

Beyond Knowledge: The Moderating Role of Investment Literacy in Biases and Irrational Investment Decision-Making

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ABSTRACT

Purpose – This study investigates irrational investment behavior among individual stock investors in the Indonesian capital market, with particular attention to the role of investment literacy. Grounded in behavioral finance theory, the research examines how cognitive biases—namely availability bias, overconfidence bias, and herding bias are associated with irrational investment decision-making and assesses whether investment literacy moderates these relationships. As an additional analysis, the study also explores potential gender differences in the proposed relationships.

Design/methodology/approach – This study employed a quantitative research design and utilized Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the relationships among the proposed constructs and test the moderating effects. Data were collected from 756 Indonesian stock investors through structured online and offline questionnaires. CMB preventive strategies were implemented to reduce the risk of common method bias (CMB).

Findings – The results show that while investing literacy was inversely correlated with irrational investment decision-making, availability bias, overconfidence bias, and herding prejudice were favorably correlated. Additionally, the association between availability bias and irrational investment decision-making was considerably mitigated by investment literacy; a lesser relationship between availability bias and irrational investment decision-making was linked to higher levels of investment literacy. The associations between herding bias and overconfidence bias, however, were not substantially mitigated by financial literacy. There were no discernible variations between male and female investors in the structural linkages analyzed, according to the supplementary Multi-Group Analysis (MGA), indicating that the observed associations function equally across gender groups.

Originality/Value – This study adds to the body of research on behavioral finance by showing that investment literacy plays a crucial boundary condition in the relationship between availability bias and irrational investment decision-making, but it has no discernible moderating effect in the relationships between herding bias and overconfidence bias. The study offers a more comprehensive understanding of the circumstances in which financial knowledge is linked to lower levels of irrational investment decision-making by incorporating cognitive biases, objective investment literacy, and an additional gender-based comparison within an emerging market setting.

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1. Introduction

The Indonesian capital market, as one of the main financial instruments in the country, has been in the spotlight in recent decades. Rapid economic growth, increasing public participation in investment, and the flow of globalization have strengthened the position of the Indonesian capital market as one of the most promising markets in the Southeast Asian region. However, behind this great potential, there are complex dynamics that influence investor behavior in making investment decisions, particularly in the context of stocks. Indonesian capital market investors have diverse backgrounds, motivations, and knowledge of the capital market. However, despite these differences, many investors tend to get caught up in irrational behavior that can result in suboptimal investment decisions (Athur, 2014). The irrationality of stock investors is shown by overtrading, overconfidence, and herding behavior, which are easily influenced by market reactions rather than making rational assessments of the intrinsic value of stocks, which is called cognitive bias (Ahmad & Shah, 2022; Shah et al., 2018; Sudirman et al., 2023; Sudirman et al., 2023a).

Inadequate financial and investment literacy is a major contributing factor to Indonesian stock investors' comparatively poor investment decision-making. Although the population's overall financial literacy rate increased from 38.03 percent in 2019 to 49.68 percent in 2022, according to data released by the Financial Services Authority of Indonesia (OJK), this improvement does not necessarily indicate a thorough understanding of all financial sectors. A more detailed breakdown of the survey results reveals that public knowledge remains heavily concentrated in traditional financial services, particularly banking, which records the highest literacy rate at 49.93 percent. This is followed by pawnshops (40.75 percent), insurance (31.72 percent), pension funds (30.46 percent), and financing institutions (25.09 percent). In contrast, literacy levels related to more complex financial domains remain notably low, especially in the capital market, which records only 4.11 percent, and financial technology services at 10.90 percent (OJK, 2022). This disparity highlights a structural gap in financial education, where individuals may be familiar with basic financial products but lack a sufficient understanding of investment instruments, market mechanisms, and risk management strategies associated with the capital market. Consequently, many investors enter the stock market without adequate knowledge, increasing their vulnerability to irrational decision-making and behavioral biases. The exceptionally low level of capital market literacy relative to other financial sectors underscores the urgent need for targeted educational initiatives aimed at improving investors' comprehension of equity instruments, portfolio diversification, and long-term investment planning. Strengthening capital market literacy is therefore a critical prerequisite for fostering more rational, informed, and sustainable investment behavior.

Previous empirical studies support the argument that investment literacy plays a decisive role in shaping investor participation and decision quality. Salem (2019) finds that investors with higher levels of investment literacy are more actively involved in capital market activities, while Baihaqqy et al. (2020) demonstrate that financial knowledge significantly influences the investment choices individuals make. Conversely, investors with limited financial literacy are more likely to engage in irrational investment behavior, experience unfavorable investment outcomes, and make decisions that do not align with fundamental financial principles (Sezer & Demir, 2015; Son & Park, 2019). Such investors also tend to construct poorly diversified portfolios and often avoid stock market participation altogether because of misperceptions of risk and uncertainty (Fedorova et al., 2015).

Investment literacy is thus a crucial mechanism for reducing the influence of cognitive biases that commonly distort investment decision-making. Behavioral finance theory suggests that individuals rely heavily on heuristics and subjective judgment when they lack sufficient knowledge, increasing their susceptibility to biases such as overconfidence, herding, and availability. According to Son and Park (2019), investor behavior is dynamic rather than fixed, evolving as individuals acquire new information and develop a deeper understanding of financial concepts. Therefore, investment decisions are closely linked to the quality and depth of an investor's financial knowledge. Investors with strong investment literacy are better equipped to process information critically, assess risks objectively, and recognize behavioral biases that may arise during the decision-making process. This enables them to make more rational, consistent, and goal-oriented decisions.

Building on this perspective, the present study aims to examine the role of investment literacy in mitigating irrational behavior among stock investors in the Indonesian capital market. In addition, this study places particular emphasis on gender-based differences in investment behavior. Prior research has identified gender as an important determinant of investor behavior, influencing risk tolerance, investment preferences, strategic approaches, and reactions to market information (Barber & Odean, 2000; Sudirman et al., 2025). Male and female investors may differ not only in their psychological responses to risk but also in how they utilize financial knowledge when making investment decisions. Therefore, creating more inclusive and successful financial education programs requires an understanding of how gender and investment literacy interact to affect investing behavior. By tackling these problems, this study hopes to add to the body of knowledge on behavioral finance and offer useful advice to financial institutions, regulators, and legislators that want to enhance the caliber of investor decision-making in developing capital markets.

Investment literacy thus serves as an important mechanism that may help investors evaluate information more effectively and reduce their susceptibility to cognitive biases during the investment decision-making process. Behavioral finance theory suggests that individuals often rely on heuristics and subjective judgments when making financial decisions, particularly under conditions of limited knowledge and uncertainty. Investors with limited financial knowledge tend to exhibit a higher propensity for irrational investment behavior, make less efficient financial decisions, and construct poorly diversified portfolios (Sezer & Demir, 2015; Son & Park, 2019; Fedorova et al., 2015). As argued by Son and Park (2019), investor behavior is dynamic rather than fixed, evolving as individuals acquire knowledge and assimilate new information. Consequently, biases such as availability bias, overconfidence bias, and herding bias remain prevalent among investors and are frequently associated with irrational investment decision-making. Investors may rely on readily available information, overestimate their abilities, or follow the behavior of other market participants without conducting adequate analysis.

While previous studies have generally documented the beneficial role of financial and investment literacy in improving investment decisions and market participation (Salem, 2019; Baihaqqy et al., 2020), the extent to which investment literacy mitigates different cognitive biases remains unclear. Existing evidence tends to view investment literacy as a broad protective factor against irrational behavior. However, limited research has examined whether its effectiveness varies according to specific cognitive biases. Investors with stronger financial

knowledge may be better equipped to identify, manage, and offset behavioral distortions during decision-making (Son & Park, 2019). Nevertheless, it remains uncertain whether investment literacy is equally effective in mitigating biases associated with information processing, such as the availability bias, and biases rooted in psychological tendencies or social influence, such as overconfidence and herding. This unresolved issue represents an important gap in behavioral finance literature.

In addition, prior studies have reported mixed findings regarding gender and investment behaviors. Some studies suggest that male and female investors differ in their levels of confidence, risk tolerance, investment preferences, and responses to market information (Barber & Odean, 2000; Sudirman et al., 2025). However, other studies have reported limited or inconsistent gender differences when factors such as financial knowledge, investment experience, and access to information are considered. Consequently, whether the relationships among cognitive biases, investment literacy, and irrational investment decision-making differ across gender groups remains an empirical question that warrants further investigation, particularly in emerging markets such as Indonesia.

In this context, the current study investigates the links between availability biases, overconfidence bias, herding bias, investment literacy, and irrational investment decisions among Indonesian stock investors. More precisely, through an additional Multi-Group Analysis (MGA), this study examines whether investment literacy moderates the relationship between cognitive biases and irrational investment decision-making and then determines whether these relationships differ for male and female investors. By tackling these problems, this study adds to the body of knowledge in behavioral finance by offering a more sophisticated comprehension of the circumstances in which irrational investment decision-making in an emerging market setting is linked to investment literacy.

2. Literature Review and Hypothesis Development

Availability Bias and Irrational Investment Decision-Making

Availability bias refers to the tendency of investors to disproportionately emphasize information that is readily accessible or easily recalled when assessing investment opportunities while overlooking alternative or more comprehensive sources of information (Asri, 2013; Tversky & Kahneman, 1974). Within the stock market context, this bias is often reflected in investors' preference for domestic equities over foreign securities due to their greater familiarity and easier access to local information (Waweru et al., 2008). Consequently, investment decisions are frequently based on immediately available information rather than systematic comparisons across multiple investment alternatives (Javed et al., 2017), increasing the likelihood of inaccurate assessments and excessive risk-taking (Shah et al., 2018). Investor preferences are largely shaped by information with which they have direct experience or are familiar (Harris & Raviv, 2005). This familiarity encourages rapid responses to market information (Bowers et al., 2014), leading investors to rely on cognitive heuristics such as availability bias rather than engaging in thorough and rational evaluation processes. As a result, decision-making may become irrational and prone to judgment errors (Khan et al., 2021; Sudirman et al., 2023). Drawing on the existing literature, this study argues that investors influenced by availability bias tend to prioritize information that is easily remembered or frequently encountered, such as recent news or events, over more fundamental and relevant data. Such reliance on readily accessible information can distort perceptions of risk and return,

thereby increasing the likelihood of suboptimal or speculative investment decisions. Based on this reasoning, the following hypothesis is proposed:

H₁: Availability Bias Has a Positive Influence on Irrational Investment Decision-Making.

Overconfidence Bias and Irrational Investment Decision-Making

Overconfidence bias represents a cognitive tendency in which investors systematically overestimate their knowledge, skills, and ability to interpret market information (Moore & Healy, 2008). This bias arises when excessive self-confidence leads investors to behave irrationally, engage in aggressive trading, and exhibit trading frequencies that exceed the optimal levels (Barber & Odean, 2000, 2001; Hoffmann & Post, 2016). Consequently, investment decisions influenced by overconfidence frequently deviate from the principles of expected value theory, as investors fail to objectively evaluate probabilities and potential outcomes (Asri, 2013). Previous empirical studies provide strong evidence that overconfidence bias significantly influences investment behavior. Bakar and Yi (2016), Qasim et al. (2019), and Almansour et al. (2023) demonstrate that overconfident investors are more likely to overinvest, underestimate risk exposure, and overestimate expected returns (Nofsinger & Baker, 2002). Furthermore, Kengatharan and Kengatharan (2014) show that overconfidence bias negatively affects investment choices, ultimately leading to inferior investment performance.

From a behavioral finance perspective, overconfidence bias causes investors to believe that they possess superior information or expertise compared with other market participants. This perception encourages them to disregard relevant external information, underestimate uncertainty, and rely excessively on subjective judgment rather than on systematic analysis. Consequently, overconfident investors tend to assume higher levels of risk, engage in excessive trading activity, and develop unrealistic expectations regarding potential profits. Although such investors often believe that they can outperform the market, empirical evidence suggests that their decisions frequently result in suboptimal outcomes and lower-than-expected returns. Therefore, overconfidence bias is expected to increase the likelihood of irrational investment behavior among stock investors. Based on this explanation, the following hypothesis is proposed: H₂: Overconfidence Bias Has a Positive Influence on Irrational Investment Decision-Making.

Herding Bias and Irrational Investment Decision-Making

Herding bias refers to the behavioral tendency of investors to imitate the investment actions or decisions of other market participants without engaging in independent analyses or rational evaluations (Asri, 2013). This bias arises when investors perceive greater safety or confidence in following the majority rather than relying on their judgment and analytical capabilities (Rook, 2006). In financial markets, such behavior frequently results in decision-making that prioritizes conformity over objective assessment, leading investors to follow prevailing market trends, even when those trends are not supported by fundamental analysis, particularly during periods of high market volatility (Caparelli et al., 2004). Herding behavior is influenced by various market and behavioral factors, including declining market conditions and increased uncertainty (Medhioub & Chaffai, 2018). Empirical evidence suggests that the degree of herding fluctuates over time, significantly affects stock market performance, and varies across regions and market structures (Chiang et al., 2013). For instance, studies in the Japanese banking sector reveal that herding behavior is more prevalent in regional markets, and atypical herding practices among large banks have contributed to excessive asset price

inflation and the formation of speculative bubbles (Nakagawa, 2020). By encouraging imitation rather than independent evaluation, herding behavior reduces the consideration of alternative investment strategies and increases the likelihood of poor or inefficient investment decisions (Javaira & Hassan, 2015).

Moreover, Barber and Odean (2008) argue that individual investors are more susceptible to herding behavior than institutional investors because of differences in experience and access to information. Investors with limited market experience tend to exhibit stronger herding tendencies because they lack confidence in their analytical abilities and therefore rely on the observed actions of others (Lai et al., 2016). Similarly, Durand et al. (2013) find that individuals with lower confidence levels are more inclined to depend on external opinions and collective behavior when making investment decisions. Subsequent studies by Agrawal et al. (2016) and Madaan and Singh (2019) further confirm that herding behavior plays a significant role in shaping investment decisions in the capital markets. Drawing on behavioral finance theory and prior empirical findings, this study argues that herding bias encourages investors to substitute rational analysis with social imitation. As a result, investors may misinterpret market signals, overreact to collective sentiment, and ignore fundamental information, leading to biased judgment and irrational investment behavior. When investors excessively rely on others' actions rather than objective evaluations, the probability of making suboptimal and inefficient investment decisions increases. Therefore, this study proposes the following hypothesis: H₃: Herding Bias Has a Positive Influence on Irrational Investment Decision-Making.

Investment Literacy and Irrational Investment Decision-Making

Investment literacy is a person's ability to understand basic investment concepts, recognize available investment products, and have the ability to analyze the risks and potential profits faced in investing (Lusardi & Mitchell, 2011). People who do not understand the basics of investment, including how the stock market works and asset valuation, tend not to be interested in investing in the stock market (van Rooij et al., 2012) and tend to be more careful when investing directly in stocks (Chu et al., 2017). Investors with low investment literacy tend to be more susceptible to being influenced by momentary market trends or rumors, which can lead them to make illogical decisions (Adil et al., 2022). Thus, increasing investment literacy can serve as an effective way to reduce irrational behavior and improve the quality of decision-making among investors (Takeda et al., 2013). With adequate investment literacy, investors are expected to make wiser, more measured decisions based on rational considerations, thereby avoiding irrational investment behavior. Based on the literature review conducted by the researcher, investment literacy has an important role in improving a person's ability to understand and analyze various aspects of investment. The higher the investment literacy of an investor, the greater their ability to make decisions based on accurate information, in-depth analysis, and understanding of risk. Good investment literacy can help investors avoid emotional, speculative, or impulsive behaviors that often cause irrational investment decisions. Therefore, the proposed hypothesis:

H₄: Investment Literacy Negatively Affects Irrational Investment Decision-Making.

Investment Literacy Moderated Effect of Cognitive Bias and Irrational Investment Decision-Making

Individual investment decision-making is strongly influenced by both psychological factors and the level of financial understanding possessed by investors. The behavioral finance literature emphasizes that cognitive distortions, such as availability bias, excessive self-confidence, and herding tendencies, often cause investors to neglect objective information and analytical reasoning. Consequently, investment choices may be driven by emotions, recent experiences, or social pressure rather than by careful evaluation of risk and return, ultimately leading to inefficient or irrational outcomes (Pompian, 2011). At the same time, inadequate financial literacy further exacerbates this problem, as investors who lack sufficient financial knowledge are less capable of interpreting market signals accurately and are therefore more vulnerable to making flawed investment decisions (Bucher-Koenen & Ziegelmeyer, 2011). Prior studies suggest that investors with stronger financial literacy demonstrate more cautious financial behavior. They are generally better at managing credit usage, exhibit greater emotional control, and are less likely to react excessively to short-term market fluctuations (Sevim et al., 2012). In contrast, investors with limited financial knowledge tend to display exaggerated reactions to market information, increasing the likelihood of impulsive trading and poor investment timing (Takeda et al., 2013). Empirical evidence provided by Ateşa et al. (2016) further reveals an inverse relationship between financial literacy and behavioral biases, indicating that higher levels of financial literacy are associated with lower susceptibility to psychological distortions. Consequently, understanding investor behavior requires a comprehensive approach that incorporates both cognitive biases and the level of financial competence.

Despite its importance, the moderating role of investment literacy in shaping investor behavior has not been sufficiently addressed in prior research. Several studies emphasize the need to explore how financial knowledge can function as a buffering mechanism that weakens the influence of behavioral biases on investment decisions (Al-Tamimi & Kalli, 2009; Ateşa et al., 2016). However, financial literacy is often overlooked as an intervening or moderating factor in behavioral finance models, even though it has the potential to significantly alter decision-making patterns (Adil et al., 2022). This gap highlights the necessity of examining investment literacy not only as an independent determinant but also as a crucial mitigating element that can reduce the adverse effects of cognitive biases. High levels of investment literacy enable investors to process information more critically, distinguish between relevant and misleading signals, and apply appropriate investment principles when facing uncertainty. Such capabilities allow investors to minimize the negative consequences of cognitive biases and adopt more disciplined and rational decision-making strategies (Takeda et al., 2013). Moreover, increased investment literacy enhances the overall quality of investment decisions and is positively associated with long-term wealth accumulation and effective portfolio diversification (Jappelli & Padula, 2015), particularly in complex and volatile market environments.

The behavioral bias literature consistently demonstrates that investors affected by overconfidence tend to overestimate their knowledge and predictive abilities, leading to excessive trading and unwarranted risk-taking (Barber & Odean, 2000, 2001, 2008). Similarly, investors exhibiting herding behavior are inclined to follow the actions of others rather than relying on independent analysis, often amplifying market inefficiencies (Agrawal et al., 2016;

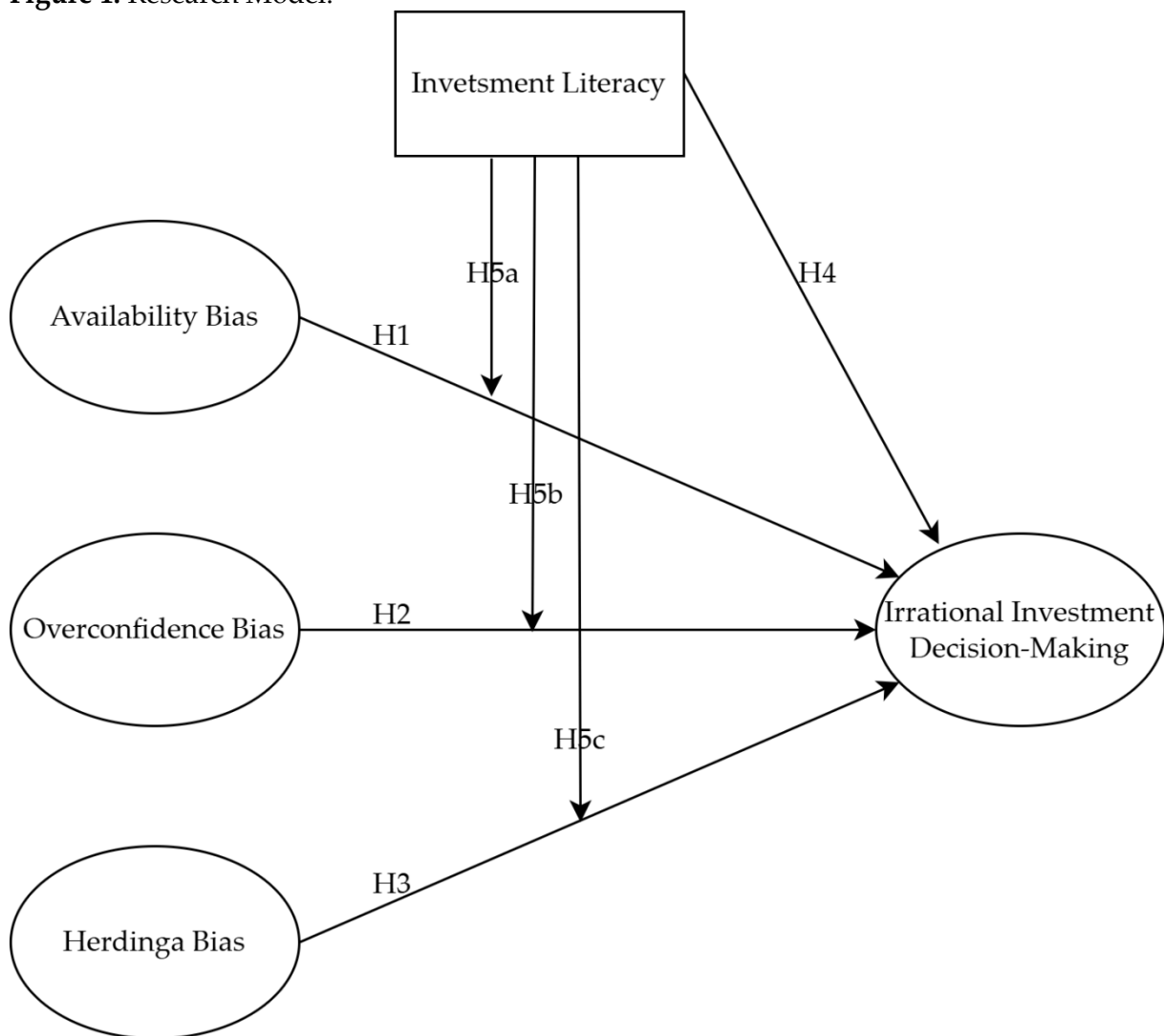
Yasir et al., 2022; Madaan & Singh, 2019). In addition, reliance on readily available or recent information, a characteristic of availability bias, can cause investors to ignore fundamental data and alternative investment options (Javed et al., 2017; Shah et al., 2018). Based on the synthesis of existing studies, this research argues that a high level of investment literacy equips investors with the cognitive tools necessary to recognize, evaluate, and manage the influence of these biases more effectively. For instance, investors who possess a sound understanding of diversification and risk management principles are less likely to rely solely on recent information or to engage in trend-following behavior. By fostering analytical thinking and informed judgment, strong investment literacy helps investors reduce their reliance on cognitive shortcuts and supports more rational investment decision-making. Accordingly, this study proposes the following hypothesis:

H5a: Investment Literacy Moderates the Effect of Availability Bias on Irrational Investment Decision-Making.

H5b: Investment Literacy Moderates the Effect of Overconfidence Bias on Irrational Investment Decision-Making.

H5c: Investment Literacy Moderates the Effect of Herding Bias on Irrational Investment Decision-Making.

Figure 1. Research Model.



H1: Availability Bias Has a Positive Influence on Irrational Investment Decision Making.

H2: Overconfidence Bias Has a Positive Influence on Irrational Investment Decision Making.

H3: Herding Bias Has a Positive Influence on Irrational Investment Decision-Making.

H4: H4: Investment Literacy Negatively Affects Irrational Investment Decision Making.

H5a: Investment Literacy Moderates the Effect of Availability Bias on Irrational Investment Decision Making.

H5b: Investment Literacy Moderates the Effect of Overconfidence Bias on Irrational Investment Decision Making.

H5c: Investment Literacy Moderates the Effect of Herding Bias on Irrational Investment Decision Making.

3. Methodology

This study used a quantitative explanatory research approach to examine the causal links between investment literacy, cognitive biases, and investment decision-making behavior. Since the main goal of the study is not only to describe observed events but also to explain why they occur and to empirically evaluate the validity of established theoretical frameworks, an explanatory method is acceptable (Neuman, 2014). Using this method, this study aims to offer solid empirical proof of the ways in which cognitive biases and investment literacy affect investors' decision-making in the Indonesian stock market. Both online and offline survey approaches were used to gather data for this investigation. Purposive sampling was used to choose respondents, and the target population consisted of Indonesian individual stock investors. This sampling strategy was selected to guarantee that participants fulfilled particular requirements pertinent to the study's goals, such as having prior stock investment experience and actively participating in investment decision-making. The goal of using both online and offline data-gathering techniques was to increase sample diversity and strengthen the generalizability of the findings.

There were two primary phases to the research process. Following the recommendations of Hair et al. (2022), the first step was to evaluate the validity and reliability of the measurement tools. PLS-SEM, or partial least squares structural equation modeling, was used to examine the study's data. Measurement and structural model testing were the two primary phases of the investigation. The initial phase sought to assess the reliability and validity of the study's constructs. Confirmatory factor analysis (CFA) was used to evaluate convergent validity by looking at the Average Variance Extracted (AVE) and factor loading values. The AVE value must be at least 0.50, and the factor loading must be greater than 0.70. Additionally, discriminant validity was assessed using the Fornell-Larcker criteria, which involves comparing the square root of the AVE ($\sqrt{\text{AVE}}$) value to the correlation between constructs. If a construct's $\sqrt{\text{AVE}}$ value is higher than its correlation with other constructs, it is considered to have good discriminant validity. Cronbach's alpha and composite reliability (CR) were used to test construct reliability; a minimum value of 0.70 is advised to indicate the internal consistency of the research instrument in evaluating the constructs under investigation.

The study moved on to the structural model stage to examine the linkages between constructs and test the research hypotheses when the measurement model satisfied the validity and reliability requirements. At this point, the coefficient of determination (R^2) was used to assess the model's predictive power, and effect size (f^2) was used to examine each exogenous construct's contribution to the endogenous construct. Cohen's criteria, which state that 0.02

denotes a minor effect, 0.15 a medium effect, and 0.35 a high effect, were used to interpret the f^2 value. To determine the path coefficients, t-statistics, and p-values, a bootstrapping approach with 5,000 subsamples was used for hypothesis testing. At a significance level of 5%, a relationship between constructs is deemed significant if the t-statistic value is larger than 1.96, and the p-value is less than 0.05. Additionally, by creating interaction constructs using the Two-Stage Approach, this study examines the moderating impact of investing literacy on the link between availability bias, overconfidence bias, and herding bias with irrational investment decision-making. If the interaction path had a p-value less than 0.05, the moderating effect was deemed significant. This suggests that the degree of investing literacy can either increase or decrease the impact of behavioral bias on investors' irrational investment decisions. This study used multi-group analysis (MGA) to examine potential gender disparities in the structural relationships in addition to examining the direct and moderating effects.

To ensure data accuracy and relevance, instruments were developed using a systematic and rigorous procedure. Based on accepted theories and earlier empirical research, the important variables were first precisely identified. Each variable was then divided into its corresponding dimensions and indicators, which were modified using approved measurement scales found in the body of existing literature. A small sample of respondents participated in a pilot test to assess the reliability, readability, and clarity of the questionnaire. Before the instrument was utilized in the main survey, it was improved and refined based on the feedback from the pilot study. In addition, this study addressed the issue of common method bias (CMB), which may arise when data for all variables are collected from a single source using the same measurement method. To mitigate this potential bias, several procedural remedies were incorporated into the questionnaire design, following the recommendations of Malhotra et al. (2006) and Podsakoff et al. (2003). Ensuring respondent anonymity, lowering evaluation anxiety, and carefully crafting and phrasing the questionnaire items to reduce ambiguity and social desirability bias were some of these solutions.

Data collection was conducted in two phases. The first phase involved a pilot study consisting of 50 offline questionnaires distributed to stock investors in Pekanbaru. This phase aimed to test the reliability and validity of the measurement instruments and identify any potential issues prior to large-scale data collection. The second phase comprised the main survey, which involved the distribution of 500 offline questionnaires to stock investors in the Bangkinang-Pekanbaru area and 300 online questionnaires shared through a Telegram group dedicated to stock investors. This approach resulted in a targeted total sample size of 800 respondents. Following data collection, a screening process was conducted to ensure that all responses met the study eligibility criteria and were suitable for analysis. Of the 500 offline questionnaires collected, 40 responses were excluded due to incomplete answers and failure to meet the predefined respondent criteria, such as not being active stock investors or lacking investment experience. Similarly, among the 300 online questionnaires received, 4 responses were removed because of incomplete data and ineligibility based on the screening criteria. Consequently, 44 questionnaires were excluded from the dataset. After the screening and data cleaning procedures, 756 valid responses remained and were retained for subsequent statistical analyses, yielding an effective response rate of 94.5%.

This study examines several key constructs related to investment behavior. Irrational investment decision-making refers to an individual's tendency to rely on intuitive judgments, such as instincts, feelings, and spontaneous reactions, when making investment-related decisions. This construct reflects the extent to which investors depend on intuition rather than systematic analysis when selecting investment alternatives. Irrational investment decision-making was measured using five items adapted from Rasheed et al. (2018), which have been widely used in prior behavioral finance research. Investment Literacy refers to an individual's level of understanding of investment-related concepts, risks, and strategies. This construct encompasses knowledge of stock market mechanisms, asset price fluctuations, diversification principles, and risk management practices (van Rooij et al., 2012). Higher investment literacy is expected to enhance investors' ability to critically evaluate information and make rational investment decisions. Investment Literacy was measured using eight items developed by Salem (2019). Availability Bias captures the extent to which investors rely on easily accessible or readily recalled information when making investment decisions. Such information may originate from friends, family members, online platforms, media sources, or investment experts. Consistent with the heuristics theory proposed by Tversky and Kahneman (1974), this bias can lead investors to overweight recent or prominent information while neglecting more relevant but less salient data. Availability Bias was measured using five indicators adapted from Abdin et al. (2017) and Nada and Moa'mer (2013). Overconfidence bias refers to an individual's excessive belief in their investment knowledge, judgment, and ability to predict future market movements. Overconfident investors tend to underestimate risks and overestimate their chances of success, which may result in suboptimal investment outcomes (Pompian, 2011). This construct was measured using five indicators adapted from established behavioral-finance studies. Finally, Herding Bias describes the tendency of investors to follow the actions of the majority or mimic the investment behavior of others, particularly during periods of rising market conditions. Such behavior often occurs without a thorough analysis and may be driven by social pressure or fear of missing out (Pompian, 2006). Herding Bias was measured using four indicators adapted from Salem (2019).

The measurement scales utilized in this study were derived from previously validated instruments reported in the extant literature. The adoption of established indicators contributes to the robustness of the research design by ensuring adequate content validity and facilitating comparisons with prior empirical findings. As these indicators have undergone validation procedures in earlier studies, their use provides greater confidence in the accuracy and consistency of construct measurement. In addition, reverse-worded items were incorporated to mitigate potential common method bias and response-pattern bias. Following prior studies, the third and fourth items of the Herding Bias construct were formulated as reverse statements. This approach helps reduce respondents' tendency to provide automatic or socially desirable responses and encourages a more thoughtful evaluation of each item. Before conducting the empirical analysis, the responses to these reverse-coded items were transformed accordingly, so that higher values uniformly reflected a higher degree of herding behavior.

Table 1. Operational Definition and Variable Measurement

Variables	Measurement Item	Scale
Irrational Investment Decision-Making: Habits that form within individuals when making investment decisions are often influenced by intuitive responses, where they rely more on hunches and feelings in the decision-making process (Scott & Bruce, 1995).	When it comes to investing, I trust my instincts and reflexes.	Likert
	I generally invest in what seems good for me.	
	When it comes to investing, I trust my gut instincts.	
	When I invest, it is more essential to me to feel like I am making the proper decision than to have a reasonable rationale for it.	
	When it comes to investing, I like to trust my gut instincts (Rasheed et al., 2018).	
	What are the main functions of the stock market?	
	Which of the following assets shows the highest price fluctuations over time?	
	When investors divide their funds among several assets, what happens to investment risk?	
	What does a beta (risk coefficient) of less than 1 indicate?	
	Which of the following statements is true regarding mutual funds?	
Investment Literacy: The ability to make investment judgments and one's comprehension of the principles, dangers, and tactics related to investing in a variety of financial products, including stocks, bonds, mutual funds, and real estate (van Rooij et al., 2012).	If interest rates fall, bond prices will fall. Is this statement correct?	Dummy
	Will buying a single stock provide a higher rate of return than buying a stock mutual fund?	
	Do investments that offer above-average returns tend to have above-average risk? (Salem, 2019).	
	I will buy stocks recommended by my friends.	
	I will buy stocks based on information from the internet.	
	I will buy stocks based on information obtained from stocks of other companies in a similar industry.	
	I will buy stocks of a company based on information recommended by a financial expert.	
	I consider information from close friends or colleagues as a reliable source of reference in my stock purchases. (Abdin et al., 2017; Nada & Moa'amer, 2013).	
	I am an experienced investor.	
	I am more confident in my investing decisions than my colleagues or friends.	
Availability Bias: The level of dependence a person has on available information can influence the way he or she makes decisions (Tversky & Kahneman, 1974).	I can forecast future stock price fluctuations using multiple analysis.	Likert
	I am an expert investor in the stock market.	
	I am always confident that I will make a profit when selling/buying stocks. (Abdin et al., 2017; Nada & Moa'amer, 2013).	
	I make investments based on the decisions of the majority of other investors.	
	I make investing selections when the market is in a bullish state.	
Overconfidence bias: unreasonable confidence in one's intuitive reasoning, judgment, and cognitive abilities (Pompian, 2011).		Likert
Herding Bias: the tendency of individuals to follow the actions or decisions of the majority in a group, often without		Likert

considering in-depth personal analysis or opinions (Pompian, 2006).	I can confidently make selections that differ from the bulk of investors in the market. My judgments are unaffected by stock market volatility. (Salem, 2019).
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Source: data processed by researchers 2025.

This study's measurement strategy integrated both subjective and objective measures. A five-point Likert scale (1 = strongly disagree to 5 = strongly agree) was used to operationalize availability bias, overconfidence bias, herding bias, and investment choice as latent factors measured using several items. Meanwhile, rather than being a latent construct, investment literacy was operationalized as an observable composite score. Respondents were given a set of investment knowledge questions covering basic investing concepts in accordance with the objective method of financial literacy measurement. Each correct answer received a score of 1, and each incorrect answer received a score of 0. Higher values indicate higher levels of investment knowledge. The scores were then added to provide a total investment literacy score.

This operationalization follows the financial literacy literature, which emphasizes the assessment of actual knowledge through objective testing rather than through subjective self-assessments. As a result, Investment Literacy was treated as a directly observed variable in the structural model. According to Hair et al. (2022), measurement model assessment procedures, including indicator reliability, internal consistency reliability, convergent validity, and discriminant validity, are applicable to latent constructs measured through multiple indicators because such constructs are not directly observable and must be inferred from their indicators. In contrast, observed variables represented by a single composite score are directly measured and, therefore, do not require evaluation through latent variable measurement criteria. Consequently, investment literacy was included directly in the structural model and was not subjected to convergent validity, discriminant validity, or reliability assessment. This approach is widely adopted in financial literacy research, where objective knowledge scores are commonly modeled as observed variables because they represent respondents' actual level of knowledge rather than an underlying latent psychological construct.

4. Result and Discussion

Data Analysis

This study used a quantitative research approach with partial least squares structural equation modeling (PLS-SEM) to investigate the predicted links between the study constructs and to assess the moderating effects. The analysis was conducted in two phases. The measurement model was first evaluated using confirmatory factor analysis (CFA) within the PLS-SEM framework. To ensure that the latent constructs were sufficient, this step involved assessments of indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. Investment Literacy was integrated directly into the structural model because it was operationalized as an observed composite score obtained from objective knowledge questions. As a result, it was not included in the validity and reliability tests that were applied to the latent constructs. Second, the suggested theories were tested by evaluating the structural model. This examination evaluated collinearity, path coefficients, coefficients of determination (R^2), and effect sizes (f^2). The statistical significance of the proposed correlations was assessed using

bootstrapping techniques. Additionally, the moderating function of investment literacy in the interactions between availability bias, overconfidence bias, herding bias, and irrational investment decision-making was investigated through the analysis of interaction effects. Lastly, the structural linkages between male and female investors were examined using multi-group analysis (MGA) to see if there were any significant differences.

Descriptive statistics

This research utilized a survey methodology for data collection, targeting stock investors on the Indonesia Stock Exchange. To ensure an inclusive sample, research questionnaires were distributed both online and offline. Offline distribution occurred in Bankinang and Pekanbaru, where 500 questionnaires were distributed, yielding 453 valid responses that met the sample criteria. From the 349 online respondents, 303 were deemed eligible, bringing the total valid sample size to 756 respondents. Table 2 presents the demographic characteristics of the respondent sample. The table above provides an overview of investor profiles covering various categories such as gender, age, investment experience, and types of stocks invested. Based on data on the gender category, the majority of investors are male, with a total of 574 people or 76% of the total population, while female investors number 182 people, representing 24%. This shows that male participation in investment is more dominant than female. In terms of age, most investors are in the 20-29 year age range, which is 640 people or 85% of the total. This indicates that the young age group is the largest investor. Meanwhile, investors under the age of 20 number 110 people (14%), and only 1% or 6 people are between the ages of 30-39, which shows that investment is more in demand by relatively young individuals.

Table 2. Respondent Characteristics

Profile	Number	Percentage
Gender		
Male	574	76
Female	182	24
Age		
<20 year	110	14
20-29 year	640	85
30-39 year	6	1
Investment Experience		
Less than 1 year	78	10
1-5 year	534	71
6-10 year	134	18
More than 10 Year	10	1
Type of Stock		
Sharia Indexed Stocks	508	67
Conventional Stocks	248	33

Source: data processed by SmartPLS 3.

Most investors in this study have 1–5 years of investment experience (534 people or 71%). Meanwhile, 18% (134 people) have 6–10 years of experience, 10% (78 people) have less than one year, and only 1% (10 people) have more than 10 years of experience. This shows that the majority are relatively new investors. Investment experience helps explain how respondents manage their stock portfolios. Those with 1–5 years of experience generally have basic stock market knowledge and are refining their strategies, while beginners (10%) are just entering the market. Only a small portion (1%) are highly experienced investors, indicating limited expert

participation. In terms of stock preference, 67% (508 people) invest in sharia stocks, while 33% (248 people) choose conventional stocks. This suggests strong interest in sharia-based investments, driven by growing awareness of sharia principles. Experience may also shape preferences: more experienced investors tend to diversify into conventional stocks, while newer or more cautious investors may prefer sharia stocks due to stricter risk and transparency standards.

Table 3. Data Descriptive

Construct	Mean	Min	Max	S. Deviation
AB1	2.860	1.000	5.000	0.899
AB2	2.722	1.000	5.000	0.891
AB3	3.093	1.000	5.000	0.920
AB4	2.997	1.000	5.000	0.950
AB5	3.029	1.000	5.000	0.958
OB1	4.032	2.000	5.000	0.708
OB2	3.987	1.000	5.000	0.699
OB3	3.989	1.000	5.000	0.709
OB4	3.984	1.000	5.000	0.690
OB5	4.050	1.000	5.000	0.702
IIDM1	4.008	2.000	5.000	0.636
IIDM2	3.865	2.000	5.000	0.683
IIDM3	4.116	2.000	5.000	0.584
IIDM4	3.931	1.000	5.000	0.702
IIDM5	3.712	1.000	5.000	0.793
HB1	3.889	1.000	5.000	0.719
HB2	3.889	1.000	5.000	0.733
HB3	3.759	1.000	5.000	0.711
HB4	3.829	1.000	5.000	0.736
IL	4.325	1.000	8.000	2.111

Source: data processed by SmartPLS 3.

Table 3 presents the descriptive statistics of the study variables. The results show that Availability Bias (AB) has the lowest mean scores among the constructs, ranging from 2.722 to 3.093, indicating a moderate tendency among investors to rely on readily available information when making investment decisions. In contrast, Overconfidence Bias (OB) exhibits relatively high mean values (3.984–4.050), suggesting that respondents generally have strong confidence in their investment knowledge and abilities. Herding Bias (HB) also shows relatively high mean scores (3.759–3.889), indicating that respondents tend to consider the actions and opinions of other investors in their decision-making process. Similarly, Irrational Investment Decision-Making (IIDM) records high mean values (3.712–4.116), implying that intuitive judgments and subjective considerations play an important role in respondents' investment decisions. Investment Literacy (IL) has a mean score of 4.325 (SD = 2.111), reflecting a moderate to relatively high level of investment knowledge among respondents. However, the larger standard deviation suggests greater variation in literacy levels compared to the other constructs.

Measurement Model

The research instrument testing was carried out by testing the validity and reliability for

each variable indicator used in the study. Validity testing was carried out using 2 tests, the first is convergent validity by looking at the factor-loading value and the average value of the extracted variance (AVE) to test whether all indicators used in the study were able to explain the construct being tested (Hair et al., 2019), the standard for convergent validity testing is > 0.5 (Hair et al., 2022), then the researcher conducted a discriminant validity test using the square root value of the average extracted variance and construct reliability testing using the cronbach alpha value and composite reliability with a threshold value of ≥ 0.70 (Hair et al., 2019).

Table 4. Convergent validity test results

Item	Factor Loading	AVE	Validity Status
IIDM1	0.805		Valid
IIDM 2	0.795		Valid
IIDM 3	0.814	0.618	Valid
IIDM 4	0.814		Valid
IIDM 5	0.695		Valid
AB1	0.878		Valid
AB2	0.824		Valid
AB3	0.831	0.735	Valid
AB4	0.867		Valid
AB5	0.885		Valid
OB1	0.874		Valid
OB2	0.922		Valid
OB3	0.917	0.814	Valid
OB4	0.928		Valid
OB5	0.870		Valid
HB1	0.873		Valid
HB2	0.903		Valid
HB3	0.831	0.733	Valid
HB4	0.814		Valid

Source: data processed by SmartPLS 3.

Convergent validity test results in the irrational investment decision-making variable, all items have a factor loading above the threshold of 0.5, with values ranging from 0.695 to 0.814. The AVE value of 0.618 also indicates that more than 61.8% of the variance explained by the indicators can be attributed to the irrational investment decision-making construct itself. This indicates that the indicators are representative enough to measure the concept of irrational investment decision-makings well. Although IIDM5 has a slightly lower factor loading (0.695),

it still meets the minimum requirements and is still considered valid. In the Availability Bias variable, all indicators show very good factor loading values, with values ranging from 0.824 to 0.885. The AVE value of 0.735 indicates that most of the indicator variance can be explained by the Availability Bias construct. With a fairly high AVE value, it can be concluded that these indicators are very strong in measuring availability bias, a construct that describes an individual's tendency to make decisions based on information that is easy to remember or available.

Overconfidence Bias is a variable with very strong convergent validity, with factor loading values for the five indicators ranging from 0.870 to 0.928, and an AVE value of 0.814. AVE above 0.8 indicates that this construct is very well explained by its indicators. The level of overconfidence in this context is measured very accurately, indicating that this construct can be relied on to explain the phenomenon of overconfidence bias in the respondents studied. Finally, in the Herding Bias variable, the indicators show good validity, with factor loadings ranging from 0.814 to 0.903, and an AVE of 0.733. This value indicates that the indicators in the Herding Bias construct are also quite strong in describing the tendency of follower behavior in irrational investment decision-making. With strong convergent validity, the herding bias variable can be relied upon to explain psychological phenomena in which individuals tend to follow the behavior of the majority without adequate rational consideration.

Table 5. Results of discriminant validity and construct reliability testing

CA	CR	AB	HB	IIDM	OB
0.910	0.933	0.857			
0.878	0.916	0.131	0.856		
0.844	0.890	0.380	0.325	0.786	
0.943	0.956	0.315	0.273	0.503	0.902

Note: diagonal line (Bold) is the AVE root of the correlation between constructs. CR: composite reliability. Source: data processed by SmartPLS 3.

The assessment of discriminant validity and reliability for the constructs availability bias, herding bias, irrational investment decision-making and overconfidence bias indicates that each variable demonstrates strong measurement adequacy, both in distinguishing itself from other constructs and in terms of internal consistency. Discriminant validity refers to the degree to which a construct is empirically distinct from related constructs. For this study, the discriminant validity evaluation shows a diagonal value of 0.857 in the discriminant validity matrix, signifying that the availability bias construct is clearly differentiated from the other measured variables. In the discriminant validity test, the diagonal value of 0.856 indicates that the Herding Bias construct is valid and significantly different from other constructs, with a low correlation with the Availability Bias construct (0.131) and irrational decision-making (0.325), which confirms the existence of clear conceptual differences. Testing the discriminant validity of the Overconfidence Bias construct, the diagonal value of 0.902 indicates that this construct is valid and significantly different from other constructs. Its correlation with irrational Investment decision-making of 0.503 indicates a moderate relationship, which may reflect that overconfidence bias influences irrational investment decision-making, but can still be distinguished as a separate construct.

Finally, a diagonal value of 0.786 was obtained in the discriminant validity matrix indicating that the irrational investment decision-making construct has fairly good discriminant validity. Its correlation with the Availability Bias construct (0.380) and Overconfidence Bias (0.503) shows a significant relationship but does not interfere with its discriminant validity. In addition, the reliability assessment examines how consistently the measurement instrument captures the construct it is intended to represent. The reliability evaluation for the Availability Bias construct yields a cronbach’s alpha (CA) of 0.910 and a Composite Reliability (CR) value of 0.933, indicating a high level of internal consistency. This value indicates that the instrument for measuring Availability bias is very reliable, with a CR value above 0.7 which is the minimum standard for good reliability. Reliability testing on the Herding Bias construct, the CA value of 0.878 and CR of 0.916 indicate a strong level of reliability. This indicates that the indicators in this construct can measure the herding phenomenon consistently and accurately. The Overconfidence Bias construct has a CA value of 0.943 and a CR of 0.956, which is the highest value among all constructs. This indicates that the instrument for measuring overconfidence bias is very reliable and consistent. Finally, reliability testing on the irrational investment decision-making construct, the CA value of 0.844 and CR of 0.890 indicate that this construct is reliable, although slightly lower than the availability bias and herding bias constructs. However, this value is still within acceptable limits for measurement reliability.

Table 6. Common Method Bias Testing

Total Variance Explained					
Initial Eigenvalues			Extraction Sums of Squared Loadings		
Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
6.969	36.679	36.679	6.969	36.679	36.679

Source: data processed by SmartPLS 3.

The results of the common method bias (CMB) test with a % of Variance value of 36.679% indicate that a small portion of the total variance explained in the model is caused by the same measurement method. According to Malhotra et al (2006), it is emphasized that when the % of Variance value of this single-factor test is below the 50% threshold, it indicates that the measurements carried out in the study are free from common method bias problems. Based on the results of the CMB test, this study is valid and is not affected by bias caused by the data collection method.

Measurement Invariance Assessment

Prior to conducting the gender-based multi-group analysis (MGA), measurement invariance was assessed using the Measurement Invariance of Composite Models (MICOM) procedure proposed by Henseler et al (2016). Establishing measurement invariance is essential to ensure that the constructs are interpreted similarly across groups and that any observed differences in structural relationships are not attributable to measurement discrepancies.

Table 7. Compositional Invariance Assessment

Construct	Compositional Invariance			Equality of Means and Variances			Conclusion
	Original Correlation	5% Quantile	Permutation p-Values	Mean Difference	Mean Variance	Permutation p-Values	

Availability Bias	0.999	0.998	0.442	0.199	-0.125	0.020	Partial Invariance
Herding Bias	0.996	0.994	0.113	-0.080	0.096	0.367	Full Invariance
Irrational Investment Decision-Making	0.999	0.998	0.357	-0.047	0.070	0.586	Full Invariance
Investment Literacy	1.000	1.000	0.313	-0.085	-0.143	0.347	Full Invariance
Overconfidence Bias	1.000	0.999	0.203	0.031	-0.080	0.697	Full Invariance

Source: data processed by SmartPLS 3.

The first phase of MICOM, configural invariance, was established since the male and female groups used the same measurement items, data treatment processes, model specifications, and algorithm parameters. As a result, the fundamental conditions for group comparison were met. Compositional invariance was assessed in the second phase. All of the key constructs' initial correlations were found to be higher than their corresponding 5% quantile values, and the permutation tests produced non-significant findings ($p > 0.05$). These results demonstrate compositional invariance by confirming that the constructs were built similarly among male and female investors. The equality of composite mean values and variances was evaluated in the third stage. The third stage evaluated the equality of composite mean values and variances. The findings showed that all of the main constructs supported equality of variances. For the majority of constructs, equality of means was also established; nevertheless, there was a notable variation in the mean values of Availability Bias between male and female investors. Henseler et al. (2016) claim that partial measurement invariance, which enables meaningful comparison of structural relationships across groups, can be achieved by establishing compositional invariance. Partial measurement invariance was attained, according to the MICOM data. As a result, it is safe to perform and understand the ensuing multi-group analysis (MGA) that compares male and female investors.

Table 8. Multi-grup analysis (MGA) test gender different

	Path Coefficients-diff (LK - PR)	p-Value new (LK vs PR)
Availability Bias -> Irrational Investment Decision-Making	-0.048	0.540
Availability*Investment Literacy -> Irrational Investment Decision-Making	-0.105	0.242
Herding Bias -> Irrational Investment Decision-Making	-0.013	0.889
Herding*Investment Literacy -> Irrational Investment Decision-Making	-0.008	0.931
Investment Literacy -> Irrational Investment Decision	0.087	0.240
Overconfidence Bias -> Irrational Investment Decision-Making	0.115	0.146
Overconfidence*Investment Literacy -> Irrational Investment Decision-Making	0.160	0.081

Source: data processed by SmartPLS 3.

To determine whether the associations between the research variables varied significantly between male and female investors, a multi-group analysis (MGA) was performed. Since all of the p-values are greater than the 0.05 significance level, the findings show that none of the structural routes show significant differences across gender groups. In particular, Availability Bias's effects ($p = 0.540$). Bias Herding ($p = 0.889$). Male and female investors do not differ significantly in terms of investment literacy ($p = 0.240$) or overconfidence bias ($p = 0.146$) regarding irrational investment decision-making. Similarly, the associations between availability bias and irrational investment decision-making are moderated by investment literacy ($p = 0.242$). Additionally, there is no statistically significant difference between gender groups for Herding Bias and irrational investment decision-making ($p = 0.931$) and Overconfidence Bias and irrational investment decision-making ($p = 0.081$). These results imply that gender has little bearing on the linkages this study looked at. In other words, when it comes to how behavioral biases and investment knowledge influence their irrational investment decisions, male and female investors show similar behavioral patterns. The difference is nevertheless statistically insignificant even if the moderating effect of investment literacy on the connection between overconfidence bias and irrational investment decision-making also has a p-value that is quite close to the significance threshold ($p = 0.081$). Consequently, the findings suggest that the suggested behavioral processes function identically in both genders.

Structural Model

This study explores the moderating role of investment literacy in the Indonesian capital market as well as the impact of cognitive biases on irrational investment decision-making. The structural model was evaluated using moderation analysis, following the methodological framework suggested by Hair et al (2022). The findings offer empirical support for behavioral finance theory and provide new insights into how financial knowledge can mitigate irrational investment behavior.

Table 9. Results of the research model test

	Phat	Coefficient (β)	Direct Effect	Moderating Effect	Decision	Effect Size (F^2)
H1	AB -> IDMD	0.213	6.376 (0.000)	-	Supported	0.067
H2	OB -> IDMD	0.347	9.991 (0.000)	-	Supported	0.167
H3	HB -> IIDM	0.160	4.747 (0.000)	-	Supported	0.039
H4	IL -> IIDM	-0.235	7.389 (0.000)	-	Supported	0.087
H5a	AB*IL -> IIDM	-0.100		2.554 (0.011)	Supported	0.016
H5b	OB* IL -> IIDM	0.014	-	0.358 (0.720)	Not-Supported	0.000
H5c	HB* IL -> IIDM	0.030	-	0.782 (0.432)	Not-Supported	0.002
R ²			0.406			

Source: data by SmartPLS 3. Notes: **P < 0.01. *P < 0.05. n=756.

The findings confirm H1 by showing that Availability Bias significantly and favorably affects irrational investment decision-making ($\beta = 0.213$, $t = 6.376$, $p < 0.001$). This research suggests that while making irrational investing decisions, investors usually depend on information that is readily available, recently acquired, or frequently encountered. Compared to thorough

foundational analysis, such information becomes more cognitively salient and so has a greater impact on decision-making. H2 is supported by the highest direct effect of overconfidence bias on irrational investment decision-making ($\beta = 0.347$, $t = 9.991$, $p < 0.001$). According to the findings, investors who are overconfident in their knowledge and analytical skills are more inclined to act forcefully and autonomously while making illogical investing decisions. This finding is consistent with behavioral finance theory, which states that overconfident investors frequently overestimate their talents while underestimating investing dangers.

The analysis also demonstrates that irrational investment decision-making is positively and significantly impacted by herding bias ($\beta = 0.160$, $t = 4.747$, $p < 0.001$). Consequently, H3 is supported. This result suggests that other market players' choices and actions have an impact on investors. Investors may act in a similar manner without performing independent assessments when they witness others purchasing or selling particular stocks, especially in uncertain times. H4 is supported by the considerable negative impact of investment literacy on irrational investment decision-making ($\beta = -0.235$, $t = 7.389$, $p < 0.001$). According to the negative coefficient, investors with greater investment literacy are less likely to base their choices on behavioral biases or snap decisions. Increased investment knowledge makes it possible for investors to make more logical decisions, evaluate information more critically, and assess risks more objectively.

Concerning moderating effects. The association between Availability Bias and irrational investment decision-making is considerably moderated by investing literacy ($\beta = -0.100$, $t = 2.554$, $p = 0.011$), supporting H5a. The favorable impact of availability bias on irrational investment decisions is lessened by investing literacy, according to the negative interaction coefficient. Practically speaking, informed investors are less likely to rely only on easily accessible information since they are able to evaluate information from various sources prior to making investing decisions. Conversely, H5b is rejected because Investment Literacy does not significantly alter the link between Overconfidence Bias and irrational investment decision-making ($\beta = 0.014$, $t = 0.358$, $p = 0.720$). This result implies that the impact of excessive confidence on investment behavior cannot be mitigated by investment knowledge alone. Even highly literate investors may continue to exhibit overconfidence in their judgments and decision-making abilities. Similarly, Investment Literacy fails to moderate the relationship between herding bias and irrational investment decision-making ($\beta = 0.030$, $t = 0.782$, $p = 0.432$), resulting in the rejection of H5c. This result indicates that investors' tendency to follow the behavior of others is not significantly influenced by their level of investment literacy. Regardless of their investment knowledge, investors may still imitate market trends, expert recommendations, or peer behavior when making investment decision.

For irrational investment decision-making, the structural model shows a coefficient of determination (R^2) of 0.406, meaning that availability bias, overconfidence bias, herding bias, investment literacy, and their interaction effects account for 40.6% of the variance. This value falls into the category of moderate explanatory power, according to Hair et al. (2022). This discovery is especially significant in the context of behavioral finance since irrational investment decisions are intrinsically complicated and impacted by a wide range of psychological, economic, social, and demographic factors. Consequently, the model's capacity to account for almost 40% of the variation in irrational investment decision-making implies that investment literacy and behavioral biases are significant factors influencing investor

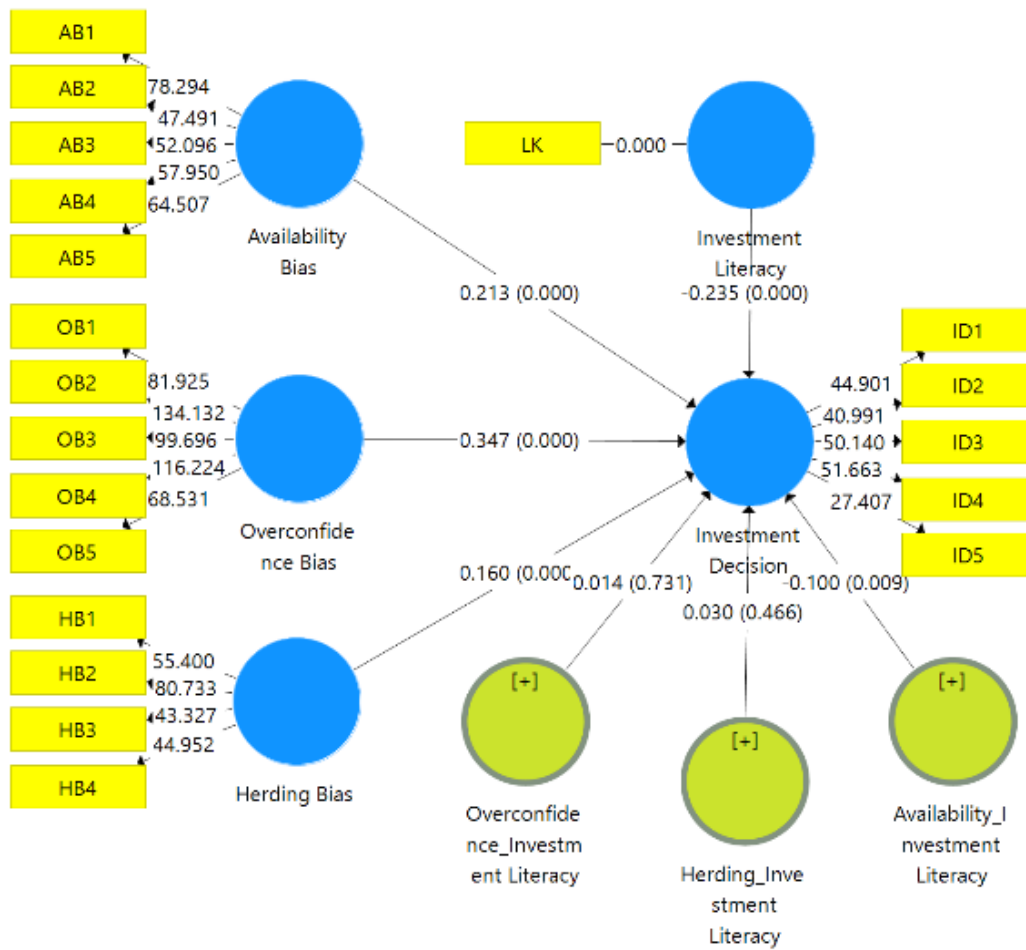
behavior. However, the remaining 59.4% of unexplained variance suggests that additional variables, including risk tolerance, financial self-efficacy, market sentiment, investment experience, financial well-being, and macroeconomic conditions, may also play a role in making irrational investment decisions and call for more research.

Effect size (f^2) was analyzed to ascertain each predictor's unique contribution to the endogenous construct in order to supplement the evaluation of explanatory power. According to Cohen's criterion, the results show that Overconfidence Bias makes the biggest contribution to the model ($f^2 = 0.167$), indicating a modest impact size. This result implies that, out of all the variables included, overconfidence is the most significant behavioral component influencing irrational investment decision-making. Excessive confidence in one's analytical and investment talents leads investors to make more frequent and decisive investment decisions, frequently underestimating the risks. This finding supports the main claim of behavioral finance, which is that one of the most enduring cognitive biases affecting investor behavior is psychological overconfidence.

The effect size for availability bias is 0.067, but the effect size for investment literacy is 0.087. Both values show significant contributions to the model even though they fall into the modest effect group. The results suggest that irrational investment decision-making is significantly influenced by investors' knowledge and comprehension of investment concepts as well as their propensity to rely on easily accessible information. These factors help to explain how investors absorb information and assess investment possibilities, even though their individual effects are not as significant as overconfidence bias. With an effect size of 0.039, herding bias has the least direct impact of all the relevant predictors. Despite being categorized as a minor influence, the outcome implies that the propensity to mimic other investors' behavior is nonetheless important in influencing irrational investing decisions. This result is consistent with the behavioral finance literature, which contends that collective behavior and social influence can impact investor decisions, especially under volatile market conditions.

As a result of the moderating effects, the interaction between investment literacy and availability bias results in an effect size of 0.016, which shows a very minor but statistically significant moderating contribution. This finding implies that, albeit to a limited extent, investment literacy mitigates the impact of easily accessible information on irrational investment decision-making. On the other hand, the interaction effects of herding bias and investment literacy ($f^2 = 0.002$) and overconfidence bias and investment literacy ($f^2 = 0.000$) are negligible, suggesting that investment literacy plays a very minor role in explaining the connections between these behavioral biases and irrational investment decision-making. These results suggest that although investment knowledge may enhance investors' capacity to analyze information, it might not be strong enough to eradicate deeply ingrained psychological traits like overconfidence and herd mentality.

Figure 2. Hypothesis testing



Discussion

Behavioral Finance Theory posits that investors’ choices are often characterized by systematic cognitive distortions, leading to patterns of behavior that deviate from the assumptions of rational decision-making in conventional financial theory. Biases such as availability, overconfidence, and herding are commonly associated with a greater reliance on subjective impressions and personal judgments rather than objective and comprehensive evaluations. According to this concept, people with lower levels of investment knowledge are more likely to make irrational investment decisions when they exhibit such cognitive tendencies. The study's findings corroborate a number of theoretical hypotheses on the connections between irrational investment decision-making, investment literacy, and cognitive biases. The substantial correlation between availability bias and irrational investment decision-making implies that investors with higher availability bias tend to prioritize information that is readily remembered or recently encountered over information that comes from thorough analysis. This result supports the theoretical claim that there may be a strong correlation between investment decisions and memory accessibility, which is linked to a higher propensity for irrational investment behavior. In this context, higher availability bias is associated with a greater likelihood of making investment decisions based on limited or readily available information (Khan et al., 2021; Sudirman et al., 2023).

The findings further indicate that overconfidence bias is positively associated with irrational

investment decision-making. Investors with higher levels of overconfidence tend to believe that they possess superior abilities to predict investment outcomes compared with other investors. This finding is consistent with Behavioral Finance Theory, which suggests that overconfidence is frequently associated with stronger risk-taking tendencies and greater confidence in investment judgments (Pompian, 2011). Among the variables examined, overconfidence bias emerged as the strongest predictor of irrational investment decision-making (Barber & Odean, 2000, 2001; Sudirman et al., 2025). Previous studies have similarly reported that overconfident investors tend to overestimate their forecasting abilities while underestimating potential risks (Moore & Schatz, 2017). Consequently, overconfidence bias appears to be closely related to investment decisions that are not fully supported by objective risk assessments.

Additionally, it was discovered that irrational investing decision-making was positively correlated with herding tendency. Irrational decision-making tendencies are more common among investors who follow the activities of other market participants without doing independent research, especially in difficult times. This result is in line with earlier studies that imply individual investment decisions are influenced by social influence and collective behavior (Nakagawa, 2020). The results indicate that herding behavior is still a significant predictor of irrational investment decision-making, even though the relationship's strength was lower than that of overconfidence bias and availability prejudice. Irrational investment decision-making was found to be adversely correlated with investment literacy. This finding suggests that investors with higher levels of investment literacy tend to demonstrate more careful information processing and greater consideration of relevant investment information. Higher investment literacy is associated a lower tendency to make decisions that are linked to cognitive biases, as financially knowledgeable investors may be better equipped to evaluate information objectively and critically (Chu et al., 2017).

The association between availability bias and irrational investment decision-making was shown to be strongly moderated by investing literacy, according to the moderating analysis. More precisely, the results imply that a reduced correlation between availability bias and irrational investment decision-making is linked to higher levels of investment literacy. When making investment decisions, investors who are more knowledgeable about investing seem to be less likely to depend solely on information that is readily available or recently encountered. This finding raises the possibility that investment literacy serves as a cognitive tool that facilitates investors' more methodical information evaluation. Crucially, the results show that investment literacy plays a selective rather than a universal moderating function.

However, the relationship between availability bias and irrational investment decision-making was significantly mitigated by investment literacy, indicating that financial knowledge may be especially important in circumstances requiring the gathering, assessing, and use of information. The associations between herding prejudice, overconfidence bias, and irrational investment decision-making, however, were not considerably mitigated by financial literacy. These results imply that having investment knowledge does not always prevent inclinations toward overconfidence or following other investors' lead. To put it another way, investors may have sufficient investment expertise but also display herd mentality or overconfidence. Consequently, it does not seem that investment literacy is consistently linked

to decreased effects across all cognitive biases. Rather, its function seems to be more focused on the connection between irrational investment decision-making and availability bias.

Gender does not significantly differentiate the associations analyzed in this study, according to the Multi-Group Analysis (MGA) results. There was no discernible difference in any of the path coefficients between male and female investors. These results imply that there is a general similarity between gender groups in the interactions between availability bias, overconfidence bias, herding prejudice, investing literacy, and irrational investment decision-making. This finding also implies that male and female investors may use similar cognitive processes while making irrational investing decisions. The Measurement Invariance of Composite Models (MICOM) approach was used to evaluate measurement invariance prior to performing the MGA. The findings supported compositional and configural invariance between the male and female groups. Furthermore, equality of variances was established for all constructs, while equality of means was supported for most constructs, except for Availability Bias. According to Henseler et al. (2016), the establishment of compositional invariance is sufficient to achieve partial measurement invariance, thereby permitting meaningful comparisons of structural relationships across groups. Therefore, the absence of significant differences observed in the MGA is unlikely to be attributed to measurement inconsistencies between male and female respondents and can be interpreted as reflecting genuine similarities in the structural relationships under investigation.

Furthermore, the absence of significant gender differences suggests that the relationships involving availability bias, overconfidence bias, and herding bias may be more closely linked to cognitive and psychological processes than to demographic characteristics. Consistent with Behavioral Finance Theory, heuristic biases arise from bounded rationality and information-processing limitations that can affect investors regardless of gender. Overall, the MGA findings suggest that gender does not substantially alter the relationships examined in this study. Therefore, the associations between cognitive biases, investment literacy, and irrational investment decision-making appear broadly comparable between male and female investors, indicating that psychological and cognitive factors may be more closely associated with irrational investment behavior than gender-related differences (Murhadi et al., 2024; Sachdeva & Lehal, 2024).

Nevertheless, these findings should be interpreted with some caution. Although the MICOM results support the validity of cross-group comparisons, the gender distribution in the sample was relatively imbalanced, with approximately 76% male respondents and 24% female respondents. Such an imbalance may reduce the statistical sensitivity of the MGA to detect subtle differences between groups. Consequently, while the current results indicate no statistically significant gender-based differences in the examined relationships, the possibility of smaller gender-specific effects cannot be entirely ruled out. Future studies are encouraged to employ more balanced gender distributions or larger female subsamples to enhance statistical power and provide a more robust assessment of potential gender-related variations in investor behavior. Taken together, the combined MICOM and MGA findings suggest that the structural relationships among cognitive biases, investment literacy, and irrational investment decision-making are largely invariant across gender groups. However, given the unequal group sizes, the conclusion should be framed as evidence of comparable behavioral patterns within the present sample rather than definitive proof that gender plays no role in

investment decision-making across all investor populations.

Conclusion and Suggestion

The study results indicate that investors who depend heavily on readily accessible or memorable information (such as frequently appearing news) tend to exhibit higher levels of Irrational Investment Decision-Making, often making decisions without thorough analysis. This behavior is associated with a greater tendency to follow short-term trends without considering the fundamental characteristics of the asset. According to the second hypothesis, irrational investment decision-making would be positively correlated with overconfidence bias. The results show that investors who exhibit higher levels of overconfidence are more likely to make mistakes in their investments because they tend to be more confident in their own judgments and may pay less attention to potential risks. Additionally, it was discovered that overconfidence bias was positively correlated with more active trading behavior because investors may think they have better knowledge or investment abilities. These inclinations can be linked to an increased chance of negative investment results.

The third hypothesis looked at the connection between irrational investment decision-making and herding prejudice. The findings demonstrate a positive correlation between irrational investment decision-making and herding behavior, or the propensity to mimic the activities of other investors without performing independent research. Stronger herd mentality investors frequently make stock purchases or sales based more on group dynamics or current market trends than on objective data. Price distortions and market inefficiencies may be linked to such conduct. According to the fourth hypothesis, irrational investment decision-making would be adversely correlated with investment literacy. The results demonstrate that investment literacy is an important predictor of irrational investment decision-making. Individuals who possess greater knowledge of capital markets and financial instruments generally exhibit more prudent and analytical investment behavior, making them less susceptible to cognitive biases such as availability, overconfidence, and herding.

According to the moderation study, the association between availability bias and irrational investment decision-making was considerably mitigated by investing literacy. More precisely, a reduced correlation between availability bias and irrational investment decision-making was linked to higher levels of investing literacy. The associations between herding bias and irrational investment decision-making and overconfidence bias and irrational investment decision-making, however, did not show any significant moderating effects. Therefore, rather than being consistently linked to reduced impacts across all biases, the role of investing literacy as a moderator appears to be restricted to particular cognitive biases.

These results imply that investors may be able to assess available information more critically if they have financial understanding. To eliminate biases related to overconfidence and social influence, however, more techniques could be required. Male and female investors did not significantly differ from one another in any of the structural correlations this study looked at, according to the Multi-Group Analysis (MGA). Across gender groupings, there were statistically similar correlations between availability bias, overconfidence bias, herding bias, investment literacy, and the moderating influence of investment literacy. Consequently, psychological biases and investment literacy appear to be more closely associated with irrational investment behavior than demographic characteristics among Indonesian stock investors.

5. Limitations and Future Research

There are a number of limitations to this study that should be noted. First, establishing causal links between cognitive biases, investment literacy, and irrational investment decision-making is limited by the use of a cross-sectional approach. Second, self-reported responses, which could be influenced by respondents' subjective opinions and social desirability bias, were used to measure the behavioral bias constructs. Third, the results' applicability to investors from other areas was limited by the sample's geographic concentration in Bangkinang and Pekanbaru. Fourth, there were demographic disparities in the sample, especially with regard to the proportion of younger investors and the gender makeup. Lastly, this study relied on survey-based impressions rather than real trade data or longitudinal observations, which could have given a more accurate picture of investor behavior.

This study emphasizes the importance of improving investors' investing literacy in order to reduce the impact of cognitive biases like as availability, overconfidence, and herding, which frequently contribute to irrational decision-making in financial markets. Investors who have a thorough understanding of asset analysis and market dynamics are less likely to be influenced by group pressure or popular news, enabling them to make judgments based on unbiased factors. This strategy can reduce the chance of losing money on rash or overconfident financial decisions. These results highlight the need for more thorough instruction on investment methods that emphasize basic analysis over short-term trends for capital market practitioners.

Future research should use longitudinal designs to investigate the stability and evolution of cognitive biases and investing literacy across time, given the constraints of the current study. The best investment education strategies for lowering particular cognitive biases in investor decision-making may be the subject of future research. In order to supplement self-reported measurements and offer more solid information about investor behavior, future research may potentially make use of experimental techniques or real trading data. In order to comprehend how these elements affect the impact of cognitive biases on investing behavior in different capital markets, additional research should look at the function of investment literacy in relation to cultural or demographic factors, such as age and experience level. Despite the abundance of information in the digital age, which may either lessen or increase these cognitive biases, future studies should also examine the effect of digital literacy in controlling availability bias..

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Appendix. Survey questions

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Investment Decision						
IDM1	When it comes to investing. I trust my instincts and reflexes.	1	2	3	4	5
IDM2	I generally invest in what seems good for me.	1	2	3	4	5
IDM3	When it comes to investing. I trust my gut instincts.	1	2	3	4	5
IDM4	When I invest, it is more essential to me to feel like I am making the proper decision than to have a reasonable rationale for it.	1	2	3	4	5
IDM5	When it comes to investing. I like to trust my gut instincts.	1	2	3	4	5
Availability Bias						
AB1	I will buy stocks recommended by my friends.	1	2	3	4	5
AB2	I will buy stocks based on information from the internet.	1	2	3	4	5
AB3	I will buy stocks based on information obtained from stocks of other companies in a similar industry.	1	2	3	4	5
AB4	I will buy stocks of a company based on information recommended by a financial expert.	1	2	3	4	5
AB5	I consider information from close friends or colleagues as a reliable source of reference in my stock purchases.	1	2	3	4	5
Overconfidence Bias						
OB1	I am an experienced investor.	1	2	3	4	5

OB2	I am more confident in my investing decisions than my colleagues or friends.	1	2	3	4	5
OB3	I can forecast future stock price fluctuations using multiple analysis.	1	2	3	4	5
OB4	I am an expert investor in the stock market.	1	2	3	4	5
OB5	I am always confident that I will make a profit when selling/buying stocks.	1	2	3	4	5

Herding Bias

HB1	I make investments based on the decisions of the majority of other investors.	1	2	3	4	5
HB2	I make investing selections when the market is in a bullish state.	1	2	3	4	5
HB3	I can confidently make selections that differ from the bulk of investors in the market.	1	2	3	4	5
HB4	My judgments are unaffected by stock market volatility.	1	2	3	4	5

Investment literacy

- 1 What are the main functions of the stock market?
 - a. The stock market helps predict the potential future earnings of stocks by analyzing various factors.
 - b. The stock market provides loans.
 - c. The stock market is a place for buying and selling shares, allowing investors to transact and invest capital in various companies.
 - d. All are correct.
- 2 Which of the following assets shows the highest price fluctuations over time?
 - a. Savings
 - b. Bonds
 - c. Preferred Stock
 - d. Common Stock

- 3 When investors divide their funds among several assets, what happens to investment risk?
- a. Increase
 - b. Decrease
 - c. Remains the same
 - d. I don't know
- 4 What does a beta (risk coefficient) of less than 1 indicate?
- a. The stock is unaffected by stock market movements.
 - b. The stock is more sensitive than the stock market.
 - c. The stock is less sensitive to market movements.
 - d. The stock responds similarly to the stock market.
- 5 Which of the following statements is true regarding mutual funds?
- a. After investing in an open-end mutual fund, investors cannot withdraw their funds in the first year.
 - b. Investments in mutual funds can be made through stock mutual funds and bond mutual funds.
 - c. Mutual funds provide a fixed and guaranteed rate of return based on past performance.
 - d. All of these are false.
- 6 If interest rates fall, bond prices will fall. Is this statement correct?
- a. Yes, the statement is correct.
 - b. No, the statement is incorrect.
- 7 Will buying a single stock provide a higher rate of return than buying a stock mutual fund?
- a. Yes, it is higher.
 - b. No, it is not higher.
- 8 Do investments that offer above-average returns tend to have above-average risk?
- a. Yes, tends to have above-average risk.
 - b. No, does not tend to have above-average risk.
-