the proportion of all successful exits. As study presents the relationship between overconfidence and IPO exits and the relationship between overconfidence and M&A exits, it is shown that VCs with high levels of overconfidence are more likely to exit through IPOs than those with lower levels of overconfidence. On the contrary, VCs with low level of overconfidence are shown to be significantly more likely to exit through M&As compared to those with high level of overconfidence.

Relationship between VC investment performance and VC overconfidence Index is visualized with the help of a squared overconfidence index term produced with quadratic regression by Amor and Kooli (2024). Based on the visualization, it is possible to conclude that the optimal confidence level peaks around the index value of 3 and 4 and that the relationship between VC investment performance and VC overconfidence is nonlinear and presents an inverse U-shape relationship. Since the index ranges from 0 to 7, the optimal index value of 3 to 4 would suggest that VC funds belonging to around 50th

percentile when measured in confidence level perform the best. This implies that that the VC firms with a balanced amount of confidence tend to perform the best, while unnecessarily cautious firms may decline high-return opportunities and excessively confident VCs may misjudge their capabilities and perform poor investments. It was also verbally stated that based on quadratic regression, that until a certain level, overconfidence positively affects VC performance but that beyond the certain level, overconfidence negatively affects the performance. As a result, moderate overconfidence seems to benefit the performance of VCs.

Utilizing a survey consisting of 20 questions, for which on each question the participants had to assign a probability that the given answer is correct, Pikulina et. Al. (2017) similarly found that in moderate amounts, overconfidence is advantageous in investment decisions as extremely overconfident individuals overestimate their capabilities to time their trades and select good stocks. As a result, extremely overconfident traders tend to trade excessively, leading to higher transaction costs (Odean, 1998).

As overconfidence can be divided into three different types, i.e. overprecision, overestimation and overplacement, the influence of these in new venture performance is studied by Kraft et. Al (2022). Constructing a meta-analysis based on 62 primary studies, they expect excess amounts of previously mentioned types of overconfidences to have a negative effect on the performance of a new venture. The results of the study suggest that not all types of overconfidences have the same economic impact, as overestimation and overplacement have p-value of >.1 (.874 and .840 subsequently), meaning that the mentioned results both have over 80% chance to occur due to a random chance. Due to this, no significant negative influence is found between them and the performance of a new venture, suggesting that entrepreneurs who overrate their capabilities or compare themselves excessively favourably to others may not harm the outcome of the venture. Overprecision on the other hand is found to have significant and negative effect on new venture performance as p<.0.05 (0.049), suggesting that there is lower than 5% chance for the results to appear by random chance. This suggests that the decision-makers are

too confident in their assessments, preventing them from searching for additional information later, which could benefit their ventures. In the study, overprecision is measured by two different approaches. In the first approach, participants of survey are given difficult questions common or meta-knowledge questions with one correct and numerical answer, for which a certainty estimate measured in percentages is given. In the second approach, participants are asked to choose between two possible options for general knowledge questions and additionally their level of confidence in percentages that they are correct ranging from 50% to 100%. As VC firms often guide the decision-making processes in ventures through governance mechanisms, the results highlight the importance of minimizing overprecision in governing positions, such as boards.

Zacharakis and Shepherd (2001) also studied the effects of overconfidence on accuracy and therefore performance, among other variables, with the methods mentioned on page 12 and 13. The study suggests that overconfident venture capitalists tend to make less accurate investment decisions and that nearly half of the variance in accuracy among VCs can be explained by their differences in overconfidence. This has economic consequences as when VCs misjudge their decision-making capabilities due to excessive confidence, they are more likely to allocate capital in suboptimal matters. This may lead to weaker ventures receiving excessive amounts of funding, while promising ventures may be overlooked. Furthermore, the research concludes that VC investments are biased by overconfidence, and that this overconfidence negatively affects the decision accuracy, and therefore leads to suboptimal decisions.

4.2 Venture capital performance as sunk costs are present

As existing literature strongly suggests, sunk costs are essentially a factor that should not influence decision-making processes. Because the sunk cost fallacy could essentially be explained as inherently negative factor in decision-making processes that leads to suboptimal choices, the effects of sunk cost fallacy in VC investments are not needed to support the Hypotheses, but moreover the presence of sunk-cost fallacy in VC investments.

Sunk cost fallacy's relevancy towards VCs follow-on decision-making is covered by Hogrebe and Lutz (2024), as they analyzed dataset consisting of 30,602 investment decisions about US-based portfolio companies from 2009 to 2019. It was found that if the invested capital measured in percentages of the VC funds volume increased by one standard deviation from 5.1% to 10.4%, the likelihood of follow-up investment increased from 56.5% to 61.4%. Hogrebe and Lutz additionally state, that in VC funds "dry powder" is a relevant factor in the decision-making process, with availability of dry powder directly impacting fund's financial flexibility and capability of taking future investments. Dry powder is explained by Chakraborty and Ewens (2018) as a difference between sum of invested capital and the total committed capital.

Hogrebe and Lutz (2024) essentially researched how sunk costs measured in capital invested, the number of rounds monitored, and time invested influenced probability of follow up investment, while also providing information about how dry power ratio and fund age influenced the effect. Their findings demonstrate how the probability of follow-up investments increases from 57.1 to around 66% when either dry powder ratio or capital invested is increased by one standard deviation. In a similar setting where the dry powder ratio is replaced by fund age measured in natural logarithmic scale, the likelihood of follow-up investment decreases from 56.2 to 45.8% as the fund age increases by one standard deviation, while the likelihood of follow-up investment increases from 56.2 to around 61% as the capital invested increases by one standard deviation. It is also presented how at the mean of dry powder ratio and sunk costs measured as rounds monitored on natural logarithmic scale, one standard deviation increase in rounds monitored increases the likelihood of follow-up investment from 57.2 to 67.7% and an increase of one standard deviation in dry powder ratio from 57.1 to 66%, while an increase of one standard deviation in fund age decreases the probability from 56.2 to 45.8%. Utilizing natural logarithmic of time monitored as measure of sunk costs it is demonstrated how increase in time monitored and dry powder ratio increases the probability of follow-up investments, while fund age decreases the probability of it. Overall, Hogrebe and Lutz (2024) find that the increase in sunk costs, whether fiscal or temporal, lead to increased

probability of VC funds providing additional funding, with the increase in dry powder ratio further strengthening the effect, while older fund age reduces the effect.

While less relevant towards VC investments, Arkes and Hutzel (2000) conduct research from a sample of two hundred and forty-one undergraduates on how the amount of sunk costs affect the probability of follow-up investment in a research project focusing on building a plane that would not be detectable by radar, while competitor is marketing a much faster and more economical alternative utilizing a questionnaire. Essentially, participants who had invested 90% of their funds towards the project were far more likely to continue funding as 63 out of 109 participants would have continued funding, while only 45 participants out of 121 would have done similarly when only 10% of the whole fund was invested towards the research. Arkes and Hutzel (2000) also find that those who decide to continue investing in the project predict a significantly higher probability of success than those who would not continue investing.

Although existing literature suggests that sunk costs tend to increase the probability of follow-up investments, research with findings contrary to this tendency has been conducted. Negrini et al. (2022) research the effect of sunk costs in investment decisions with results suggesting that sunk costs have a negative relationship with probability of follow-up investments. However, differences in results may be caused by different research methods and limitations. Possible explanation is based on risk aversion with asset integration excluded, implying that the decision maker considers the possible payoffs from the experiment in isolation, neglecting the negative probabilities and considering the money in the experiment only as potential profit (Negrini et Al. 2022). For this thesis, it is also important to note that as the study did not focus on VC investments, it does present limitations to conclusions.

Similarly in general investment decision-making, Haita-falah (2016) constructs an experiment with three different subject groups; Control (CT), Low sunk cost (LSC) and High sunk cost -group (HSC). The groups were endowed with either 20 units of asset A and

200 Experimental Euro (EE), 1000 EE with option to buy 20 units of asset A for 40 EE per unit, or 1400 EE with option to buy 20 units of asset A for 60 EE per unit respectively. The subjects are also informed during the offer to invest, that at the end of the experiment they could sell their 20 assets of A for a unit price of 70 EE. Following up, they are informed that they should acquire a combined amount of 30 units of either asset A or asset B, the former of which could be sold for a lower unit price than the initial price it was bought, but higher than the unit price of asset B. They are also informed that in the end, asset B could also be sold for 70 EE, resulting in the option to sell all units of asset A and to buy 30 units of asset B to be optimal choice. The results of the experiment suggest that although only statistically significant for the HSC group, the experiment was consistent with sunk costs negatively impacting decision-making as subjects in all groups and especially in HSC group did not maximize their acquisition of asset B and therefore maximizing their returns, even when information about the potential payoffs was provided.

5 Effect of experience on cognitive biases in VC

Experience is often seen as a factor that improves the accuracy and rationality of decision-making processes. Existing literature has researched the relationship between cognitive biases and experience moderately in the investment environment, but scarcely in VC investments. Therefore, we will primarily focus on the former and its relationship with the latter.

5.1 Experience and overconfidence

Zacharakis and Shepherd (2001) research overconfidence on venture capital decision making. As addressed earlier, they found that overconfidence in VC investments lead to lower accuracy. Additionally, Zacharakis and Shepherd (2001) proposed that although accuracy may improve through experience, confidence increases at a higher rate, leading to experienced VCs exhibiting increased amounts of overconfidence compared to their less experienced counterparts. The results of the research however didn't support this proposition and regressions analysis using years of VC experience as the independent variable indicates that experience is not significantly correlated with overconfidence.

Using a model where a venture capitalist must decide whether to invest in a highly uncertain project, Casamatta and Haritchabelet (2007) state that very experienced venture capitalists remain too optimistic about the project's success and exert too much effort. In the case of syndication (finding financial partners to complete their investment) highly experienced venture capitalists view syndication to be too expensive for which reason they collect insufficient amount of information, while also they put in too much effort based on their judgement (Casamatta and haritchabelet, 2007).

Menkhoff et al. (2013) find that variable of experience, which was measured by questioning years of investment experience, had varied effects on overconfidence. Although experienced individuals were found to be less miscalibrated (I.e., they estimated

probabilities and risks more accurately), they exhibited unrealistically positive self-evaluation over time. This miscalibration tends to increase with age, but on the contrary experience can mitigate some of this effect. Similar findings about miscalibration and self-evaluation were also found by Menkhoff et al. (2006)

Using a questionnaire consisting of questions related to overconfidence bias and self-attribution bias, Mishra and Metilda (2015) study the effect of investment experience, gender and level of education on self-attribution and overconfidence bias. For the study, a sample of 309 mutual fund investors is used. Based on the questionnaire, a relationship is seen between overconfidence and investment experience in addition to a relationship between overconfidence and level of education. It is suggested that as investment experience and level of education increases, overconfidence also increases.

Deaves et al. (2010) study connections between overconfidence and experience based on a survey made in 2003 where participants were asked monthly to predict a series of financial market and macroeconomic variables for the key industrialized economies as of 6 months in the future. For this survey, answers of 250 participants are used and the gender, education level, age, educational field and professional experience of these participants is known. A positive coefficient between Years in markets is found with b 0.0058 (p-value=0.054) and c 0.0035 (p-value=0.030). As p-value of c is <0.05, it is statistically significant, which suggests that experience increases overconfidence. As p-value of b os >0.05, it is statistically insignificant, which suggests that the relationship between age and overconfidence is not consistent across models. Furthermore, Deaves et al. (2010) state, that instead of self-attribution bias, this overconfidence operates through reduced knowledge rather than increased certainty and they conjecture that importance attached to high job demands decreases over time to be the reason for this.

Utilizing a survey made in 2004 of Canadian DC pension plan members consisting of two five-option multiple-choice questions and their certainty level on their answers,

Bhandari and Deaves (2006) also find that as education increases and time to retirement decreases, the overconfidence increases.

5.2 Experience and sunk cost fallacy

As previously found, the likelihood of follow-up investments based on sunk costs, time monitored, and rounds monitored increases as the VC fund age decreases by one standard-deviation and decreases as the VC fund age increases by one standard-deviation. This suggests that the age of the fund, which is usually linked to experience, has a negative correlation with the effects of sunk costs.

With a focus on mergers & acquisitions, Guenzel (2025) conducts a systematic search for divestitures with a large sample of U.S stock acquisitions by public acquisitions since 1980. Additionally, acquisition terms for all identified acquisitions and matched sample of nondivested acquisitions are hand-collected from Securities and Exchange Commission. In the study, it is researched how random changes in acquisition costs impact the likelihood of selling off assets later, depending on the market value of the company at the time of acquisition. The results suggest that as CEOs of firms, who are central in the investment decisions, are more sophisticated, the likelihood of sunk cost effect decreases. Additionally, it is suggested that the size of the company works as a proxy for CEO sophistication, and as it increases, the impact of sunk cost effect decreases.

The relationship between experience and sunk cost effect is also studied by Hogrebe and Lutz (2024), where they used reputation score as variable in their research. Reputation scores are calculated by using the average number of funds managed, the equity invested, the number of companies the firm managed in all of their funds, the number of IPOs in the last 5 years and the age of the venture capital firm. These factors match well with the definition of experience as “(The process of getting) knowledge or skill from doing, seeing, or feeling things, or something that happens which has an effect on you” (Cambridge dictionary). The study in question suggests that VCs with higher scores on reputation exhibit a lower tendency to make follow-on investments based solely on sunk

costs. These findings suggest more reputable and therefore more experienced VCs to be more disciplined, with capabilities to ignore past investments and instead focus on future potential.

Fennema and Perkins (2008) conduct an experiment where they request participants to make six independent investment decisions on whether to continue real estate projects, and another one similar to the one mentioned before with added justifications. The 6 mentioned projects include three high sunk cost projects and 3 low sunk cost projects. The experiment included Certified Public Accountants (CPAs), MBAs, undergraduate accounting students (UGAs) and students enrolled in an introductory psychology class (PSYs). The research suggests that MBAs and CPAs performed better when asked to justify their decisions compared to the control group that did not need to. More importantly, the study suggests that MBAs and CPAs, who are more financially experienced compared to UGAs and PSYs, developed better strategies, such as marginal decision making and loss comparison instead of mental budgeting.

6 Discussion and conclusions

This study examined the effect of cognitive biases, specifically overconfidence and sunk cost fallacy in venture capital (VC) environment and how investor experience moderates the effect, for which central and contradicting findings were made.

When addressing the reviewed literature, it should be noted that overconfidence is defined in varying ways across existing literature , with certain sources emphasizing multiple dimensions of overconfidence while other sources define it by individuals' certainty on their answer being correct. Certain studies were utilized where focus was on general investments instead of VC investments, leading to possible distortions and reduced correlation as venture capital investments are a sub-category of former. Various methods for defining experience were also applied, for which reason variable of experience differs when measuring relationship of it with either overconfidence or sunk costs. In this thesis cultural or geographical factors were not considered, so correlation to economies with certain cultural norms regarding confidence or sunk costs or economies with highly centralized and deviant industries may be lower.

Overconfidence was found to have various effects on the performance of VCs, varying on the amplitude of overconfidence present. Additionally, experience was often found to not be significantly correlated with overconfidence, rather suggesting a connection between time in industry and overconfidence. Overconfidence was found to be particularly harmful in excessive amounts, leading to suboptimal exit options as well as investments. However, VCs displaying moderate amounts of overconfidence were found to perform better compared to unconfident VCs, presenting an inverse-U relationship between overconfidence and VC performance (Amor & Kooli, 2024). Focusing on the various types of overconfidences, overprecision was found to significantly impact the decision-making processes when compared to overestimation and overplacement by Kraft et. Al (2022). Increased sunk costs were also found to generally increase the probability of follow-up investments significantly. In addition, the situations where sunk costs had a

contrary effect to the probability of follow-up investments, could the differences be explained by limitations of study. This suggests a tendency among VCs to make follow on investments more likely as more resources such as prior capital, time or round monitored, had been invested, even when fundamentals and potentials of target investments were weak (Hogrebe & Lutz, 2024). The effects of sunk costs were additionally magnified as dry powder ratio increases and on the contrary mitigated, as the age of the fund increases.

Interestingly, experience had varying effects on the presence of cognitive biases. When discussing overconfidence, experienced venture capitalists were found to exhibit lesser amounts of miscalibration, but at the same time increased amounts of self-evaluation. However, studies also suggest that the increased amounts of overconfidence and particularly self-evaluation are not necessarily correlated with experience, but rather age. Moreover, the correlation between experience and overconfidence among different studies were often found to be insignificant. On the other hand, studies covering connection between overconfidence and sunk costs largely suggested experience to mitigate the effects of sunk costs in VC investments, suggesting that experienced VCs are more disciplined and capable of ignoring past investments and focus on future potential.

Essentially, this thesis finds support for H1, as the reviewed literature consistently presents that both overconfidence as well as the sunk cost fallacy are associated with suboptimal investment outcomes and reduced returns in venture capital investments. Studies of Amor and Kooli (2024) and Zacharakis and Shepherd (2001) demonstrate that excessive amounts of overconfidence leads to lower success rates in exits with Pikulina et. Al (2017) further explaining how extreme amounts of overconfidence leads to overestimating one's capabilities in timing their trades and picking optimal stocks, leading to increased excessive transaction costs and therefore lower returns.

Regarding the sunk cost fallacy, Hogrebe and Lutz (2024) find that VC firms are more likely to make follow-up investments on poorly performing ventures simply due to prior

investments. Although in general investments Negrini et. Al (2022) conclude that participants in the study are less likely to make additional investments as sunk costs increase, may the behavior be explained by loss aversion and may not generalize in VC context. Furthermore, prior research by Arkes and Hutzel (2000) and Haita-Falah (2016) in general investments finds evidence that is consistent with traditional sunk cost behavior, suggesting that the findings of Negrini et al. may be context-dependent.

Evidence for H2 is partially supported. The literature reviewed suggests that experience moderates the impact of sunk cost bias in a more consistent manner than of overconfidence as Hogrebe and Lutz (2024) demonstrate how more reputable and therefore more experienced VCs exhibit reduced tendency to making biased follow-up investments based on prior sunk costs. While there may be certain context-driven limitations, Guenzel (2025) also finds evidence that CEOs who are central in mergers & acquisition investments are less prone to sunk cost effect the more sophisticated they are. Additionally, Fennema and Perkins (2008) find that in real estate investments, as experience measured in education increases, the influence of sunk costs decreases, which however produces limitations in context.

However, the findings on the relationship between experience and overconfidence show variation. While the studies of Menkhoff et al. (2013) and Deaves et al. suggest that confidence increases with experience, others such as Zacharakis and Shepherd, 2001) find no significant correlation. Furthermore, as H2 suggests that experience would mitigate the negative effects of overconfidence, findings proposing the opposite or no correlation would make the role of overconfidence inconclusive.

In a environment where investors provide mentoring in addition to resources for the subject of investment, this thesis provides valuable insight into the potential costs associated with excessive amounts overconfidence and vulnerability to the sunk cost fallacy in venture capital. Furthermore, as a individual acquires experience in venture capital, it becomes crucial to recognize development of one's capabilities to avoid excessive growth of confidence to mitigate the risk of acquiring overconfidence and particularly overprecision.

For future research this thesis suggests that the relationship between experience and both sunk costs and overconfidence would be constructed with same variable of experience, and that future research would include either focus on geographical location or certain industry. Additionally, the relationship between experience and sunk cost effect in venture capital context is researched in limited amounts, which could also provide an opportunity for future research.

References

Amor, S. B., & Kooli, M. (2024). Does overconfidence affect venture capital firms' investment? *Journal of Behavioral and Experimental Finance, 41*, 100884. https://doi.org/10.1016/j.jbef.2023.100884

Arkes, H. R., & Blumer, C. (1985). The psychology of sunk cost. *Organizational Behavior and Human Decision Processes, 35*(1), 124–140. https://doi.org/10.1016/0749-5978(85)90049-4

Arkes, H. R., & Hutzel, L. (2000). The role of probability of success estimates in the sunk cost effect. *Journal of Behavioral Decision Making, 13*(3), 295–306. https://doi.org/10.1002/1099-0771(200007/09)13:3%3C295::AID-BDM353%3E3.0.CO;2-6

Ben-David, I., Graham, J. R., & Harvey, C. R. (2013). Managerial miscalibration. *The Quarterly Journal of Economics, 128*(4), 1547–1584. https://doi.org/10.1093/qje/qjt023

Bengtsson, O., & Sensoy, B. A. (2011). Investor abilities and financial contracting: Evidence from venture capital. *Journal of Financial Intermediation, 20*(4), 477–502. https://doi.org/10.1016/j.jfi.2011.02.001

Bhandari, G., & Deaves, R. (2006). The demographics of overconfidence. *The Journal of Behavioral Finance, 7*(1), 5–11. https://doi.org/10.1207/s15427579jpfm0701_2

Busenitz, L. W., & Barney, J. B. (1997). Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making. *Journal of business venturing*, *12*(1), 9-30. https://doi.org/10.1016/S0883-9026(96)00003-1

Casamatta, C., & Haritchabalet, C. (2007). Experience, screening and syndication in venture capital investments. *Journal of Financial Intermediation, 16*(3), 368–398. https://doi.org/10.1016/j.jfi.2007.03.003

Chakraborty, I., & Ewens, M. (2018). Managing performance signals through delay: Evidence from venture capital. *Management Science, 64*(6), 2875–2900. https://doi.org/10.1287/mnsc.2016.2662

Cochrane, J. H. (2005). The risk and return of venture capital. *Journal of Financial Economics, 75*(1), 3–52. https://doi.org/10.1016/j.jfineco.2004.03.006

Conlisk, J. (1996). Why bounded rationality? *Journal of Economic Literature, 34*(2), 669–700. https://www.jstor.org/stable/2729218

Deaves, R., Lüders, E., & Schröder, M. (2010). The dynamics of overconfidence: Evidence from stock market forecasters. *Journal of Economic Behavior & Organization*, *75*(3), 402-412. https://doi.org/10.1016/j.jebo.2010.05.001

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of Management Review, 14*(1), 57–74. https://doi.org/10.5465/amr.1989.4279003

Ericsson, K. A., & Ward, P. (2007). Capturing the naturally occurring superior performance of experts in the laboratory: Toward a science of expert and exceptional performance. *Current Directions in Psychological Science*, *16*(6), 346-350. https://doi.org/10.1111/j.1467-8721.2007.00533.x

Ewens, M., Nanda, R., & Rhodes-Kropf, M. (2018). Cost of experimentation and the evolution of venture capital. *Journal of Financial Economics*, *128*(3), 422-442. https://doi.org/10.1016/j.jfineco.2018.03.001

Fama, E. F. (1980). Agency problems and the theory of the firm. *Journal of Political Economy, 88*(2), 288–307. https://doi.org/10.1086/260866

Fama, E. F., & Jensen, M. C. (1983). Agency problems and residual claims. *The journal of law and Economics*, *26*(2), 327-349. https://doi.org/10.1086/467038

Fennema, M. G., & Perkins, J. D. (2008). Mental budgeting versus marginal decision making: Training, experience and justification effects on decisions involving sunk costs. *Journal of Behavioral Decision Making, 21*(3), 225–239. https://doi.org/10.1002/bdm.585

Gage, D. (2012, September 20). The venture capital secret: 3 out of 4 start-ups fail. *Wall Street Journal (Online)*. https://www.proquest.com/docview/1041113334

Gompers, P. A. (1996). Grandstanding in the venture capital industry. *Journal of Financial Economics, 42*(1), 133–156. https://doi.org/10.1016/0304-405X(96)00874-4

Gompers, P. A., Gornall, W., Kaplan, S. N., & Strebulaev, I. A. (2020). How do venture capitalists make decisions? *Journal of Financial Economics, 135*(1), 169–190. https://doi.org/10.1016/j.jfineco.2019.06.011

Guenzel, M. (2025). In too deep: The effect of sunk costs on corporate investment. *The Journal of Finance*. https://doi.org/10.1111/jofi.13430

Haita-Falah, C. (2017). Sunk-cost fallacy and cognitive ability in individual decision-making. *Journal of Economic Psychology, 58*, 44–59. https://doi.org/10.1016/j.joep.2016.12.001

Hall, R. E., & Woodward, S. E. (2010). The burden of the nondiversifiable risk of entrepreneurship. *American Economic Review*, *100*(3), https://www.jstor.org/stable/27871243

Hogrebe, F., & Lutz, E. (2024). The sunk cost fallacy in venture capital staging: Decision-making dynamics for follow-on investment rounds. *Journal of Corporate Finance*, 102589. https://doi.org/10.1016/j.jcorpfin.2024.102589

Jensen, M. C., & Meckling, W. H. (2019). Theory of the firm: Managerial behavior, agency costs and ownership structure. In *Corporate Governance* (pp. 77–132). Gower. http://dx.doi.org/10.1002/9780470752135.ch17

Kahneman, D., & Tversky, A. (2013). Prospect theory: An analysis of decision under risk. In *Handbook of the Fundamentals of Financial Decision Making: Part I* (pp. 99–127). https://doi.org/10.1142/9789814417358_0006

Kandel, E., Leshchinskii, D., & Yuklea, H. (2011). VC funds: Aging brings myopia. *Journal of Financial and Quantitative Analysis*, *46*(2), 431-457. https://doi.org/10.1017/S0022109010000840

Kaplan, S. N., & Lerner, J. (2010). It ain't broke: The past, present, and future of venture capital. *Journal of Applied Corporate Finance, 22*(2), 36–47. https://doi.org/10.1111/j.1745-6622.2010.00272.x

Khanna, N., & Mathews, R. D. (2022). Skill versus reliability in venture capital. *Journal of Financial Economics*, *145*(2), 41-63. http://dx.doi.org/10.1016/j.jfineco.2021.07.007

Kraft, P. S., Günther, C., Kammerlander, N. H., & Lampe, J. (2022). Overconfidence and entrepreneurship: A meta-analysis of different types of overconfidence in the entrepreneurial process. *Journal of Business Venturing, 37*(4), 106207. https://doi.org/10.1016/j.jbusvent.2022.106207

Meikle, N. L., Tenney, E. R., & Moore, D. A. (2016). Overconfidence at work: Does overconfidence survive the checks and balances of organizational life? *Research in Organizational Behavior, 36*, 121–134. https://doi.org/10.1016/j.riob.2016.11.005

Menkhoff, L., Schmeling, M., & Schmidt, U. (2013). Overconfidence, experience, and professionalism: An experimental study. *Journal of Economic Behavior & Organization, 86*, 92–101. https://doi.org/10.1016/j.jebo.2012.12.022

Menkhoff, L., Schmidt, U., & Brozynski, T. (2006). The impact of experience on risk taking, overconfidence, and herding of fund managers: Complementary survey evidence. *European Economic Review, 50*(7), 1753–1766. https://doi.org/10.1016/j.euroecorev.2005.08.001

Meckling, W. H., & Jensen, M. C. (1976). Theory of the Firm. *Managerial behavior, agency costs and ownership structure*, *3*(4), 305-360. https://doi.org/10.1007/978-94-009-9257-3_8

Mishra, K. C., & Metilda, M. J. (2015). A study on the impact of investment experience, gender, and level of education on overconfidence and self-attribution bias. *IIMB Management Review, 27*(4), 228–239. https://doi.org/10.1016/j.iimb.2015.09.001

Moore, D. A. (2021). Perfectly confident leadership. *California Management Review, 63*(3), 58–69. https://doi.org/10.1177/0008125621992173

Moore, D. A., & Healy, P. J. (2008). The trouble with overconfidence. *Psychological Review, 115*(2), 502–517. https://doi.org/10.1037/0033-295X.115.2.502

Negrini, M., Riedl, A., & Wibral, M. (2022). Sunk cost in investment decisions. *Journal of Economic Behavior & Organization, 200*, 1105–1135. https://doi.org/10.1016/j.jebo.2022.06.028

Odean, T. (1998). Volume, volatility, price, and profit when all traders are above average. *The Journal of Finance, 53*(6), 1887–1934. https://doi.org/10.1111/0022-1082.00078

Olivola, C. Y. (2018). The interpersonal sunk-cost effect. *Psychological Science, 29*(7), 1072–1083. https://doi.org/10.1177/0956797617752641

Pikulina, E., Renneboog, L., & Tobler, P. N. (2017). Overconfidence and investment: An experimental approach. *Journal of Corporate Finance*, *43*, 175-192. https://doi.org/10.1016/j.jcorpfin.2017.01.002

Simon, H. A. (1955). A behavioral model of rational choice. *The quarterly journal of economics*, 99-118. https://doi.org/10.2307/1884852

Simon, H. A. (1979). Rational decision making in business organizations. *The American Economic Review, 69*(4), 493–513. https://www.jstor.org/stable/1808698

Thaler, R. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization, 1*(1), 39–60. https://doi.org/10.1016/0167-2681(80)90051-7

Zacharakis, A. L., & Shepherd, D. A. (2001). The nature of information and overconfidence on venture capitalists' decision making. *Journal of Business Venturing, 16*(4), 311–332. https://doi.org/10.1016/S0883-9026(99)00052-X

Zider, B. (1998). How venture capital works. *Harvard business review*, *76*(6), 131-139.