

June 2024

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Recommended Citation

Karki, U., Bhatia, V., & Sharma, D. (2024). A Systematic Literature Review on Overconfidence and Related Biases Influencing Investment Decision Making. *Economic and Business Review*, 26(2), 130-150.
<https://doi.org/10.15458/2335-4216.1338>

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REVIEW ARTICLE

A Systematic Literature Review on Overconfidence and Related Biases Influencing Investment Decision Making

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Abstract

In the current market scenario, it has been observed that biases are among the most significant factors influencing investment decisions. Among these biases, overconfidence is a common phenomenon managers tend to exhibit while making decisions. To understand the role of overconfidence bias in investment decision making, this study thoroughly scrutinizes and consolidates the current research on overconfidence bias. To achieve the objective, this study performs a systematic review of literature utilizing the PRISMA approach and examines 92 journal articles published in the last 20 years. Results suggest that the other two biases—hindsight and confirmation—are related to overconfidence bias. In addition, the review suggests that biases result in three major outcomes. The first, positive, aspect pertains to the promotion of mental well-being and significant allocation to research and development investments. Conversely, the second, negative, aspect involves the manipulation of operating cash flow, which tends to diminish the value of shareholders. Third, there is a preference for internal financing over external financing options. Furthermore, the research also suggests factors that may overcome the influence of the overconfidence bias. This study demonstrates its originality through thematic analysis, which effectively examines multiple dimensions of biases. Moreover, incorporating these research findings can enhance managerial decision-making processes, promote more objective assessments, and ultimately improve the overall quality of investment choices.

Keywords: Overconfidence bias, Confirmation bias, Hindsight bias, Investment decision making, Managerial decision making, Investment biases

JEL classification: G40, G41

Introduction

Organizations expect financial managers to decide on three crucial aspects: financing, investment, and dividend payout. These decisions aim to attain the ultimate organizational objective of shareholder wealth maximization (Bierman & Smidt, 2003). While specific classical financial theories, like the efficient market hypothesis (Fama, 1970) and expected utility theory (Bernoulli, 2011), presuppose rationality among individuals, it is essential to acknowledge that not all individuals consistently adhere to rational be-

havior (Barberis & Thaler, 2003). This contention has paved the way for the emergence of a novel paradigm known as behavioral finance. Among several lines of inquiry, one of the dimensions behavioral finance focuses on is investment decision making, which is multifaceted and influenced by several factors related to psychology, sociology, and cognitive biases (Shukla et al., 2020). Cognitive biases are a regular pattern of deviance from rationality (Kumar & Goyal, 2015), which could include overconfidence (Barber & Odean, 2001), anchoring (Kahneman & Tversky, 1984), confirmation (Duong et al., 2014), hindsight

Received 27 November 2023; accepted 13 March 2024.
Available online 5 June 2024

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<https://doi.org/10.15458/2335-4216.1338>

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(Fischhoff & Beyth, 1975), disposition effect (Shefrin & Statman, 1985), and mental accounting (Thaler, 1985). Recent research has directed significant scholarly attention towards examining biases' potential impact on decision-making processes, which extends beyond investment decision making, also influencing management (Maule & Hodgkinson, 2003), medicine (Blumenthal-Barby & Krieger, 2015), law (Rachlinski, 2018), and finance (Baker & Nofsinger, 2002) among others.

Malmendier and Tate (2005) argue that managers may not exhibit entirely rational decision-making behaviors and are likely to be influenced by their own cognitive biases, particularly overconfidence. Rauwerda and De Graaf (2021) suggest that biases are among the most significant factors influencing investment decisions. Therefore, understanding and addressing biases is essential for successful investment decision making and superior financial outcomes. For instance, research has shown that gender diversity in investment teams can help reduce biases and improve investment performance (Adams & Ferreira, 2009); incorporating the participation of acquaintances and relatives can mitigate biases (Abreu & Mendes, 2012); overconfidence can enhance price quality and improves market efficiency (Ko & Huang, 2007); expertise does not always mitigate overconfidence bias (Glaser et al., 2013).

Overconfidence is among individuals' most common biases, particularly in business management (Hambrick & Mason, 1984). Interestingly, some studies posit that confirmation and hindsight biases are related to overconfidence bias (Shefrin, 2006; Soll & Klayman, 2004). For instance, overconfidence bias can be linked to hindsight bias, as prior accomplishments and reinterpreting past events can lead to inflated self-assurance (Lant & Hewlin, 2002). Similarly, overconfidence bias is intertwined with confirmation bias (Soll & Klayman, 2004). One of the cognitive biases that can lead to being too sure of oneself is confirmation bias, which occurs when a person processes new information in a way that fits with what they already believe. These biases distort the perception of reality, potentially leading to undue trust in judgments and abilities. Merkle (2017) highlights that past success and hindsight influence overconfidence. Therefore, it is imperative to comprehensively examine the existing literature on overconfidence bias and its implications.

Recently, authors have examined the existing literature investigating biases' role in investment decisions. In their study, Kumar and Goyal (2015) examine research about the diverse biases that impact individual investors. The research conducted by the authors offers valuable insights into several cogni-

tive biases, such as overconfidence, disposition effect, herding, and home/familiarity biases. It specifically examines the influence of these biases on trading behavior, market volatility, returns, and portfolio selection. Similarly, Zahera and Bansal (2018) present a comprehensive theoretical examination of various biases and delineate 17 discrete biases manifesting in the investment-decision-making process. They also observe that a new field known as behavioral finance is gaining prominence, attracting the attention of both scholars and professionals in the corporate sector. However, these studies only identify these biases after exploring their underlying causes and broader effects on investment decisions.

Moreover, the above studies do not investigate the intricacies of the biases. While acknowledging the substantial contributions of these prior studies, our research takes a significant step further. This study investigates the antecedents and consequences of overconfidence bias and aims to improve the understanding of overconfidence biases in investment decision making. By establishing the intricate interrelationships among these biases and delving deeper into the overconfidence bias, we address a pressing need for a more comprehensive understanding of how cognitive biases collectively impact investment choices. Thus, our research significantly contributes to the scholarly discussion on cognitive biases and their ramifications, shedding light on the intricacies of these biases and their far-reaching consequences.

We outline the study's research objectives (RO) as follows.

- RO1. To review the extant literature on overconfidence bias (OB), confirmation bias (CB), and hindsight bias (HB).
- RO2. To establish the possible interrelationships among biases.
- RO3. To identify the underlying consequences of the biases.
- RO4. To create potential research themes and provide future research directions.

We implemented the preferred reporting items for systematic reviews and meta-analyses (PRISMA) criteria, as Moher et al. (2009) outlined. By following PRISMA guidelines, we ensured a structured and standardized approach to the review process, reducing the risk of bias and enhancing the clarity of reporting (Liberati et al., 2009). PRISMA's rigorous reporting requirements for search strategies, eligibility criteria, study selection, and quality assessment facilitate the evaluation of the review's rigor and reliability, making it a valuable tool for systematic literature review. Thus, it improves the quality of systematic literature reviews (Knobloch et al., 2011). Furthermore,

its widespread recognition and continuous updates reflect its relevance and impact in systematic reviews and meta-analyses (Moher et al., 2009). We focused on the ABDC journal quality list as the first selection criterion and employed keywords such as overconfidence bias, confirmation bias, and hindsight bias. This step resulted in 792 research articles. By adhering to the PRISMA methodology and incorporating additional criteria,¹ we obtained a final sample consisting of 92 research papers.

We found that several biases are interconnected. In addition, CB, HB, and self-attribution bias contribute to OB (Barber & Odean, 2002; Lant & Hewlin, 2002; Soll & Klayman, 2004). For instance, self-attribution bias impacts overconfidence and may increase buying and selling shares (Huang et al., 2022). We also explored the ramifications of OB, revealing both positive and negative outcomes. The positive literature on OB indicates that organizations led by managers who exhibit overconfidence tend to allocate more excellent resources toward research and development (R&D) and generating innovative solutions within emerging industries (Hirshleifer et al., 2012; Malmendier & Tate, 2005). Ko and Huang (2007) argue that managers who exhibit overconfidence will likely gather more knowledge. This tendency is believed to surpass any price errors resulting from bias, ultimately enhancing market efficiency.

OB is also linked with numerous negative consequences across various research investigations. The manipulation of operating cash flow is more likely among managers who exhibit overconfidence (Koo & Yang, 2018; Yang & Kim, 2020). Such managers, driven by their excessive ambition, engage in manipulative practices. Moreover, Adebambo and Yan (2018) suggest that the presence of overconfidence among individuals might lead to an inflated assessment of organizations, consequently prompting them to engage in assertive merger and acquisition (M&A) endeavors that ultimately diminish the worth of shareholders (Gu, 2023; Malmendier & Tate, 2008).

Understanding OB presents significant implications for managers in diverse facets of financial decision making. The propensity for overconfidence among CEOs significantly impacts the finance decisions made by organizations, often resulting in a preference for internal financing by these overconfident executives (Ebrahimi et al., 2020; He et al., 2019; Malmendier & Tate, 2005; Wang et al., 2020; Wu et al., 2021). Nevertheless, it is imperative to establish a harmonious equilibrium between internal and external funding in order to manage and minimize potential

risks effectively (Inderst & Müller, 2003). Similarly, managers should make a concerted effort to communicate transparently with lenders to prevent misjudgments. Implementing share repurchase schemes in organizations under the leadership of overconfident CEOs may yield favorable outcomes initially (Andriosopoulos et al., 2013). However, long-term financial advantages may erode over time, especially in intricate or unfavorable situations (Andreou et al., 2018). To mitigate the impact of systematic forecasting errors stemming from overconfidence, it is recommended that managers adopt stringent forecasting procedures (Ismail & Mavis, 2022).

When collaborating with professional financial advisors, managers must acknowledge the possibility of overconfidence (Gort et al., 2008) and ensure that their judgments are based on well-rounded evaluations. Maintaining a delicate equilibrium between optimism and overconfidence is paramount, given that excessive optimism can result in less-than-ideal decisions (Heger & Papageorge, 2018). The implementation of mitigation methods, such as the practice of postponing judgments, actively seeking external information, and promoting cognitive reflection, can effectively mitigate the negative consequences associated with overconfidence (Abreu & Mendes, 2012; Cheng, 2010; Rieger et al., 2022). Managers must distinguish between institutional and retail behaviors when managing retail investors and provide direction and instruction to facilitate rational decision making (Jaiyeoba et al., 2019). Finally, managers must recognize the widespread existence of cognitive biases among investors while emphasizing the significance of acquiring knowledge from errors and adjusting strategies in response to market fluctuations (Hsu, 2022). Therefore, comprehending and mitigating OB within diverse financial contexts can optimize decision-making processes and mitigate the potential dangers of irrational decision making.

The paper is structured into the following sections. Section 1 discusses the PRISMA methodology utilized for reviewing existing literature. Section 2 presents our findings, and Section 3 discusses the managerial implications of the study. Lastly, we outline directions for future research in Section 4.

1 Methodology

1.1 Review protocol—PRISMA

The present investigation follows the PRISMA guidelines proposed by Moher et al. (2009). The

¹ Details are provided in Section 1

PRISMA guidelines provide a standardized approach for conducting systematic reviews and meta-analyses, which helps to minimize bias and increase the reliability of the findings. The approach offers three distinct benefits, namely: (1) the formulation of a well-defined research query that facilitates the systematic investigation of the subject matter, (2) the establishment of criteria for determining which materials are to be included in or excluded from the analysis, and (3) the endeavor to conduct verification procedures (Sierra-Correa & Cantera Kintz, 2015).

We began the systematic literature review (SLR) by developing relevant research questions guided by the PRISMA protocol. We then created and implemented a three-part document search strategy, including identifying, screening, and determining document eligibility and synthesizing the selected literature. Fig. 1 outlines the SLR process to extract, select, and analyze the data.

The current study accessed articles on behavioral investment through the Web of Science (WOS), a well-regarded indexed database. We selected WOS for document collection because of its broad bibliographic data coverage, as highlighted by Dima et al. (2022). This database is recognized worldwide as a highly reliable source for academic publications and citations, as confirmed by Birkle et al. (2020).

1.1.1 Identification

Table 1 presents the search query design used to identify relevant WOS studies. Query 1 yielded 554 studies, while Query 2 resulted in 195 studies, and Query 3 produced 42.

1.1.2 Screening

Screening includes studies from the WOS in categories such as Economics, Business Finance, Management, Business, Applied Psychology, and Multi-disciplinary Psychology. We choose these categories for their relevance to our research topic and the availability of studies within them. Including various categories allowed for a thorough review of the

literature related to our research question. To ensure high-quality studies, we restricted our sample to the journals listed in the ABDC index. Initial screening excluded 145 studies from the first query, 138 from the second query, and 19 from the third query. The initial screening resulted in a sample of 489 studies, with 409, 57, and 23 studies in queries 1, 2, and 3, respectively, which were further screened based on their titles, abstracts, and keywords.

1.1.3 Eligibility

A total of 120 studies from the first query, seven from the second query, and six from the third query met the criteria for full-text assessment. These research papers were further evaluated to identify the relevant sample for our study.

1.1.4 Included

The refined sample comprised 94 studies, including 81 studies from query 1 and 3 studies each from query 2 and query 3, respectively. Eight (8) studies were identified using forward and backward snowballing techniques. Finally, the 92 studies were analyzed to draw conclusions and insights about the research question.

2 Results

2.1 Descriptive statistics

The investigation of OB has been a topic of considerable scholarly inquiry in finance and behavioral economics. Significantly, prominent academic publications such as the *Journal of Banking & Finance*, *Journal of Financial Economics*, and *Journal of Behavioural Finance* have made noteworthy contributions to this study area (see Fig. 2 and Fig. 4). Over time, research endeavors centered on overconfidence and biases have seen significant growth (see Fig. 3). This trend suggests a mounting curiosity and acknowledgement of the influence of these phenomena. Nonetheless, confirmation bias and hindsight bias have received limited attention within finance, with a mere six (6) papers identified through implementing the PRISMA methodology.

2.2 Interrelationship framework

Inherent cognitive tendencies, called biases, can significantly influence investment-decision-making processes. Confirmation bias is a notable cognitive bias that entails exhibiting a preference for information consistent with a preexisting belief while neglecting contradictory evidence (Shefrin, 2006). Confirmation bias can be exacerbated when individuals collaborate

Table 1. Queries used in the study.

Query 1/ overconfidence bias	(overconfidence bias or overconfidence) AND (investment decision-making or behavioural finance or behavioral finance or investing or finance)
Query 2/ confirmation bias	(confirmation bias or confirmation) AND (investment decision-making or behavioural finance or behavioral finance or investing or finance)
Query 3/ hindsight bias	(hindsight bias or hindsight) AND (investment decision-making or behavioural finance or behavioral finance or investing or finance)

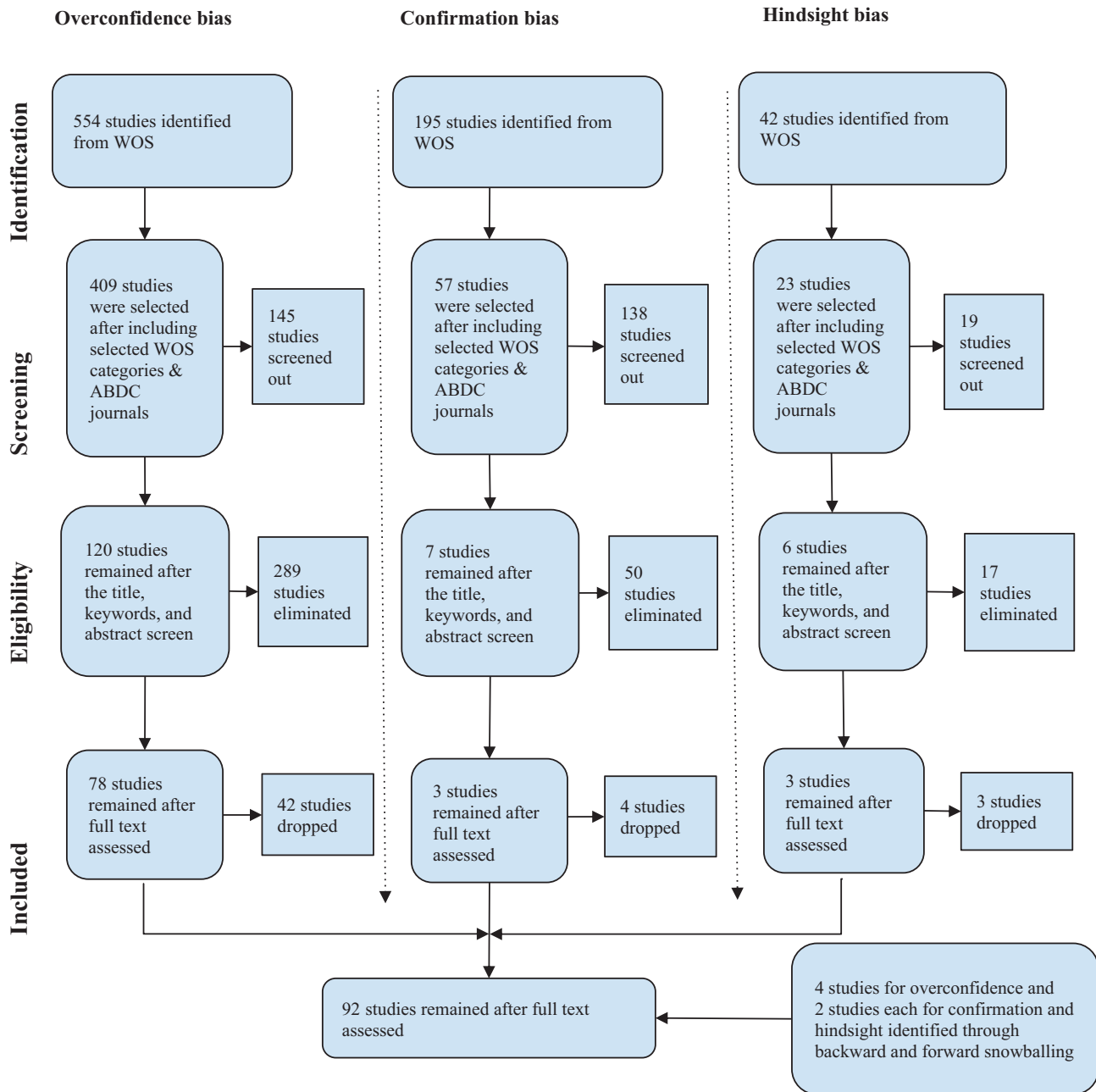


Fig. 1. PRISMA flowchart.

in groups to achieve consensus, ultimately resulting in an unjustified level of assurance in the group's final decision (Shefrin, 2006).

Investors may exhibit overconfidence, wherein they perceive themselves to possess more trading knowledge than they do, primarily based on their prior successes. This phenomenon can increase trading activity, as Barber and Odean (2001) and Daniel et al. (1998) noted. Moore and Healy (2008) conducted a study on different manifestations of overconfi-

dence, which encompassed (i) an inflated assessment of one's actual performance, (ii) an overestimation of one's performance relative to others, commonly known as the better-than-average effect, and (iii) an unwarranted level of confidence in one's beliefs, also referred to as miscalibration. Studies on overconfidence, such as those conducted by Glaser et al. (2013), have explored these different aspects, highlighting the multifaceted nature of overconfidence in influencing investment decisions.

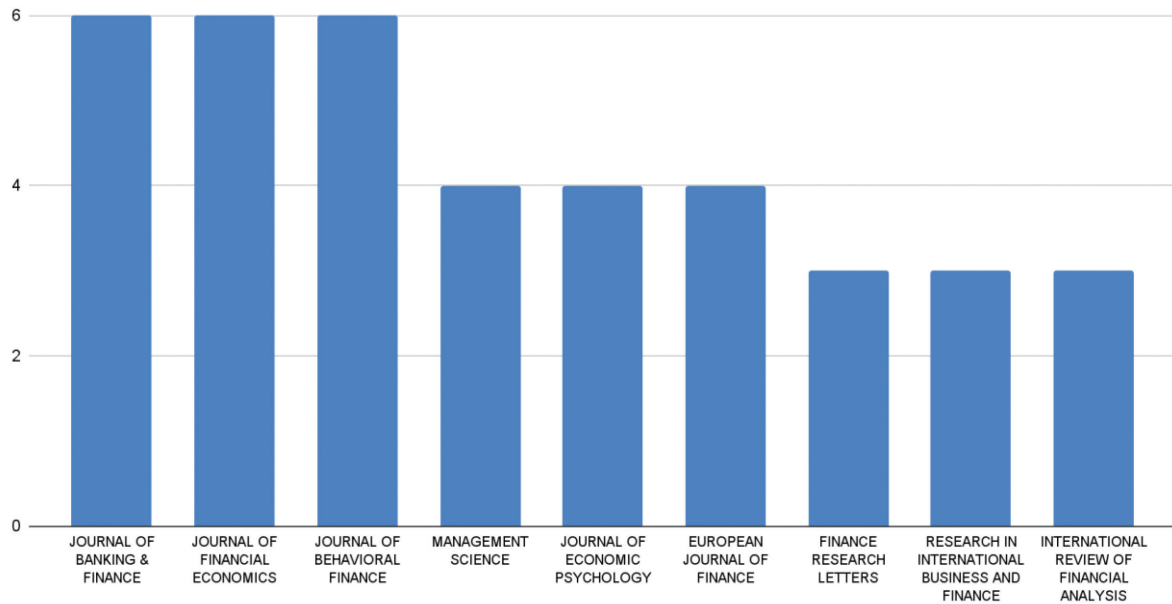


Fig. 2. Number of articles published in journals with more than two publications.

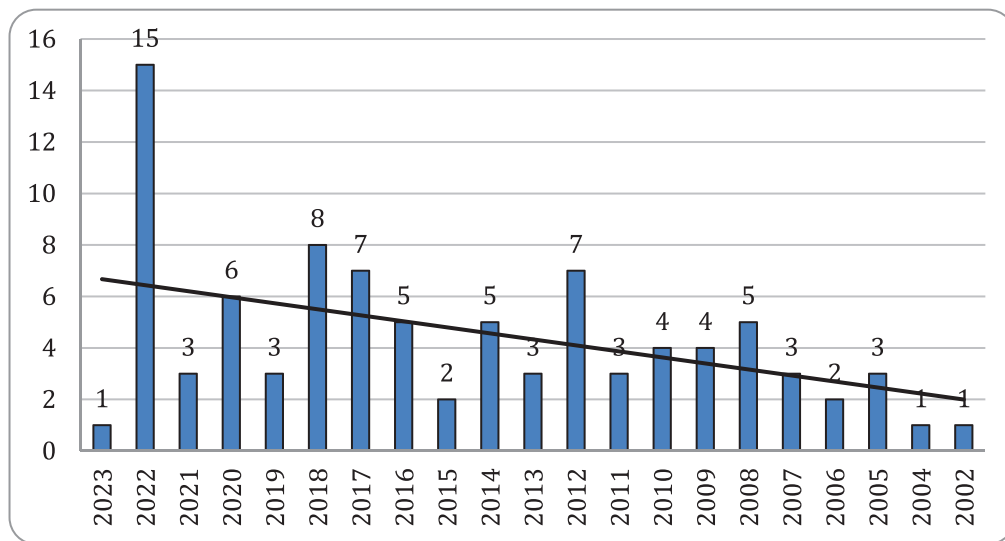


Fig. 3. Number of articles published by year.

2.2.1 Overconfidence and cognitive biases

The phenomenon of overconfidence has been extensively documented and has been linked to several cognitive biases. [Soll and Klayman \(2004\)](#) identified several cognitive biases that can lead to overconfidence. These include the tendency of a person to rely too heavily on initial information (anchoring) and not adjust their views sufficiently, the inclination to selectively retrieve information that supports their existing beliefs, and the habit of favoring information that confirms what they already think (confirmation bias) when interpreting new information.

2.2.2 Overconfidence and hindsight bias

One possible rationale for overconfidence can be found in hindsight bias, which leads to an exaggerated sense of self-assurance due to the influence of prior accomplishments and the reinterpretation of past occurrences ([Lant & Hewlin, 2002](#)). Also, according to [Merkle \(2017\)](#), past success and hindsight can impact investor overconfidence.

2.2.3 Overconfidence and disposition effect

According to [Trejos et al. \(2019\)](#), individuals who exhibit the disposition effect may be prone to

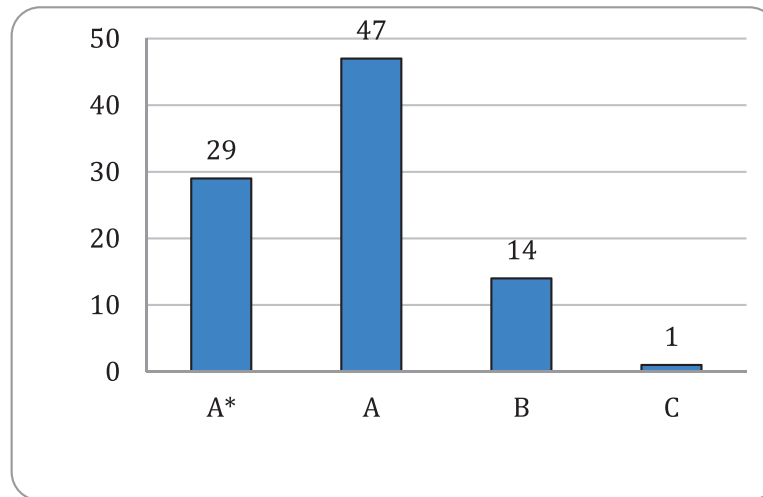


Fig. 4. Number of articles published in ABDC List.

overconfidence. Further, [Ho \(2011\)](#) states that investors who display excessive confidence are prone to demonstrating the disposition effect, which involves retaining underperforming investments for an extended period. In addition, it has been observed that traders who exhibit overconfidence tend to indicate a preference for stocks with lower market capitalization.

2.2.4 Overconfidence and framing effect

The framing effect describes how information is presented and can significantly sway a person's choices, often more than the information itself ([Plous, 1993](#)). It is closely linked to overconfidence, particularly in how the presentation of information affects a person's investment decisions. [Workman \(2012\)](#) highlights this connection, showing that the content and framing of information play a crucial role in making financial choices.

2.2.5 Overconfidence and self-attribution bias

Researchers focusing on personal finance increasingly delve into self-attribution bias, a tendency believed to fuel the overconfidence seen in individual investors ([Barber & Odean, 2002](#); [Dorn & Huberman, 2005](#)). Further, [Hoffmann and Post \(2014\)](#) assert that the self-attribution bias plays a critical role in magnifying the overconfidence of individual investors. According to [Czaja and Röder \(2020\)](#), self-attribution bias may lead to a decline in performance due to the involvement in excessively confident trading endeavors.

2.2.6 Overconfidence and familiarity bias

Familiarity bias and overconfidence are well-known concepts across various fields, suggesting that

people often overrate their understanding or abilities in familiar areas. This overestimation can lead to flawed judgments, poor decisions, and a reluctance to seek or consider different perspectives. There is a strong link between familiarity bias and overconfidence: the more a person feels familiar with a subject, the more it can skew their decision-making processes. [Tekçe et al. \(2016\)](#) found that familiarity bias can exacerbate the tendency to stick with the status quo, leading to even more pronounced distortions in how a person perceives and makes decisions, especially when combined with overconfidence.

The existence of various biases, including CB, HB, and self-attribution bias, can exert a considerable influence on decision-making procedures and foster overconfidence. Biases have the potential to skew the interpretation of data, result in overconfidence, and impact investment choices. Moreover, the framing effect, disposition effect, and familiarity bias interplay with overconfidence, influencing decision making in diverse settings. Comprehending these biases and their interrelationships is imperative for individuals, collectives, and entities to arrive at more knowledgeable and logical decisions. Acknowledging and reducing biases makes it possible to pursue more impartial evaluations and enhance the general caliber of investment-decision-making procedures.

[Fig. 5](#) depicts the interrelationship among several biases as identified in the literature. Based on this, we propose a conceptual framework to investigate the collective influence of self-attribution bias, HB, and CB on overconfidence and, subsequently, their impact on investment decision making. This model will provide a more comprehensive understanding of the combined effects of these biases, as previous research has primarily focused on their impacts.

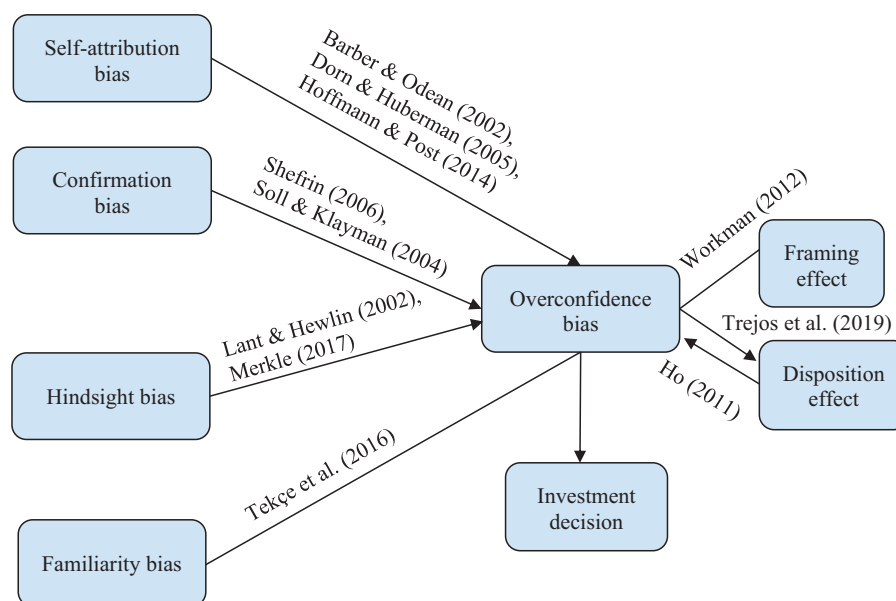


Fig. 5. Interrelationship framework.

2.3 Antecedents of overconfidence and its effects

2.3.1 Information

According to [Jiang et al. \(2005\)](#), in situations where the future of an asset is characterized by a high degree of uncertainty, confident investors may demonstrate an elevated level of overconfidence in their personal opinions and forecasts. The presence of an overly confident attitude in individuals may result in the assumption of higher levels of risk than what is deemed appropriate, which could hurt their expected investment gains. The study's findings support the notion that an abundance of confidence can act as a viable mechanism by which investor overconfidence can impact anticipated returns within financial markets (see [Table 2](#)).

According to [Chuang and Lee \(2006\)](#), it is common for investors to exhibit overconfidence because they tend to overreact to sensitive information. Notwithstanding, the traditional economic models that depict agents as having an exaggerated perception of the precision of their private signals may not comprehensively encapsulate the various manifestations of

individuals' overconfidence in diverse settings ([Fellner & Krügel, 2012](#)).

Research shows that investors often display undue confidence under uncertain conditions and overreact when their private information becomes public ([Black et al., 2017](#)). This tendency is especially pronounced following a public disclosure, where investors lean too heavily on their previously exclusive insights, leading to amplified reactions. For instance, they may react too positively to good news, like private cash influxes or stock deals, exhibiting an optimistic bias. Conversely, their response to adverse developments, such as public stock transactions, can be excessively negative. The empirical findings from the study suggest that the market's reaction to announcements of acquisitions is significantly shaped by this overconfidence, affecting both the interpretation and the response to such news.

Further, [Hwang et al. \(2022\)](#) indicate that investors tend to be overconfident when interpreting public information about established, easily analyzed companies. These companies are usually older, larger, pay dividends, have a lot of physical assets, need less

Table 2. Authors and the antecedents.

Antecedents	Findings	Authors
Information	<ul style="list-style-type: none"> Public information Private information Information uncertainty 	Black et al. (2017) , Chuang and Lee (2006) , Fellner and Krügel (2012) , Hwang et al. (2022) , Jiang et al. (2005)
Investment climate	<ul style="list-style-type: none"> Prone to overconfidence 	Huang and Goo (2008)
Demographics	<ul style="list-style-type: none"> Younger CEOs with MBAs overconfident Gender, education, and career are significant in explaining overconfidence 	Beber and Fabbri (2012) , Trejos et al. (2019)

outside funding, and grow at a moderate pace. This overconfidence is linked to notable short-term fluctuations in returns, but this effect does not last long across different stocks. The study also points out that overconfidence can be costly, leading to losses of over 1.1% in the first month of setting up a portfolio, even after considering risks. Interestingly, even with more people using arbitrage trading strategies in the 2000s, the risk-adjusted cost of overconfidence remains significant.

2.3.2 Investment climate

The findings show that investors who are more passionate about the natural world are less prone to exhibit overconfidence. Conversely, investors are more prone to overconfidence when the investing climate is more favorable (Huang & Goo, 2008).

2.3.3 Demographics

CEOs with MBA degrees and less work experience are likely to speculate more. These results are consistent with managers who take unnecessary risks and are overconfident (Beber & Fabbri, 2012). While nationality and age are not statistically significant variables, educational, career, and gender levels are significant in explaining overconfidence (Trejos et al., 2019).

2.3.4 Joint decision making

Piehlmaier’s (2022) study findings indicate that adopting collaborative decision-making processes can significantly mitigate investor overconfidence. Collaborative financial decision making by analyzing information obtained from investors, consumers, and individuals participating in experimental studies makes an impact. The study findings also suggest that investors who engage in collective decision making exhibit lower overconfidence than those who make decisions independently. Rather than depending on the expertise of a financial advisor, interpersonal connections with family or friends are more effective in reducing overconfidence (Piehlmaier, 2022).

2.3.5 Feeling good about a company

When someone feels optimistic about a company, they are more likely to overestimate the potential financial gains from its shares and underestimate the risks involved. On the other hand, if a person’s positive feelings are less intense, they might not fall into the trap of overconfidence as easily, leading to a more realistic assessment of the risks, especially when considering actions that benefit the greater good (Aspara & Tikkanen, 2010).

Table 3. Authors providing positive notes on overconfidence.

Author	Findings
Hirshleifer et al. (2012), Malmendier and Tate (2005)	<ul style="list-style-type: none">Invest more in R&DOnly produce more innovation in cutting-edge sectors of the economy
Sahi (2017)	<ul style="list-style-type: none">Overconfidence behavior is crucial for sustaining mental health
Ko and Huang (2007)	<ul style="list-style-type: none">Enhance price qualityAcquired more information that outweighs pricing error induced by bias
Mueller and Brettel (2012)	<ul style="list-style-type: none">Improves market efficiencyThe early stage of the economic cycle has significant benefit

2.4 The potential benefits of exhibiting overconfidence

CEO overconfidence (see Table 3) has a favorable impact by promoting more significant investment in research and development (Malmendier & Tate, 2005). Even though some pricing errors may occur due to bias, this proactive behavior generally leads to improved pricing quality and enhances market efficiency (Ko & Huang, 2007). However, the effects of CEO overconfidence are influenced by the economic environment. In times of economic downturn, the consequences can be negative. Yet, overconfidence can significantly benefit corporate profitability and stock market performance during the early stages of an economic cycle. This suggests that the impact of overconfidence varies between normal conditions and unexpected economic challenges (Mueller & Brettel, 2012).

In addition, CEOs who exhibit overconfidence tend to allocate a more significant proportion of their resources towards innovation, resulting in heightened levels of return volatility, amplified patent and patent citation counts, and superior, innovative performance relative to their allocated R&D budget. This behavior is mainly seen in the most innovative areas of the economy, where CEOs take advantage of opportunities for new growth (Hirshleifer et al., 2012).

There is a link between OB and how satisfied people feel with their financial situation. Overconfident individuals often overestimate their ability to make wise investment choices, think they know more than others and are more willing to take risks. While past studies have shown that too much confidence can lead to poor results due to not spreading investments enough, recent findings highlight that overconfident behavior can support mental well-being. It gives people control over their lives, especially when making investment decisions (Sahi, 2017).

2.5 Negative consequences of overconfidence bias

2.5.1 Cash flow

Numerous scholarly investigations have put forth a convincing account regarding the impact of managerial overconfidence on diverse facets of corporate finance. The variables under consideration encompass operating cash flow (OCF), investment-cash-flow sensitivity (ICS), research and development (R&D) outlays, and the participation of chief executive officers (CEOs) in investment determinations.

Yang and Kim (2020) suggest that overconfident managers might invest too much too quickly, using up a lot of OCF. To compensate, they might report figures that are higher than the actual OCF. Their study shows that companies with overconfident managers report fewer small losses and more small gains in OCF than others. This implies that overconfident managers might adjust OCF figures more than their more cautious peers, possibly to keep the board from turning down their future investment ideas.

According to the research conducted by Koo and Yang (2018), it can be inferred that managers who demonstrate overconfidence, especially in organizations with limited restrictions, tend to display a greater degree of overconfidence bias in their decision-making process compared to their logical counterparts. Furthermore, the amalgamation of overconfidence and self-attribution bias intensifies the endurance of stickiness in ICS. This highlights the importance of considering overconfidence and cognitive biases when analyzing their impact on in-

vestment decisions and their reaction to cash flows (see Table 4).

Research and development (R&D) was the subject of a study by Zavertiaeva et al. (2018). They found that organizations with overconfident managers tended to devote more of their budgets to R&D. The study considered several variables, including the nation, industry, and period. Managers who demonstrate overconfidence increase the influence of financial R&D variables, such as business liquidity and profitability. Despite increased spending on research and development, overconfident managers need help to make effective decisions in this area, which could lower the firm's overall value.

Kaplan et al. (2022) have focused on CEOs and have found that those holding shares for a prolonged period and those with lower levels of competence exhibit greater investment-cash-flow sensitivities. Despite controlling for variables such as aptitude, the investment choices made by CEOs who hold their positions for an extended period are still considerably impacted by cash flows.

Chiu et al. (2022) have shown that managers with high levels of overconfidence tend to engage in overinvestment activities when internal cash flow is deemed adequate, especially in the presence of financial constraints. This study further asserts that financial constraints, managerial hubris, and overconfidence may result in the expeditious depletion of OCF due to excessive investment. The study also highlights the importance of the free-cash-flow dilemma, managerial hubris, and financial

Table 4. Authors and themes of research on negative consequences.

Themes	Findings	Authors
Cash flow	<ul style="list-style-type: none"> • Manipulate operating cash flow • High investment-cash-flow sensitivity 	Chiu et al. (2022), Kaplan et al. (2022), Koo and Yang (2018), Yang and Kim (2020), Yung and Long (2022), Zavertiaeva et al. (2018)
Corporate investment	<ul style="list-style-type: none"> • Significant corporate losses • Tend to lower the value for owners of these investors' companies • Lower investment in real options 	Benson and Ziedonis (2010), Hatoum (2021), Hatoum et al. (2022), Lee et al. (2023), Malmendier and Tate (2015)
Financial literacy	<ul style="list-style-type: none"> • Overconfidence in financial literacy results in fraud victimization • Less inclined to seek expert advice 	Hsu (2022), Jain et al. (2022), Xiao et al. (2022)
M&A	<ul style="list-style-type: none"> • Devalue stockholders 	Gu (2023), Malmendier and Tate (2008)
CSR	<ul style="list-style-type: none"> • Influence 	McCarthy et al. (2017)
Firm valuation	<ul style="list-style-type: none"> • Overvalued 	Adebambo and Yan (2018)
Momentum	<ul style="list-style-type: none"> • Momentum profits negated 	Lin et al. (2016)
Risk	<ul style="list-style-type: none"> • Adoption of risky investments • Risk-taking behaviors among professionals are significantly influenced by overconfidence 	Breuer et al. (2014), Broihanne et al. (2014), Jiang et al. (2005), Nosić and Weber (2010)
Tax	<ul style="list-style-type: none"> • Avoidance 	Hsieh et al. (2018)
Trading behavior	<ul style="list-style-type: none"> • Increased trading frequency • Self-attribution bias impacts overconfidence, and results in higher buying and selling of shares 	Abreu and Mendes (2012, 2020), Graham et al. (2009), Huang et al. (2022), Meier (2018), Talwar et al. (2021)

constraints as crucial determinants of corporate investment choices.

The impact of managerial overconfidence on financial decision making within organizations has been extensively studied by [Yang and Kim \(2020\)](#), [Koo and Yang \(2018\)](#), [Zavertieva et al. \(2018\)](#), [Kaplan et al. \(2022\)](#), and [Chiu et al. \(2022\)](#), leading to a comprehensive understanding of the phenomenon.

2.5.2 Corporate investment

According to [Benson and Ziedonis \(2010\)](#), corporate investors' acquisition of entrepreneurial enterprises is typically successful. However, when these investors acquire portfolio companies, their shareholders' value often decreases. This is attributed to managerial overconfidence, underscoring the negative consequences of excessive self-assurance on the results of business mergers and acquisitions.

[Hatoum \(2021\)](#) developed a model to examine the effects of CEO overconfidence as a unique form of OB. The model estimates potential losses and missed opportunities resulting from CEO overconfidence in corporate investments. Research shows that CEO arrogance negatively affects corporate investments and decision-making processes. The model differentiates between CEOs who demonstrate overconfidence and those who do not. The results suggest that CEOs who exhibit overconfidence tend to generate biased project return estimates. In contrast, CEOs who do not display overconfidence tend to employ a Bayesian learning strategy. The model aims to enhance comprehension concerning the influence of overconfidence bias on decision making within organizations by emphasizing its adverse effects on corporate investments.

Following up on the above, [Hatoum et al. \(2022\)](#) have developed a metric for assessing CEO overconfidence based on probability, utilizing the principles of Bayesian network theory. The metric, which draws on empirical investigations into the probabilistic association between CEO overconfidence and diverse antecedents, exhibits considerable precision in forecasting CEO overconfidence. Additionally, the research reveals a correlation between heightened CEO self-assurance and corporate investment, underscoring the importance of CEO overconfidence in molding investment choices.

[Lee et al. \(2023\)](#) argue that the impact of CEO overconfidence on a company's approach to real options (choices available in future investment opportunities) deserves more attention. Their study suggests that overconfident CEOs might not fully appreciate the value of being able to adapt strategies flexibly, leading to less investment in these real options. The research shows that this tendency be-

comes more pronounced under market uncertainty, linking CEO overconfidence more strongly with reduced real-options investments. This work adds to our understanding by showing how psychological biases, such as overconfidence, can affect strategic decision making, especially in uncertain environments. It reveals that an overconfident CEO could make a company less adaptable and more prone to failure. The study also shows how overconfidence might impair a CEO's ability to deal effectively with complex and unpredictable situations, ultimately affecting the company's performance.

The scholarly works of [Benson and Ziedonis \(2010\)](#), [Malmendier and Tate \(2015\)](#), [Hatoum \(2021\)](#), [Hatoum et al. \(2022\)](#), and [Lee et al. \(2023\)](#) collectively provide a comprehensive understanding of the adverse impacts of CEO overconfidence on corporate investments, decision-making processes, and real options portfolios.

2.5.3 Financial literacy

[Jain et al. \(2022\)](#) found strong links between individual investors' personality traits, understanding of finance, goals for investing, and actual plans to invest. Their research shows that OB and financial knowledge positively and significantly impact the desire to invest. Additionally, financial knowledge is a bridge partly explaining how personality affects how much one intends to invest. On a related note, [Xiao et al. \(2022\)](#) discovered that being overconfident about one's financial knowledge could increase the risk of falling for financial scams. This highlights the importance of creating prevention programs tailored to address this issue and encouraging a more accurate self-assessment of financial knowledge through testing as part of financial education.

Furthermore, [Hsu \(2022\)](#) found that investors who exhibit overconfidence tend to be less inclined to seek expert advice and more prone to making autonomous investment decisions. It is recommended that financial literacy campaigns incorporate measures to counteract overconfidence bias. Additionally, it is essential to note that various biases, including self-attribution bias and mental accounting, may lead to an inconsiderable inclination toward seeking financial guidance. The results above underscore the significance of mitigating partialities in financial decision making and advocating for financial education to augment the efficacy of financial advisory services.

2.5.4 Mergers and acquisitions

[Malmendier and Tate \(2008\)](#) suggest that overly confident CEOs tend to overrate their ability to make profitable decisions, leading to value-diminishing

mergers and overpayments for acquired companies. This study tests this idea by looking at two aspects of CEO overconfidence: their investment in their company and their public image. The negative impacts of this overconfidence are particularly noticeable in mergers aimed at diversifying the business that do not require borrowing money. While this overconfidence might make CEOs more likely to pursue M&A opportunities, it tends to harm innovation and the financial success of these ventures once they are completed.

The research uses a detailed way of measuring manager overconfidence and addresses potential biases in selecting study samples through propensity score matching. The findings suggest that too much confidence can hinder entrepreneurial efforts, even in fast-growing economies such as China.

2.5.5 Risk

Studies have shown that overconfidence significantly affects people's willingness to take risks, especially in finance. Jiang et al. (2005) found that overestimating one's skills or knowledge can lead to riskier actions. This idea is supported by Nosić and Weber (2010), who highlight how overconfidence and too much optimism can push people towards riskier behaviors. They suggest that investment advisors can help correct these mistaken beliefs and improve their advice by understanding these biases and promoting better financial understanding.

Broihanne et al. (2014) conducted interviews with senior finance professionals and discovered that overconfidence greatly affected their willingness to take risks. These professionals exhibited too much confidence in their general and financial judgment, particularly in predicting stock prices. The study noted that while seeing risks as more significant had a negative impact, overconfidence and optimism made individuals more inclined to take risks.

Breuer et al. (2014) discovered that individualism, which often comes with overconfidence and unrealistic optimism, tends to increase people's willingness to take financial risks. This finding challenges the traditional idea in portfolio theory that more risk-averse people are less likely to engage in risky financial activities. The authors suggest that cultural values such as individualism can help explain investment behaviors and economic patterns worldwide. Understanding these influences can lead to policies that reduce investment errors. The study highlights the significant role of overconfidence and related biases in shaping risk-taking behaviors. It points out that education and culture influence people's attitudes towards risk and financial decision making.

2.5.6 Trading behavior

Overconfident investors significantly influence trading patterns, often leading to more frequent buying and selling in various markets. Graham et al. (2009) noted that such investors trade more often, driven by overconfidence. Abreu and Mendes (2012) further confirmed that overconfident investors who believe they will perform better than average also tend to trade more often.

Meier's (2018) study explores how investor confidence affects the trading of smaller stocks, revealing that cautious investors trade more when they feel confident. Abreu and Mendes (2020) observed that overconfident investors tend to trade in warrants rather than domestic stocks, suggesting that overconfidence influences trading across various markets. Talwar et al. (2021) demonstrated that biases, including overconfidence, impact trading behavior and the likelihood of investors recommending investments to others, highlighting the substantial role these biases play in investment decision making.

Huang et al. (2022) investigated trading behaviors in China's A-share market. They found that investors tend to trade more during market upswings, driven by overconfidence and a tendency to credit their successes to their own decisions. However, during downturns, they often blame external factors for their losses and trade less, leading to lower trading volumes. This research highlights how overconfidence affects trading habits, frequency, and market movements, emphasizing the need to manage overconfidence in investment decisions.

2.5.7 Corporate social responsibility

Overconfidence (OB) can negatively impact a company's efforts in corporate social responsibility (CSR), which is essential for supporting ethical and sustainable business practices (McCarthy et al., 2017). The research also shows that CSR's impact is more substantial in its institutional aspects, which play a more significant role in shaping the company's reputation and its relationships with stakeholders.

2.5.8 Firm valuation

Adebambo and Yan (2018) found that companies with a high market-to-book ratio and signs of being mispriced are often overvalued, especially when overconfident investors are involved. This trend is most evident in stocks primarily owned by mutual funds, especially those actively managed. Moreover, companies with many overconfident investors usually experience lower future stock returns, issue more shares, and make more significant investments.

2.5.9 Momentum

OB plays a significant role in the momentum trends in Taiwan's stock market. Overconfidence grows when the market is stable, leading to profits from this momentum. However, the study by [Lin et al. \(2016\)](#) shows that these profits are often wiped out during market change, indicating that overconfidence can lead to investor losses during such transitions.

2.5.10 Tax

[Hsieh et al. \(2018\)](#) discovered that companies are more likely to adopt tax-avoidance strategies when both their CEO and CFO are overconfident rather than when just one or neither is. This finding supports the False Consensus Effect Theory, which suggests that people often overestimate how much others agree with them. The study highlights the importance of investors, regulators, and policymakers understanding the role of executive overconfidence in tax-related decisions. Recognizing CEOs' and CFOs' overconfidence levels can help stakeholders better gauge the risk of tax evasion, potentially affecting investment decisions, regulatory measures, and policy making.

2.6 Impact of overconfidence bias in general

2.6.1 Source of finance

Studies reveal that a CEO's overconfidence plays a crucial role in shaping a company's financial strategies, affecting the use of internal resources and the pursuit of external funding. [Adomdza et al. \(2016\)](#) point out that overconfident CEOs might lean to-

wards using the company's own funds rather than external sources. On the other hand, [Wu et al. \(2021\)](#) discovered that firms with more overconfident CEOs are more likely to secure entrusted loans compared to those led by less confident CEOs, suggesting that strong self-belief in CEOs can sway the loan approval process, mainly when there is a significant lack of information between lenders and borrowers. Overconfident CEOs may underestimate these information risks and seek loans more eagerly (see [Table 5](#)).

Furthermore, [Malmendier and Tate \(2005\)](#) observed that overconfident CEOs prefer financing projects with internal funds rather than external borrowing. [Kamoto \(2014\)](#) noted that overconfident managers might delay investment decisions when internal funds are scarce, thinking the market undervalues their equity.

[He et al. \(2019\)](#) also highlighted that the preference for internal financing can lead to more efficient investments, reducing instances of underinvestment and potentially leading to overinvestment, especially in private companies with limited external funding options. In scenarios where external funding is needed, overconfident CEOs might prefer debt over equity financing, reflecting their confidence in the company's future performance.

[Hackbarth \(2008\)](#) found that overconfident managers often choose higher debt levels and are likelier to take out loans because they do not fully grasp the risks of fluctuating earnings. Similarly, [Huang et al. \(2016\)](#) observed that overconfident CEOs prefer borrowing over issuing new stock, believing that the stock market undervalues their company's

Table 5. Authors and themes of the impact of overconfidence bias in general.

Themes	Findings	Authors
Buyback	<ul style="list-style-type: none"> • Successful execution • Financial benefits diminished 	Andreou et al. (2018) , Andriosopoulos et al. (2013)
Source of finance	Preferences <ul style="list-style-type: none"> • Internal finance • Debt financing • Equity financing 	Adomdza et al. (2016) , Ebrahimi et al. (2020) , Hackbarth (2008) , He et al. (2019) , Huang et al. (2016) , Kamoto (2014) , Malmendier and Tate (2005) , Seo et al. (2017) , Wang et al. (2020) , Wu et al. (2021)
Forecasting	<ul style="list-style-type: none"> • Error • Imprecise and more acquisitions 	Ismail and Mavis (2022) , Leitner et al. (2017)
Retail investor	<ul style="list-style-type: none"> • Adaptive market hypothesis • Entrepreneurs are overconfident in their ideas • Negligible distinction between institutional and retail investors 	Hooshangi and Loewenstein (2018) , Jaiyeoba et al. (2019) , Mushinada (2020)
Mitigating	<ul style="list-style-type: none"> • Deferring the decision-making process • Origin of the information • Cognitive reflection 	Abreu and Mendes (2012) , Cheng (2010) , Rieger et al. (2022)
Optimism	<ul style="list-style-type: none"> • Overoptimism equivalent to overconfidence • Moderate level of optimism 	Campbell et al. (2011) , Heger and Papageorge (2018) , Puri and Robinson (2007)
Professional	<ul style="list-style-type: none"> • Financial advisors • Swiss pension plan • Expertise does not mitigate 	Glaser et al. (2013) , Gort et al. (2008) , Lambert et al. (2012) , van de Venter and Michayluk (2008)

shares. This preference for debt extends to choosing short-term over long-term borrowing despite liquidity risks. Despite these risks, overconfident CEOs may not give them due consideration. These findings underline how CEO overconfidence can shape a company's approach to financing, highlighting the need to account for psychological biases when analyzing financial strategies and their impacts.

2.6.2 Buyback

CEO overconfidence can influence share buyback programs. [Andriosopoulos et al. \(2013\)](#) found that companies with overconfident CEOs are more likely to complete planned share repurchases successfully. However, [Andreou et al. \(2018\)](#) noted that the long-term financial gains from announcing share buybacks are smaller for companies with overconfident CEOs. This effect is especially pronounced for businesses that are harder to evaluate, like startups, small companies, or those facing financial challenges. Companies with poor stock performance or high book-to-market ratios, which might indicate the market's overreaction to bad news, are also affected. Companies in financial distress see similar effects. Overall, while overconfident CEOs can push through share buyback plans, this trait might lessen the long-term financial benefits, especially in complex or challenging situations.

2.6.3 Forecasting errors

Forecasting errors highlight the impact of overconfidence on financial decisions and predictions. [Leitner et al. \(2017\)](#) found that overconfidence in corporate hierarchies can lead to systematic mistakes in forecasting, such as over- or underestimating project outcomes. These errors are more harmful when they stem from overconfidence rather than random mistakes.

[Ismail and Mavis \(2022\)](#) explored how managerial overconfidence affects the accuracy of predictions in company acquisitions. In this context, they introduced a new way to measure overconfidence, finding that CEOs who are more off in their synergy predictions tend to be more overconfident. Companies led by overconfident CEOs often make more acquisitions, leading to greater diversification but also taking on more risk. These acquisitions are linked to higher spending, debt, innovation, and concerns about issuing new stock. The study also found that higher takeover premiums and lower returns for the acquiring company are related to errors in predicting synergies. This suggests that overconfident CEOs are more likely to take calculated risks, sometimes leading to adverse outcomes, especially when their predictions are off.

2.6.4 Professional

[Van de Venter and Michayluk \(2008\)](#) found that professional financial advisors often exhibit significant overconfidence, leading to cognitive biases and inaccurate judgments and mistakes.

[Gort et al. \(2008\)](#) studied Swiss pension plan decision makers. They found they were also prone to overconfidence, as shown by their too narrow predictions about past and future returns of different assets. However, their overconfidence was less extreme than that of non-experts. This suggests that while overconfidence is common, its intensity can vary among individuals and tasks, indicating that some people might be more naturally inclined towards overconfidence regardless of their professional background.

[Glaser et al. \(2013\)](#) have emphasized the existence of consistent patterns of overconfidence, regardless of one's level of expertise. This discovery suggests that the phenomenon of overconfidence cannot be exclusively ascribed to a deficiency in knowledge or logical reasoning. The statement implies that even those who possess specialized knowledge in their domains may demonstrate excessive self-assurance, underscoring the importance of acknowledging and remedying this partiality in expert judgment.

Additionally, scholarly research has explored the significance of expertise within the framework of overconfidence. According to [Lambert et al. \(2012\)](#), a comparative analysis of bankers and students revealed no discernible disparities in the degree of overconfidence exhibited by either cohort. Nevertheless, discrepancies existed in how excessive confidence impacted the decision-making process. The study results indicate that students were more susceptible to the effects of overconfidence on their risk aversion tendencies. In contrast, bankers were found to be more influenced by overconfidence in their valuation and investment decision-making processes. The results above underscore the intricate function of expertise in conjunction with overconfidence and propose that including an evaluation phase during the decision-making procedure could facilitate a more comprehensive comprehension of the disparities between professionals and novices.

The results underscore excessive confidence in professional environments and their impact on evaluations, assessments, and investment choices. Acknowledging and resolving this partiality is of utmost importance in augmenting decision-making precision and circumventing the possible drawbacks of excessive self-assurance.

2.6.5 Overoptimism

The results of overoptimism underscore its importance as a cognitive bias and its association with

overconfidence. According to [Puri and Robinson \(2007\)](#), an excessive degree of optimism can be interpreted as equivalent to overconfidence, whereas a moderate level of optimism can be advantageous. This statement posits a delicate boundary between optimism and overconfidence, and transgressing this boundary may result in adverse consequences for making decisions.

The level of optimism is crucial in CEO decision making. [Campbell et al. \(2011\)](#) found that CEOs with a balanced level of optimism are likely to make investment decisions that are just right. However, if their optimism is too high or too low, they might invest too little or too much. There is also a noticeable link between a company's value and its CEO's optimism: too much optimism can lead to less-than-ideal investment choices.

Understanding the difference between overconfidence and overoptimism is crucial. [Heger and Pageorge \(2018\)](#) explain that overconfidence involves overestimating one's abilities or performance, while overoptimism is about expecting better outcomes, not directly tied to one's actions or abilities. These tendencies are not completely separate and can both contribute to wishful thinking, especially in high-stakes situations where outcomes depend on personal performance. It is important not to treat optimism and overconfidence as separate, as doing so might overlook how they interact and collectively influence decision making and behavior through wishful thinking.

The findings highlight how overoptimism, a type of cognitive bias, is closely linked with overconfidence. Too much optimism can result in poor decision making and often goes hand in hand with overconfidence. Understanding the difference between optimism and overconfidence is critical to fully grasping how they influence economic behavior.

2.6.6 Mitigation

The results of mitigation strategies underscore methodologies that can aid individuals in mitigating the adverse impacts of overconfidence and cognitive biases. [Cheng \(2010\)](#) proposed a strategy to mitigate the influence of the confirmation heuristic. By deferring the ultimate decision-making process, individuals allow their unconscious mind to assess information and allocate appropriate weights to salient factors objectively. It is widely posited that unconscious cognition is more efficacious in this capacity than conscious mentation. This methodology aids in reducing overconfidence by encouraging a more equitable and logical evaluation of data.

Another approach to address overconfidence is to consider the origin of the information. According to

[Abreu and Mendes' \(2012\)](#) research, investors who exhibit overconfidence and rely on information from their social networks tend to engage in lower levels of trading activity. The proposition above implies that the act of acquiring information from external sources that are less susceptible to personal biases can aid in reducing overconfidence. By acquiring varied perspectives and insights, individuals can enhance their decision-making abilities and mitigate the adverse effects of overconfidence.

[Rieger et al. \(2022\)](#) have identified cognitive reflection as a possible mechanism for reducing biases in belief updating. Cognitive reflection pertains to pausing and critically evaluating one's initial thoughts and beliefs. The research has provided initial indications that cognitive reflection can mitigate the inclination towards biases in updating beliefs while potentially enhancing the inclination towards effect, particularly negative affect. Through the practice of cognitive reflection, individuals can mitigate the effects of overconfidence and arrive at more rational judgments by conducting a more objective evaluation of the information at hand.

As mentioned above, the results underscore the significance of executing measures to mitigate the adverse impacts of overconfidence and cognitive biases. Adopting specific decision-making strategies, such as postponing decisions, gathering information from various sources, and employing cognitive reflection, can enhance the objectivity and soundness of decision-making processes. This can mitigate the adverse effects of overconfidence and enhance the overall quality of decisions.

2.6.7 Retail investors

[Jaiyeoba et al. \(2019\)](#) found that institutional and retail investors are similar in how their behaviors are measured. However, their actions diverge regarding religious and herding biases, while they show similarities in representative heuristics, overconfidence, and anchoring biases. [Hooshangi and Loewenstein \(2018\)](#) highlight the risks of overconfidence for entrepreneurs, showing that entrepreneurs often need more confidence in their ideas, leading them to make more significant investments.

Entrepreneurs often need more confidence in others' ideas and hesitate to invest in them. However, the possibility of another investor capitalizing on an opportunity they passed up can increase their willingness to invest. This goes against the common belief that lower imitation risks deter pioneering entrepreneurs. [Mushinada \(2020\)](#) found evidence of cognitive biases, such as self-attribution and overconfidence, among Indian stock market participants. These biases can hinder transparent decision making,

especially in uncertain or hostile scenarios. However, the study also aligns with the adaptive market hypothesis, suggesting that investors can learn from errors, adjust to market changes, and help achieve market balance. Despite biases, investors can make rational choices by adapting to new circumstances.

2.7 Hindsight bias

HB refers to the tendency of people to believe, after an event has happened, that they had known the outcome all along. The first study showed that people affected by HB adjusted their beliefs as predicted by the model, showing less volatility in their views. A study on investment bankers found that they also displayed HB when asked about economics, banking, and finance topics. Surprisingly, their level of expertise did not significantly influence this bias. Interestingly, bankers who exhibited less HB tended to perform better financially (Biais & Weber, 2009).

The research also found that when people were paid more, they were more likely to experience HB. This means they were more inclined to think they could have predicted an event's outcome after it happened, especially if much money was involved. Additionally, Chelley-Steeley et al. (2015) suggest that the number of people experiencing HB can be influenced by the financial rewards linked to an event.

2.8 Confirmation bias

Studies by Duong et al. (2014), Chang and Cheng (2015), and Cai et al. (2022) show that CB occurs when investors and analysts tend to actively look for and interpret information in a way that matches their existing beliefs or opinions.

Duong et al. (2014) found that investors in value and glamour stocks exhibit CB, leading to biased reactions to financial news. Value investors, who often have a more pessimistic view, tend not to react much to good news but respond usually or even too strongly to bad news. On the other hand, those attracted to glamour stocks, who are generally more optimistic, react slowly to negative news and are more likely to value or overrate positive news. This study provides solid evidence of how CB causes investors to react differently to financial information.

Chang and Cheng (2015) argue that investors exhibit CB by seeking and interpreting information that aligns with their existing beliefs. Their research suggests that CB becomes more pronounced in environments with abundant information. However, in settings where information is minimal, market reactions to irrelevant news or the absence of it tend to show the opposite effect. Specifically, a 1% increase

in intangible returns for small firms leads to a 2.33% drop in their monthly returns over the next year, whereas large firms see a slight increase of 0.70% in returns. These findings support the idea that CB significantly influences how the market behaves across different company sizes.

Cai et al. (2022) present CB while making earnings predictions in response to consensus expectations. Analysts tend to favor information consistent with their prior forecasts, and individuals who have demonstrated superior performance in the past exhibit a more pronounced CB. Analysts with limited predictive expertise may have an advantage in avoiding CB, as obsolete hypotheses do not burden them.

To summarize, the studies above offer valuable insights into CB, highlighting its influence on investment decision making, market reactions, and earnings forecasts made by analysts. Investors and analysts must acknowledge the presence of this bias and endeavor to surmount it, enabling them to render more impartial and equitable evaluations.

3 Managerial implications

CEO overconfidence, as highlighted by Malmendier and Tate (2005), Ko and Huang (2007), and Mueller and Brettel (2012), can be beneficial, particularly for investments in innovation and research and development. However, financial managers must keep a close eye on this bias, especially during economic downturns, to avoid negative consequences, as suggested by Benson and Ziedonis (2010), Hatoum (2021), and Lee et al. (2023). Introducing safeguards such as advisory boards or investment committees is essential for improved risk management. These groups can critically review significant decisions, ensuring that investments driven by CEOs are balanced with thorough risk and opportunity assessments. This approach leverages the positive sides of CEO overconfidence while controlling its downsides, leading to a more balanced corporate governance and decision-making process.

As Barber and Odean (2001) highlight, investors may exhibit overconfidence, wherein they perceive themselves to possess more trading knowledge than they possess, which leads to increased trading activity. Hence, investment bankers should be encouraged to base their decisions on their financial capabilities and experience rather than heuristic biases or emotional sentiments. Recognizing and understanding these biases can help investors make more informed decisions, improve investment performance, and may aid in creating efficient markets.

Managerial overconfidence may result in the expeditious depletion of OCF due to excessive investment,

which may prompt managers to overstate reported OCF figures (Yang & Kim, 2020). This highlights the need for robust risk management strategies to address the manipulation of OCF. Firms might consider implementing more stringent financial oversight mechanisms, such as enhanced auditing processes or more rigorous review procedures for investment proposals and financial reporting. Additionally, encouraging a culture of realistic financial forecasting could also be beneficial in reducing the likelihood of OCF manipulation. Andriosopoulos et al. (2013) and Andreou et al. (2018) state that CEO overconfidence can facilitate the execution of share repurchase programs (buybacks), which in the long term can have positive as well as negative impacts. Therefore, firms should consider implementing more nuanced criteria for evaluating buyback decisions, potentially incorporating independent assessments or external advice to counterbalance the optimism of overconfident CEOs, especially in challenging environments.

Further, to effectively manage risks and make informed investment decisions, managers should institute reflection periods before critical decisions (Cheng, 2010), diversify sources of information to avoid echo chambers (Abreu & Mendes, 2012), and promote a culture of cognitive reflection where initial instincts are critically assessed. Such practices encourage more balanced and objective decision making, reducing the likelihood of errors stemming from overconfidence and enhancing the overall quality and sustainability of managerial decisions in the face of uncertainty.

4 Future research directions

Drawing upon the discoveries of this research, which have shed light on the complex field of biases in investment decision making, encompassing the subtle function of overconfidence and its diverse implications, it is apparent that the pursuit of knowledge in this field is still ongoing. The findings of our study indicate that biases have three main consequences. These consequences include their impact on investment decision making and risk management, possible positive effects on the mental well-being of managers, and allocation of additional resources to R&D of the firm, but also pose risks such as manipulating cash flow. Additionally, we have found certain elements that can mitigate OB.

This study significantly improves the understanding of the behavioral biases in investment decisions and risk management, setting the stage for future research. By applying our findings, especially those on reducing overconfidence bias, managers' decision making can be improved, fairer evaluations can be

promoted, and the quality of investment choices can be improved. We offer a range of research directions to further the academic discussion on biases in investment decision making and risk management.

Beber and Fabbri (2012) suggest that younger CEOs might be more prone to taking risks. However, Trejos et al. (2019) found that age does not significantly explain overconfidence. Future studies could benefit from a broader and more diverse group of participants from different industries and regions to clarify these mixed findings and better understand the link between age and overconfidence. Additionally, researchers should look into factors that might mediate or alter the impact of age on overconfidence, such as experience and industry-specific knowledge (Trejos et al., 2019).

While there is limited research on how overconfidence affects real options, Lee et al. (2023) have started to explore its overall impact. They also highlight a significant opportunity for further study, particularly when to delay, expand, start, or stop projects.

The contradictory results concerning the correlation between overconfidence and the disposition effect and the inclination to invest in stocks with moderate market capitalization offer prospects for future investigations to scrutinize these occurrences further. A potential avenue for further research could involve exploring the fundamental mechanisms that underlie the correlation between overconfidence and the disposition effect. The investigation could encompass an analysis of cognitive biases, risk attitudes, or other psychological factors that could influence or regulate the association, as stated by Ho (2011).

Moreover, future investigations may explore the influence of personal attributes, such as trading expertise, investment acumen, and dispositional traits, on the association between overconfidence and investment conduct. By considering these factors, scholars can acquire a more intricate comprehension of the manner and rationale behind the manifestation of the disposition effect and the inclination toward specific categories of stocks among overconfident investors (Trejos et al., 2019).

Additionally, future research could look into how debt levels and access to exclusive information affect overconfident traders' tendency to hold onto losing investments for too long. This research might examine the psychological reasons, financial incentives, and regulatory factors behind this behavior. To understand these complexities better, researchers might consider long-term studies to track overconfident investors' actions over time and see how their investment decisions evolve. A longitudinal study could reveal whether overconfidence and related behaviors are consistent over time or change, and highlight the

long-term effects of overconfidence in investing, as Ho (2011) and Trejos et al. (2019) have indicated. Exploring these underresearched areas can deepen the understanding of how overconfidence interacts with investment habits and decision making.

Herrmann et al. (2015) have shown that using IT systems to decrease emotional attachment and the effect of the sunk cost fallacy on investment decisions works. This method could be helpful in many situations, such as allocating resources, managing projects, and making financial decisions. It is essential to determine if using IT in business decision making reduces or increases OB. This can help managers remedy bad choices. Studies on dealing with bias can give managers helpful information to help them deal with these problems better. Similarly, future researchers could explore the possibilities of new technologies, including artificial intelligence and machine learning, in identifying and reducing OB within real-time investment environments.

One of the findings of this study is the interrelationship framework of OB, CB, and HB. However, future studies could focus on the following key directions to deepen the understanding of how these biases interact and impact decision making by conducting a dynamic analysis that examines how these biases interact over various stages of decision-making processes. Investigating whether the presence of one bias enhances or mitigates the effects of another bias leads to complex interplays. This analysis could involve experimental designs or real-world case studies, capturing the temporal evolution of biases and their combined influence on decision outcomes.

Further, future research could also look into factors that might change how these biases interact. This includes examining how personal differences, ways of thinking, personality characteristics, and situational factors can either increase or decrease the impacts of overconfidence, confirmation, and hindsight biases. Understanding these factors can help improve decision-making models and approaches. Additionally, exploring new ways to reduce the combined effects of these biases would be valuable. For example, studying if solutions aimed at one bias, such as overconfidence, might also affect other biases, such as confirmation and hindsight.

Festinger's 1957 Cognitive Dissonance Theory suggests that people strive for consistency among their thoughts, beliefs, and actions. When inconsistencies arise, this causes discomfort (dissonance), leading individuals to seek resolution. In line with the CB hypothesis, individuals might search for information aligning with their beliefs to reduce this discomfort. Future studies could explore how cognitive dissonance strengthens CB and impacts investment

choices. Specifically, it would be interesting to examine if the tendency to interpret new information to confirm preexisting beliefs leads to suboptimal investment decisions.

The scarcity of research addressing CB and HB in investment decision making and risk management is apparent, with a substantial focus on overconfidence bias. Therefore, a significant opportunity exists for further exploration of these biases along similar lines.

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