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The moderating role of financial literacy on the nexus of financial information sources and risky investment behavior: is it contingent on financial interest and risk tolerance level?

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Abstract

Financial literacy and financial information sources are crucial in influencing investors' risky investment behavior, which is reflected in their investment decisions and performance. However, these relationships have not been fully explored, particularly in the context of Bangladesh. Understanding how different types of financial literacy interact with financial information sources can assist investors in making informed investment decisions and achieving better performance. This study offers a unique perspective by differentiating two types of financial literacy—basic financial literacy and financial market literacy—in investigating the link between risky investment behavior and five types of financial information sources—advisors, brokers, friends & family, financial reports, and media coverage. Data were collected through a self-administered structured questionnaire from 474 retail investors in Bangladesh, and hypotheses were tested via multivariate regression models. All financial information sources are highly significant, suggesting that information sourced from advisors, brokers, friends & family, financial reports, and media coverage importantly influences investors' investment decisions and performance. Specifically, basic financial literacy strengthens the informational effects of advisors and brokers on investors' investment decisions, whereas financial market literacy weakens the impact of information sourced from friends and family. With respect to investment performance, basic financial literacy improves the informational effects of advisors, whereas advanced financial literacy strengthens the informational impacts of brokers. Additionally, the moderation effects of financial literacy are contingent on investors' financial interest and risk tolerance levels, suggesting the importance of recognizing investors' unique traits. These findings expand academic understanding, support policy interventions in designing targeted financial literacy programs, and provide insights for investors in formulating investment strategies that align with their financial interest and risk tolerance levels.

Keywords: Financial literacy, Financial information sources, Retail investor, Risky investments, Risk tolerance

JEL classification: D14, D91, G11, G41

Introduction

As of 2023, the Bangladeshi stock market was considered a frontier market with a market capitalization of BDT 7808.05 (USD 70.99) billion. According to the Bangladesh Securities and Exchange Commission (BSEC), retail investors are primarily responsible for market turnover, which accounts for approximately 80% of total turnover (Habib 2022). Institutional investors, on the other hand, contribute to approximately 20% of the remaining turnover. In June 2015, the total number of stock investment accounts stood at 3.2 million, and it experienced a worrisome decline. At the end of June 2023, on the basis of data from the Central Depository Bangladesh Ltd. (CDBL 2023), the figure had dropped to 1.87 million. According to Habib (2024), the ongoing decline in the stock market index in Bangladesh has led investors to leave the stock market. The persisting stock market decline in Bangladesh is driven primarily by macroeconomic factors such as increasing interest rates in the banking industry, rising exchange rates, a lack of effective governance in the market and a lingering economic downturn, as the economy has been struggling to recover from the impacts of the COVID-19 pandemic and the Russia–Ukraine war (Habib 2024). Financial literacy promotes responsible financial behavior and can play a role in assisting in the recovery of stock market investment in several ways. Financially literate individuals are better able to navigate market recovery and make informed decisions even during market decline and uncertain times. Similarly, Akhter and Hoque (2022) and Miazee et al. (2014) reported that a lack of awareness and financial knowledge are significant obstacles to stock market participation. Investors lacking fundamental financial knowledge face challenges in making informed investment decisions (Ahmed et al. 2021; Mushafiq et al. 2023), impeding the growth of stock investment accounts in Bangladesh. Owing to their limited ability to analyze disclosed financial information and news effectively, investors in Bangladesh tend to mimic other investors' behaviors (Speidell 2009; Khan et al. 2019; Hossain and Siddiqua 2022) and are often influenced by rumors, resulting in panic selling and financial losses (Das 2019; Islam and Rahman 2014; Imran et al. 2021; Hossain and Siddiqua 2022). Financial literacy can promote the recovery of stock market investment by helping investors assess risk to prevent panic selling and impulsive reactions during market downturns. Additionally, the emergence of new innovative products and services often poses challenges to investors with limited financial knowledge. Financial literacy empowers investors to better understand these product offerings, enabling them to navigate the complexities of their investment to help promote stock market recovery.

In the context described above, the government of Bangladesh has been pushing multiple financial literacy initiatives over the last seven years, collaborating with various organizations to promote the United Nation Sustainable Development Goals (SDGs) 4 and 8. In support of SDG 4 (quality education) to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all", the Central Bank of Bangladesh (Bangladesh Bank) has issued a guideline to banks and other financial institutions to strengthen the financial literacy of people in fostering responsible financial behavior and improving their financial health (Sarker 2024). With respect to SDG 8 (decent work and economic growth), which aims to "promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all", the government of Bangladesh recognizes that in advancing SDG 8, strengthening financial literacy is a

prerequisite for bringing its people into mainstream financial and economic activities to foster sustainable economic development (Agency to Innovate (a2i), Government of Bangladesh, 2019). Improving financial literacy helps narrow financial knowledge disparities and mitigate economic inequality, thus contributing to more inclusive and sustainable economic development. However, progress toward enhancing financial literacy is still slow, and it is unclear how these financial literacy initiatives, via financial literacy upgrading programs, increase participation in financial markets and investment in the stock market. Financial literacy matters, as it enables individuals to comprehend investing ideas and evaluate risk-return choices. However, a significant number of people in Bangladesh do not have basic financial literacy, and they are not keen in learning how to make basic financial decisions (Agency to Innovate (a2i), Government of Bangladesh, 2019). Moreover, *majority of population has overconfidence in many aspects of life. When asked if they have the financial literacy, majority answers “yes” but in practice the answer is “no”*. According to the findings of Standard & Poor’s Ratings Services Global Financial Literacy Survey, financial literacy in Bangladesh was reported to be 19% (Klapper and Lusardi 2020). Hence, it is not surprising that people in Bangladesh who lack financial skills or have minimal financial knowledge may make high-risk investments and expose themselves to financial disaster from imprudent financial decisions. The consequences of financial illiteracy are high at both the individual and aggregate levels (Klapper and Lusardi 2020). Hence, it is important to examine how financially knowledgeable retail investors are in Bangladesh and to what extent higher financial literacy promotes a greater tendency for them to engage in risky investments.

Financial markets, such as the capital market, provide individuals with opportunities to invest in complex financial instruments (Liao et al. 2017; Li et al. 2020). These products have the potential to increase investors’ financial returns and facilitate long-term wealth accumulation (Koomson et al. 2023). Strong financial knowledge and literacy are needed for household and retail investors to participate actively in financial markets (Lusardi and Mitchell 2014; Mouna and Anis 2017; Hermansson et al. 2022; Prasad et al. 2021). Highly financially literate individuals tend to exhibit greater confidence in their financial decision making (Prasad et al. 2021; Zhao et al. 2023). Conversely, inadequate financial knowledge and skills restrain investors from investing in financial markets (Lusardi and Mitchell 2014). Hence, individuals with a strong understanding of financial matters generally possess greater financial assets in their investment portfolios than do those with limited financial knowledge (Feng et al. 2019; Hermansson and Jonsson 2021). In this context, financially literate investors understand the costs of financial market participation, increase their stock market engagement, and have large allocations of riskier assets such as equities and bonds in their portfolios (Jappelli and Padula 2015).

However, the influence of financial literacy on risky investment behavior depends on the type of financial literacy, namely, basic financial literacy or advanced financial literacy. Li et al. (2020) emphasized that basic financial literacy encompasses essential financial information such as interest rates, the time value of money, and numeracy skills. Financial market literacy centers mostly on the comprehension and analysis of high-risk financial investments, such as risk-return trade-offs, investments in the stock market, and the mutual fund market (Li et al. 2020). Financial market literacy is related to more advanced financial knowledge that may be directly associated with investment strategies

in financial markets and portfolio choices (Li et al. 2020; Bellofatto et al. 2018). Therefore, the impacts of basic financial literacy and advanced market literacy on risky investment behavior are expected to differ. Thus, it is crucial to examine how different types of financial literacy impact risky investment behavior among retail investors in Bangladesh, as this topic has not been investigated. In our study, risky investment behavior is a composite variable encompassing two constructs—investment decisions and investment performance.

Market news and financial information have substantial impacts on stock market movements and individual investors' decision-making (Yang 2013; Lillo et al. 2015; Naveed et al. 2020; Sadik et al. 2023; Nuzula et al. 2019; Tauni et al. 2016; Baker & Nofsinger 2010; Shiller 2003). As a result, retail investors frequently look for daily reports on financial market developments to stay informed (Shiller 2003). Retail investors obtain economic and financial information from diverse sources, such as personal networks, professional advisors, investment communities, social media, and traditional news outlets. Therefore, as investors utilize multiple information sources to make informed decisions, they develop different biases that ultimately influence their investment decisions and performance (Yao and Lei 2018; Tauni et al. 2016). Henceforth, investigating the impact of various financial information sources on the risky investment behavior of retail investors in Bangladesh would be interesting, as it has not yet been investigated. Furthermore, various financial information sources, such as advisors, brokers, friends and family, media coverage (including online sources), and financial statements, may influence investors' risky investment behavior heterogeneously.

The role of financial literacy extends beyond increasing or decreasing investments; it empowers investors in identifying investments with potential positive returns while minimizing excessive risk exposure to align with their risk tolerance. In this context, financial literacy can shift investors' risk perceptions in financial decision making. Basha et al. (2023) and Graña-Alvarez et al. (2024a, b) underscore the importance of financial literacy in shifting risk perceptions and influencing financial decisions. Basha et al. (2023) demonstrated that financially literate small business owners are more capable of understanding financial concepts and the available financial services to help address their financial constraints, leading to informed leverage decisions. Graña-Alvarez et al. (2024a, b) find that high levels of financial literacy among start-up entrepreneurs empower them to better navigate the trade-off between taking risk in using financial leverage and having a robust management control system. The findings of Chauhan and Dey (2020) suggest that financial literacy influences investors' risk perceptions by helping them better comprehend the real value of financial advice. Specifically, investors who are highly financially literate recognize the benefits of seeking financial advice for their decision making. Furthermore, past studies have shown that individuals with higher financial literacy are more risk tolerant and have a greater tendency to invest in risky financial assets than those with lower financial knowledge (Van Rooij et al., 2011), implying that financial literacy shapes investors' risk perception levels. Individuals with high financial literacy are better positioned to use financial information to make higher risk decisions than are those with low financial literacy. On the other hand, individuals with low financial literacy tend to use the same information to make conservative and lower-risk decisions. Gathergood and Weber (2017) show that financially literate

individuals are less likely to withdraw equity from their mortgages, as financial literacy improves their awareness of portfolio risks and diversification benefits. This further supports the idea that financial literacy plays a role in shaping risk perceptions, influencing individuals' financial decisions. Bellofatto et al. (2018) and De Winne (2021) document that financially literate investors are less likely to exhibit a disposition effect (the tendency of investors to realize gains too quickly and are unwilling to take losses), suggesting that changes in the risk perceptions of financially literate investors help to dampen such behavioral bias. Past studies that investigated the relationship between financial information sources and stock market participation highlighted the moderating role of financial literacy (Hermansson et al. 2022). In line with that, we contend that while investors have access to various sources of financial information, their financial literacy level influences their ability to use that information for making investment decisions. Thus, it is essential to differentiate between two types of financial literacy—basic financial literacy and advanced financial literacy—and their role in the relationship between financial information and risky investment behavior. This study differs from that of Hermansson et al. (2022) in two ways. First, instead of stock market participation, we examine risky investment behavior in two dimensions— investment decisions and investment performance—and second, we divide financial literacy into basic financial literacy and advanced financial literacy.

Hermansson et al. (2022) investigate the interaction effect between financial literacy and financial news, showing how such interaction can have different effects on stock market participation and investment behavior. The levels of individuals' financial interest and risk tolerance influence how they use financial literacy resources to make portfolio decisions (Harahap et al. 2022; Hermansson and Jonsson 2021; Lusardi 2019; Mushafiq et al. 2023). However, the impact of financial interest and risk tolerance on the study relationship is not fully understood. Hermansson and Jonsson (2021) find that financially literate individuals with financial interest exhibit a higher level of risk tolerance. Hung and Yong (2013) demonstrated that while financial literacy plays a role in determining financial behavior and outcomes, individuals' interest in finance is also important in investment decision making. Additionally, since risk is inherent in every financial decision, knowing individuals' risk tolerance is essential for understanding their financial behaviors (Hermansson and Jonsson 2021). Hence, investors with different financial interests and risk tolerance levels may seek and interpret financial information differently (Loibl and Hira 2009). On the basis of the above discussions, this study conjectures that while financial literacy may moderate the relationship between financial information sources and risky investment behavior, the moderating effects may vary across groups with high and low levels of financial interest and risk tolerance. That is, this study aims to examine whether investors' financial interest and risk tolerance levels affect the moderating role of financial literacy in the link between financial information sources and risky investment behavior, resulting in a second-stage moderated moderation analysis or a three-way moderation. This conditional moderated moderation among financial literacy, financial information sources, and risky investment behavior has not been explored in previous studies.

Building on the above background and a review of past empirical research, this study attempts to fill these gaps in the literature. To this end, this study has four objectives: (i)

to investigate the role of basic financial literacy and advanced financial literacy (financial market literacy) in risky investment behavior among Bangladeshi retail investors; (ii) to examine the role of different financial information sources in risky investment behavior among Bangladeshi retail investors; (iii) to investigate the moderating role of basic and advanced financial literacy in the relationship between various financial information sources and risky investment behavior; and (iv) to examine to what extent the moderation effects vary with investors' financial interest and risk tolerance levels. To achieve the study's objectives, we collected data through a self-administered structured questionnaire survey from 474 retail investors in Bangladesh. The questionnaire collected information from respondents about their basic and advanced literacy levels, as well as their financial interest and risk tolerance. It also inquires about respondents' use of various financial information sources, such as advisors, brokers, media, and publications, and includes items for risky investment behavior, encompassing both investment decisions and performance. Multivariate regression models are used to examine the predicted relationships and assess the role of moderating variables—primary and secondary moderators.

Our study contributes to the literature in several ways. First, this study is the first to differentiate between two types of financial literacy—basic financial literacy and advanced financial literacy—and investigate their impacts on investors' risky investment behavior in Bangladesh. Second, we expand the study of Hermansson et al. (2022) by examining risky investment behavior, encompassing two dimensions—investment decisions and investment performance—rather than stock market participation. We also extend their work by performing a multidimensional moderating effect of financial literacy on the relationship between financial information sources and risky investment behavior. Third, while Liao et al. (2017) and Li et al. (2020) investigated the impact of financial literacy on risky investment behavior in China, their studies did not consider the role of financial interest and risk tolerance in this behavior. We build upon their work by performing a moderated moderation or three-way moderation analysis, which shows that the moderation effect of financial literacy on the relationship between financial information sources and risky investment behavior varies with investors' financial interest and risk tolerance levels.

The major findings of this study are as follows. Investors possess moderate levels of basic financial literacy but poor financial market literacy levels. While basic financial literacy directly improves investors' investment decisions and performance, advanced financial literacy plays no significant role. Financial information sourced from advisors, brokers, friends and family, annual reports or financial statements, and media coverage has positive impacts on investors' investment decisions and performance. Basic financial literacy strengthened the informational impact of advisors and brokers on investment decisions. Financial market literacy weakened the informational effects of family and friends on investment decisions. For investment performance, basic financial literacy enhances advisors' impact, whereas advanced financial literacy strengthens the broker's effect. Finally, the moderation effects of financial literacy are contingent on investors' financial interest and risk tolerance levels.

The rest of the study is organized as follows. Section two discusses the literature review and develops the hypotheses. The third section elaborates on the research

methodologies. The following section presents and discusses the empirical results. The final section concludes the study with practical and policy implications.

Literature review and hypothesis development

Theoretical background

Financial literacy refers to the educational process through which people acquire the necessary knowledge and skills to manage their money properly and make informed and pragmatic decisions about financial matters. More precisely, as defined by the Organization for Economic Co-operation and Development (OECD), "Financial literacy is a combination of financial awareness, knowledge, skills, attitudes, and behavior necessary to make sound financial decisions and ultimately achieve individual financial well-being" (Atkinson & Messy, 2012). According to Lusardi (2019), financial literacy includes both people's knowledge and financial behavior.

The stock market is complex because the investment vehicles offered in the market are highly risky due to the volatile nature of the market (Chu et al. 2017; Li et al. 2020; Prasad et al. 2021; Zhao et al. 2023). In such cases, investors' financial literacy helps in optimizing investment decisions and addressing adverse market situations (Prasad et al. 2021). The prospect theory (Harahap et al. 2022; Kumar et al. 2023b) contends that people with high financial literacy tend to evaluate future gains and losses more accurately, leading them to make more informed investment decisions. Financially literate investors are better able to objectively assess and evaluate the risks of different investment options, enabling them to make well-informed choices (Lusardi and Mitchell 2014; Graña-Alvarez et al. 2024a, b; and Zhao et al. 2023). Similarly, behavioral finance suggests that people who are knowledgeable in financial matters may have better abilities to recognize and mitigate cognitive biases in decision-making. In essence, financial literacy influences investors' investment decisions in two ways. On the one hand, financial literacy improves individuals' investment decision making through enhanced financial knowledge of products and services. On the other hand, financial literacy can also make individuals more cautious of investment risks and the impacts on their well-being, which in turn can potentially prevent individuals from investing in risky assets. Therefore, the role of financial literacy goes beyond increasing or decreasing investments. It affects individuals' risky investment behaviors by empowering them to identify investments with potential positive returns while managing risks that align well with their investment goals and risk tolerance levels.

Financial information sources can be classified into formal (e.g., financial advisors and brokerages) and informal sources (e.g., friends and family, financial reports, and media coverage). These factors facilitate the ability of individuals to make better-informed financial decisions. Investors gather economic and financial information from various sources, such as family and friends, financial specialists, financial news media, and corporate reports (Nuzula et al. 2019; Tauni et al. 2016). Advisors and brokers play important roles in influencing clients' portfolio choices by providing financial suggestions and advice (Hackethal et al. 2012). Furthermore, they may also provide an in-depth analysis of financial instruments. As a result, their suggestions and expertise may encourage people to make riskier or less risky investment choices (Foerster et al. 2017). Reports and financial statements provide standardized facts and financial information, and by using

them, investors may interpret intricate financial data and make investments (Shakespeare 2020). Media coverage has the potential to trigger herd behavior when emotional responses outweigh rational thinking. Similarly, friends and family provide investors with informal initial investment guidance (Hermansson et al. 2022).

Information processing theory helps clarify how financial literacy could play a role in moderating the link between investing behavior and financial information sources. Accordingly, financial literacy improves people's capacity to analyze, comprehend, and evaluate financial data gathered from several news sources (Giri et al. 2023). Higher degrees of financial literacy help investors use information from advisers, brokers, media coverage, financial statements, and personal networks properly when making investment choices and assessing investment performance (Hermansson et al. 2022). Thus, for those with greater financial literacy, the influence of these information sources on risky investing behavior is likely more pronounced. Accordingly, in the current study context, individuals seek financial information from diverse sources (advisors, brokers, friends & family, financial reports, and media coverage), process the information, and retain adequate financial information to be used for making investment decisions. Consistent with information processing theory, investors engage in information search through the use of internal and external learning channels (Nuzula et al. 2019; Tauni et al. 2016), which process that information and incorporate it into their decision-making process and portfolio allocations (Hermansson et al. 2022). Hence, financial information obtained from various sources can affect individuals' investment decisions and performance. Additionally, according to the theories of rational expectations and financial decision theory, the information available to investors is an investment-deciding factor (Garcia 2013; Giri et al. 2023). Past studies have identified several major outlets used by investors to acquire information and knowledge in guiding their investment decision making (Hermansson et al. 2022; Yang et al. 2022).

Complementing human capital theory (Becker 2009), financial interest corresponds with the intrinsic motivation construct of self-determination theory, hence guiding information collection and utilization behaviors. Risk tolerance reflects the economic risk preferences of utility theory (Ahmad et al. 2020; Ahmed et al. 2021; Mohta and Shunmugasundaram 2024), therefore affecting individuals' attitudes toward risky investment prospects. Financial interest and risk tolerance may help moderate how investors combine financial literacy and financial information sources, hence strengthening or weakening the effects of literacy on information processing and risky investment behavior (Appelt et al. 2011).

Studies related to investor behavior in Bangladesh have focused mostly on how attitudinal factors and behavioral biases affect investor behavior (Akhter and Ahmed, 2013; Gupta and Banik 2013; Hossain and Siddiqua 2022; Khan et al. 2015; Rahman and Bristy 2016). A few empirical studies focus on financial literacy and investment or stock market participation intentions in Bangladesh. Miazee et al. (2014) investigated the barriers to basic financial literacy and their effects on Dhaka stock exchange participants. They found that a low level of financial literacy results in investors making poor investment decisions. Akhter and Hoque (2022) examined the moderating effects of financial cognitive abilities on the nexus of attitudes and behavioral intentions of investors and reported that financial literacy has no direct or interactive effects on the behavioral intentions

of investors toward stock market participation in Bangladesh. Ghose and Dhar (2022) reported a negligible inverse relationship between financial literacy level and investment intention in mutual funds in Bangladesh, and they argued that the lack of financial literacy makes investors choose saving products over capital market investments.

Hypothesis

Financial literacy and risky investment behavior

Financially knowledgeable investors are better able to comprehend the risks and uncertainties inherent in an investment, thus allowing them to make more informed investment choices (Ahmed et al. 2021; Suresh 2021; Prasad et al. 2021; Putra 2021). Financial literacy can be distinguished by its level of knowledge, such as basic financial literacy and advanced financial literacy (Sivaramakrishnan et al. 2017; Fisch and Seligman 2022). In capital market participation, one needs additional financial market knowledge or literacy along with basic financial literacy. Financial market literacy is related to more advanced financial knowledge that may be directly associated with investment strategies in financial markets and portfolio choices (Li et al. 2020; Bellofatto et al. 2018). Li et al. (2020) emphasized that basic literacy encompasses essential financial information such as interest rates, the time value of money, and numeracy skills. Financial market literacy or advanced financial literacy centers mostly on the comprehension and analysis of high-risk financial investments, such as risk-return trade-offs, investments in the stock market, and mutual fund markets (Li et al. 2020).

Raut et al. (2021) and Prasad et al. (2021) emphasize that investors' financial literacy levels are reflected in their financial decision-making processes and investment returns. Zhao et al. (2023) reported that greater financial literacy is associated with a greater likelihood of engaging in risky investment. Van Rooij et al. (2011) find that individuals with lower financial literacy are less likely to invest in stocks, implying that financial literacy influences financial decision making. Low financial literacy can interfere with risk reduction and effective resource allocation, resulting in suboptimal financial decision-making, which negatively impacts an individual's overall financial well-being. Li et al. (2020) argued that financial literacy promotes a greater inclination to seek information, as enhanced literacy promotes curiosity about financial topics. Khan et al. (2020) provide evidence that financial literacy is significantly and positively associated with investment in financial markets, even after controlling for demographic, socioeconomic, and psychological factors. Bellofatto et al. (2018) reported that subjective financial literacy promotes retail investors' behavior. Hermansson et al. (2022) and (Hermansson and Jonsson 2021) demonstrated that individuals with greater financial literacy are more likely to invest in the stock market. Mushafiq et al. (2023) also highlight how subjective and objective financial literacy influences investment choices. On the basis of the literature reviewed above, this study formulates the following hypothesis:

H₁: Financial literacy has positive impacts on risky investment behavior.

Financial information sources and risky investment

Past studies have established a relationship between financial information sources and risky investment behavior (Hackethal et al. 2012; Hermansson et al. 2022; Foerster et al.

2017; Shakespeare 2020). However, the impact of financial information sources on risky investment behavior can differ for different individuals depending on their level of financial literacy. For example, when financially literate investors source information from formal advisors and brokerages, they tend to evaluate the information to ensure that it is acceptable to reduce biases in decision-making. Additionally, while information in annual reports and financial statements is standardized, investors with higher financial literacy are more capable of accurately interpreting and incorporating this information for financial gain. Moreover, information channels such as media coverage can potentially create herd behavior in decision making, particularly when emotional responses outweigh rational thought, which can lead to financial instability and substantial repercussions. Financial literacy empowers individuals and enhances their rational decision-making. Similar implications may appear when financial literacy interacts with social networks such as friends and family.

Tauni et al. (2017) highlights that information collected from social gatherings or word-of-mouth communication is one of the key determinants influencing stock market participation and investment decisions. Nuzula et al. (2019) and Tauni et al. (2016) reported that sources of information, including family and friends, financial specialists, financial news media, and corporate reports, have significant effects on investment decisions. Their findings highlighted that financial statements and professional advisor sources are important in investment decision-making. Hermansson et al. (2022) explore the impact of private networks, financial advisors, and media learning channels on stock market participation. They discovered that learning via private networks and financial advisors has no effect on stock market participation.

Building on the literature, this study has formulated the following hypotheses:

H₂: The use of financial information sources has positive effects on risky investment behavior.

Hypotheses 1 and 2 lay the groundwork for a deeper understanding of the study's objective. Both hypotheses are tested simultaneously to capture the combined effects of financial literacy alongside the five distinct financial information sources on investors' risky investment behavior. Financial literacy and information sources are inter-related and contribute simultaneously to the decision-making process. Hastings and Mitchell (2020) show that individuals with limited financial literacy are more sensitive to how financial information is structured and communicated to them, hence affecting investment behavior. Van Rooij et al. (2011) find evidence that a large proportion of households with low basic financial literacy rely on informal information sources when making financial decisions. Those with a high level of advanced financial literacy are less likely to rely on informal channels and are much more likely to seek information from formal sources. Nguyen and Rozsa (2019) find that financial literacy is positively correlated with individuals' tendency to seek financial advice on retirement investment choices, suggesting a complementary relationship. Calcagno and Monticone (2014) show evidence that low financial literacy investors have a lower tendency to seek consultation from advisors for their financial decisions. These studies suggest that financial literacy or information sources alone may not be sufficient to explain investors' risky investment behavior. Individuals with different levels of

financial literacy engage differently with different information sources. Therefore, the impacts of financial literacy and the five distinct information sources should be analyzed simultaneously to provide a more complete understanding of their collective influence. The simultaneous testing of H1 and H2 sets the stage for moderation analyses in Hypothesis 3, which investigates how financial literacy influences risky investment behaviors through various financial information sources.

Moderating roles of financial literacy on the nexus between financial information sources on risky investment behavior

While investors can access financial information from various sources, their ability to process information and retain financial knowledge for investment decision making depends on their financial literacy level. That is, financial literacy impacts investors' decision-making by improving their ability to analyze and compare investment alternatives. Gallego-Losada et al. (2022) find that people with higher financial literacy are more likely to search for and process financial information, resulting in better financial decisions. In support of this, bounded rationality (Simon 1955) and cognitive limitations (Kahneman 2003) suggest that financial literacy may moderate how investors evaluate and act on information. In line with the above, we argue that advanced financial literacy may lessen the effects of informal sources by lowering bias sensitivity, whereas basic literacy could increase the influence of credible sources by enhancing cognitive capacity. For example, individuals with greater financial literacy possess the ability to discern between factual information and subjective opinions as well as biases with greater efficacy (Vijay et al. 2023). Self-efficacy theory posits that financial knowledge enhances self-efficacy in financial tasks, such as investment evaluation (Lone and Bhat 2022; Liu and Zhang 2021). This mitigates anxiety and decreases dependence on expert opinions disseminated through media coverage. That said, we contend that financial literacy could moderate the nexus between financial information sources and risky investment behavior. Furthermore, information processing theory suggests that financial literacy improves people's capacity to analyze, comprehend, and evaluate financial data gathered from several news sources (Giri et al. 2023). Therefore, the impacts of financial information sources on investment decisions and performance depend on the moderation effects of basic financial literacy and financial market literacy.

Li et al. (2020) reported that investors with greater financial literacy are more likely to prioritize continuous learning and information acquisition. Individuals seek new information to enhance their financial decision-making and to remain well informed. However, they have also discovered that financial knowledge is not essential for all investors to obtain higher returns from financial markets. The findings indicate that while financial literacy increases investment returns for younger and more educated families, the opposite is true for older and less educated families. Consistent with this, the results of Hermansson et al. (2022) highlight that financial literacy influences the nexus between financial news and stock market participation. Additionally, Ullah et al. (2024) examined the impacts of Chat-GPT-based insights and financial information sources on investment decisions and reported that the impacts depend on the financial literacy of investors. Hence, this study has developed the following hypotheses:

H₃: Financial literacy moderates the impact of financial information sources on risky investment behavior.

While our primary focus is to examine financial literacy as a moderator in the relationship between financial information sources and risky investment behavior, we recognize that financial literacy also functions as an antecedent in our study. The dual role of financial literacy as both an antecedent and a moderator provides a richer understanding of how financial literacy shapes financial behavior and outcomes. The antecedent role of financial literacy is well documented in the literature. For example, in a highly cited article, Lusardi and Mitchell (2014) examine the broader economic impacts of financial literacy and find that financial literacy is positively correlated with planning for saving, investment, debt management, retirement and wealth accumulation. Numerous studies have also shown that individuals with greater financial literacy are more likely to participate in the stock market, highlighting the crucial role of financial literacy in shaping investment behavior (Van Rooij et al. 2011; and Hermansson et al. 2022). As a moderator, financial literacy can influence the strength or direction of the relationship between financial information sources and risky investment behavior. The moderator role is grounded in the idea that investors' investment decisions and outcomes are guided by the use of information from various sources. In this moderator role, financial literacy might change how effectively information sources impact investment decisions and outcomes. More financially literate individuals are better at evaluating the information they receive, resulting in better investment decisions and outcomes. In contrast, individuals with lower financial literacy may be unable to use financial information effectively, leading to less favorable investment decisions and performance. In our study, the dual role of financial literacy, particularly in the context of using multiple types of financial information, aligns with the work of Hermansson et al. (2022), who examine how information from different learning channels, such as private networks, financial advisors and media, affects individuals' stock market participation and how financial literacy influences these relationships. We expand on Hermansson et al. (2022) by including five distinct financial information sources (advisors, brokers, friends & family, financial reports, and media coverage) and differentiating between basic and advanced financial literacy to demonstrate the dual role of financial literacy in the context of risky investment behavior.

Impact of financial interest and risk tolerance on the moderating role of financial literacy in the relationship between financial information and risky investment behavior

While past studies have investigated the moderating role of financial literacy in the relationship between financial information sources and risk-taking behavior, little work has been undertaken on how investors' noncognitive traits influence the dynamics of the relationship. Numerous studies have indicated that individuals with higher financial literacy are more risk tolerant and have a greater tendency to invest in risky financial assets than those with lower financial knowledge (Van Rooij et al. 2011). The results of Hermansson and Jonsson (2021) show that higher financial literacy and financial interest are associated with a higher level of risk tolerance. Hung and Yoong (2013) highlight that financial interest is important in achieving positive financial performance regardless of financial literacy level. Both financial interest (i.e., motivation to learn

about investments) and risk tolerance (i.e., capacity to bear uncertainty) could plausibly affect how financial literacy and financial information resources are applied to investment decision-making. In terms of risk tolerance, individuals with a greater propensity for risk-taking are generally more receptive to bold strategies highlighted in the media and exhibit reduced emotional responses that inhibit their willingness to take risks (Nicholson et al. 2005; Kannadhasan 2015; Mushafiq et al. 2023). Individuals with low risk tolerance tend to choose safer options, even when they are exposed to news narratives about potentially profitable opportunities. Similarly, the level of personal financial interest is a factor in critical thinking and information filtering, as individuals who are more interested in finance tend to evaluate news claims more rigorously and apply their existing knowledge in the field. Investors' high financial interest enhances their motivation to comprehend investment trends and evaluate risk-return tradeoffs, making them less likely to rely solely on headline news. Low interest in financial matters can lead individuals to make uninformed decisions that are largely influenced by superficial or irrational factors. Therefore, investors' noncognitive traits, such as risk tolerance and financial interest, can potentially impact the moderation effects of both basic and financial market literacy. On the basis of the above discussions, the following hypotheses are formulated:

H₄: The risk tolerance level moderates the moderating effects of financial literacy on the nexus between financial information sources and risky investment behavior.

H₅: Financial interest level moderates the moderating effects of financial literacy on the nexus between financial information sources and risky investment behavior.

Building on the above theoretical linkages and hypotheses, we have developed a conceptual framework, as shown in Fig. 1, demonstrating how the combination of financial literacy, financial information sources, risk tolerance, and financial interest impacts risky investment behavior. The hypotheses of this study seek to investigate the impact of

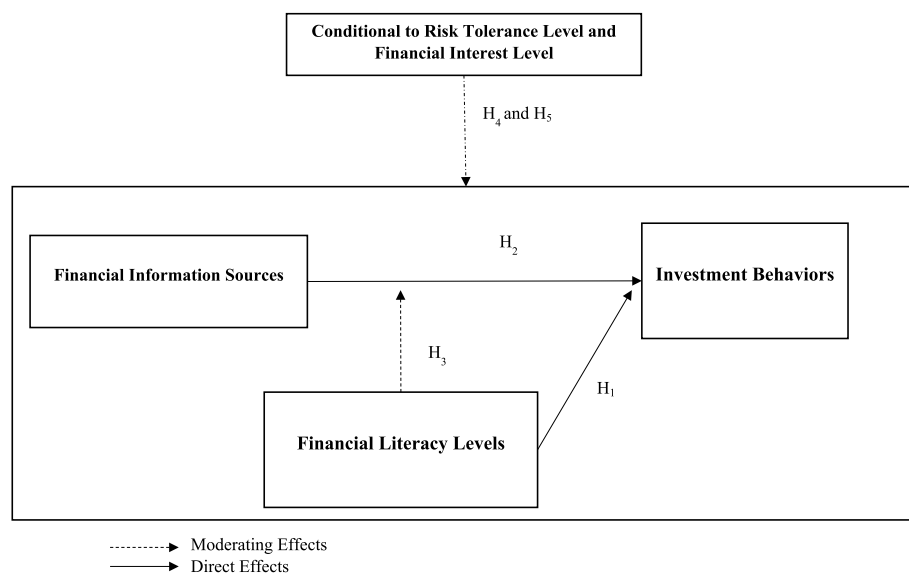


Fig. 1 Conceptual Framework

financial information sources on risky investment behavior, with a focus on how financial literacy moderates this relationship and whether the moderation effects are contingent on investors' financial interest and risk tolerance levels.

Research methodology

Research design and respondent profile

We target retail investors with a minimum investment of BDT 50,000 in bonds, stocks, and mutual funds. The reason is that these groups of investors actively participate in capital market investment and follow financial market developments (Akhter and Hoque 2022). However, the sampling frame for the population of investors is not publicly accessible, making it difficult to reach the respondents (Susanto et al. 2023). In such situations, convenient and snowball sampling methods are useful. With a convenient approach, researchers have the option to select individuals who are easily available to take part in the study, which reduces the time and effort needed, compared with using random sampling (López 2023). Additionally, in snowball sampling, current participants refer the researcher to other possible respondents, thereby increasing the sample size (López 2023). Therefore, we utilized a combination of convenient and snowball sampling methods to select our sample. This study utilized a structured questionnaire to gather data from retail investors in the stock market of Bangladesh. The questionnaire has three sections: the first section contains filtering questions with demographic questions and general investment-related questions; the second section consists of measurement items (questions) of constructs; and the third section lists two sets of financial literacy questions. We distributed more than 700 questionnaires to prospective respondents. After data filtering to exclude incomplete questionnaires and unengaged respondents, a total of 474 valid questionnaires remained for analysis. The minimum sample size required for the study is 199 for 15 predictors, including control variables. This calculation is based on an effect size of 0.15, an alpha level of 0.05, and a desired statistical power of 95%. Thus, the chosen sample size possesses sufficient power to detect the anticipated effect.

Construct measurement items

The main objective of this study is to investigate the role of financial literacy in influencing the impact of financial information on risky investment behaviors and whether the moderation effects are contingent on investors' financial interest and risk tolerance levels, which is our second objective. Our study targets and selects retail investors who participate in Bangladesh's financial market. To measure the financial literacy of investors, we separate financial literacy into two dimensions: basic financial literacy and advanced financial literacy. Following Li et al. (2020), we questioned investors about their basic financial knowledge regarding numeracy, interest compounding, and inflation. For the second dimension of financial literacy, we asked them questions on financial market literacy, which is related to investment strategies in financial markets and investment choices. Specifically, these questions are devised to assess knowledge of risk-return trade-offs, monetary policies, and financial products such as stocks and capital funds. Table 3 provides a list of questions for assessing basic financial literacy and financial market literacy.

To measure risky investment behavior, we selected investment performance and investment decision variables. This study adopted three measurement items from Ahmed and Shah (2020) to measure investment performance and investment decisions. Table 3 shows the measurement items of the questionnaire for investment decisions and performance constructs. For risk tolerance, this study adopted four items from Rahman et al. (2020) and Hermansson and Jonsson (2021). Three measurement items for financial interest were adopted from Hermansson and Jonsson (2021). Following Hermansson et al. (2022), this study selected several learning sources, such as financial advisors, brokers, friends & family, financial statements, and media coverage. The measurement items of financial risk tolerance and financial interest are also adopted from Hermansson et al. (2022). These measurement items, along with the reliability and convergent viability of the constructs, are presented in Table 1.

Table 1 Summary for Convergent Validity and Internal Consistency Reliability

	Items Loading	Cronbach-Alpha	Rho	CR	AVE
Financial Interest (Hermansson et al. (2022))		0.701	0.697	0.868	0.767
FI1: I am interested in economic matters and financial markets					
FI2: I follow the about developments in the financial markets	0.871				
FI3: I follow the about the developments of new saving products	0.880				
Risk Tolerance (Rahman et al., 2020 and Hermansson and Jonsson 2021)		0.707	0.746	0.832	0.624
RT1: I can accept to lose part of my investment if the chance of getting a good return is great	0.833				
RT2: I think one has to take risk in order to gain something	0.832				
RT3: I would like to increase risk since return is too low	0.698				
RT4: I would like to accept low risk for returns (reverse statement)	Drop				
Investment Performance (Ahmad and Shah 2020)		0.908	0.908	0.942	0.845
IP1: The return rate of your recent stock investment meets your expectation	0.889				
IP2: Your rate of return is equal to or higher than the average return rate of the market	0.942				
IP3: You feel satisfied with your investment decisions in the last year (including selling, buying, choosing stocks, and deciding the stock volumes)	0.926				
Investment Decision (Ahmad and Shah 2020)		0.769	0.778	0.866	0.683
ID1: I likely to buy the stocks that recently outperformed the market	0.783				
ID2: I prefer to invest in stocks that are frequently advertised when the market goes down	0.866				
ID3: I tend to sell some of my riskier investments and put the money in safer investment	0.829				
Basic Financial Literacy (BFL is a single item construct with a score ranging from 0 to 5)	1	1	1	1	1
Financial Market Literacy (FML is a single item construct with a score ranging from 0 to 6)	1	1	1	1	1

Cronbach's alpha; CR, composite reliability; AVE, average variance extracted; Model Information: RMR = 0.059; GFI = 923; AGFI = 0.860; NFI = 0.909; IFI = 0.910; CFI = 0.904; TLI = 0.894; RMSEA = 0.056

Respondent profile and financial literacy scores of investors

Table 2 reports the demographics and profiles of the respondents. A total of 474 questionnaires were collected, with 63.29% of the respondents identified as male.

Table 2 Respondents Profile

Gender			Age Distribution		
	Number of respondents	Frequency (in %)	Age	Number of respondents	Frequency (in %)
Male	300	63.29%	18–25	11	2.32%
Female	174	36.71%	26–33	32	6.75%
Education			34–40	63	13.29%
Level of Education	Number of respondents	Frequency (in %)	41–47	255	53.81%
Below SSC/O-level	12	2.53%	above 47	112	23.73%
SSC/O-level	36	7.59%	Investment Proportion in Risky Assets		
HSC/A-level	50	10.55%	Range	Number of respondents	Frequency (in %)
Diploma	52	10.97%	0–10%	15	3.37%
Bachelors	269	56.75%	10–20%	6	1.26%
Masters	45	9.49%	20–30%	15	3.16%
PhD	10	2.11%	30–40%	20	4.21%
Investment Experience			40–50%	32	6.74%
Years	Number of respondents	Frequency (in %)	50–60%	41	8.63%
0 to 2	46	9.70%	60–70%	69	14.53%
2 to 4	79	16.67%	70–80%	53	11.16%
4 to 6	45	9.49%	80–90%	39	8.21%
6 to 8	84	17.72%	90–100%	184	38.74%
8 to 10	122	25.74%	Preferred Investment Period		
10 to 12	36	7.59%	Period	Number of respondents	Frequency (in %)
12 to 14	16	3.38%	Intraday	18	3.80%
14 to 16	30	6.33%	Short term (less than 1 year)	183	38.61%
16 to 18	4	0.84%	Medium term (1–3 years)	167	35.23%
18 to 20	8	1.69%	Long term (more than 3 years)	42	8.86%
20+	4	0.84%	Mixed approach	64	13.50%
Frequency of trading					
Trading	Number of respondents	Frequency (in %)			
Daily	60	12.66%			
Once a week	80	17.13%			
Once a month	300	64.24%			
Once quarterly	19	4.07%			
Once in last 12 months	15	1.71%			

Table 3 Financial Literacy Score of Retail Investors

Panel A: Basic Financial Literacy	Correct	Incorrect	Do not know
According to your estimations, what is the annual interest rate of one-year fixed bank deposits?	68%	18%	13%
Suppose you have a one-year fixed deposit of 10,000 BDT, and the annual interest rate is 3%. If you do not withdraw in this period, how much money will you receive on the due date?	66%	23%	10%
After the due date of the deposit described in the above equation, if you continue to save the money as a one-year fixed deposit and the annual interest rate is 3%, how much money will you have in this account after one year, including the principal and interest?	17%	75%	8%
If the annual interest rate of your savings account is 3% and the inflation rate is 5%, how many goods can you buy from your savings in this account after one year?	69%	25%	7%
Time Value of Money: Suppose Mr. Karim inherits 100,000 BDT today and Mr. Rahim will inherit 100,000 BDT three years from now. Who has more inheritance?	70%	24%	5%
Overall Score BFL: 57.63%			
Panel B: financial market literacy	Correct	Incorrect	Do not know
In general, investments with high returns come with considerable risks	67%	20%	13%
In general, the risk of investing in one-share stock is less than that of investing in mutual funds	24%	64%	12%
Who Regulates Monetary Policy?	6%	57%	37%
When you purchase stocks of a company, this means: The definition of the P/E ratio is	76%	16%	8%
Which one of the following is correct in terms of describing the mutual fund	49%	22%	29%
Which of the following statements correctly describes the core function of the stock market?	14%	71%	15%
Overall FML: 31.47%			

Approximately 56.75% of investors, specifically 269 out of 475, possessed a bachelor's degree as their highest level of education. Investors between the ages of 41 and 47 account for 53.81% of the participants. Seventy percent of individuals possess more than six years of investment experience in capital market instruments. Table 2 shows that 39% (184 out of 474 respondents) allocated 90%–100% of their total investment to stocks, bonds, or mutual funds. Approximately 90% of the participants expressed a preference for trading via brokerage or investment houses, with approximately 10% opting for online trading. The reported monthly trading activity of the respondents is 64%. The majority of investors, comprising 39% and 36% of respondents, prefer short-term (less than 1 year) and medium-term (1–3 years) investment holding periods, respectively.

In Table 3, Panel A and Panel B present the basic financial literacy (BFL) and advanced financial literacy scores, respectively. The BFL score of 57.63% suggests a moderate comprehension of fundamental concepts such as interest rates and inflation. A 70% accuracy rate in their responses during the BFL evaluation showed that participants had a solid understanding of the time value of the money concept. This suggests that they grasp the notion that money has greater value when it is obtained earlier. The lowest BFL appraisal score was 17%, which was obtained in a multistep question involving the computation of interest earned on a deposit over numerous

years. This demonstrates individuals' limitations in applying mathematical abilities to financial situations. In general, there is evidence that there is a greater level of comprehension among individuals regarding straightforward financial products such as deposits than about more complex investments.

The financial market literacy (FML) score of 31.47% in Panel B suggests a general lack of knowledge about complex financial subjects such as equities, mutual funds, and monetary policy. A majority of individuals, specifically 67%, understand the risk–return relationship, but only 24% accurately recognize that individual stocks have greater risk than diversified mutual funds do. This highlights gaps in the understanding and application of the risk–return framework to specific financial instruments. Investors demonstrated a commendable understanding of the P/E ratio, achieving an accuracy rate of 76%. However, in terms of understanding collective investment vehicles such as mutual funds, their accuracy rate decreased to a modest 49%. The survey participants exhibit greater proficiency in comprehending and utilizing conventional equity performance indicators than in understanding specialized vocabulary-related mutual funds. The percentage of individuals who accurately identified the regulatory authority responsible for monetary policy was significantly alarming, standing at a mere 6%. The evidence of a knowledge gap regarding interest rate determination and policy tools suggests a substantial lack of information among participants. A total of 71% of the respondents answered the questions regarding the core function of the stock market incorrectly, with only 14% correctly answering the questions. The data indicate that participants are more likely to give incorrect responses than to correctly identify the appropriate conceptual definition. Additionally, the observed literacy differences between basic "risk–return" analysis and the specific instrument comparisons indicate major issues related to how basic ideas are used to make real investment decisions. The analysis suggests that the level of familiarity with financial terms plays a significant role in understanding different concepts. More specifically, the price-to-earnings ratio (P/E) received a higher score, indicating greater understanding of the term, whereas mutual funds received a lower score, suggesting less awareness of the financial terms. This implies that individuals have varying degrees of comprehension in regard to different financial concepts. Hence, there is a pressing need to increase financial literacy, particularly in areas such as markets, policy, and risk–return trade-offs, through the implementation of more comprehensive educational programs.

Empirical estimation strategy

We employ a correlational research design using ordinary least squares (OLS) regression to examine the associations between various factors and risky investment behavior. Specifically, we estimate linear models to assess the direct and interactive effects of financial literacy, financial information sources, financial interest, and risk tolerance level on two measures of risky investment behavior: performance and decision-making. The OLS approach allows us to estimate the individual and joint relationships between these predictor variables and the continuous outcome variables within a single statistical model framework. We hypothesize that factors such as financial literacy and risk tolerance may directly impact investment performance and decision-making. Additionally, we explore how these predictors may interact—for example, whether an individual's financial literacy moderates the effect of financial information sources on risky investment behavior (IB) and whether

the moderation effects are contingent on investors' financial interest and risk tolerance levels. To study the direct effects of basic financial literacy, financial market literacy, and financial information sources, we employ the following equations:

$$IB_i = \alpha + \beta_i F_i + \varepsilon_i \quad (1a)$$

$$IB_i = \alpha + \beta_i F_i + \gamma_i FL_i + \varepsilon_i \quad (1b)$$

$$IB_i = \alpha + \beta_i F_i + \gamma_i FIS_i + \varepsilon_i \quad (1c)$$

$$IB_i = \alpha + \beta_i F_i + \gamma_i FL_i + \gamma_i FIS_i + \varepsilon_i \quad (1d)$$

The moderating effects of financial literacy on the relationship between information sources and risky investment behavior participation are estimated as follows:

$$IB_i = \alpha + \beta_i F_i + \gamma_i FL_i + \beta_i FIS_i + \delta_i FL_i \times FIS_i + \varepsilon_i \quad (2)$$

where IB_i represents investors' risky investment behavior, which is proxied by investment decisions and investment performance. F_i represents the control factors as described below. Individual investment decisions and performance are influenced by multiple factors, including demographics such as age, gender, and income (Mayfield and Shapiro 2010; Jain et al. 2023). The experience and income of the investor are important indicators of trade frequency (Lan et al. 2018; Jain et al. 2023). Therefore, we consider investors' allocation to risky investment (Portion), age, gender, education (EdU), occupation (Occ), income level (Inc), investment experience (InvEx), trading frequency (TF) and preferred investment period (PrInvest) as control variables in Eqs. (1a, 1b, 1c, 1d and 2). FL_i denotes financial literacy, which includes basic financial literacy (BFL) and financial market literacy (FML). FIS_i are financial information sources such as financial advisors, brokers, friends & family, annual reports/financial statements, and media coverage.

Empirical results

Descriptive statistics and correlations

Tables 4 and 5 present descriptive statistics and a correlation matrix, respectively. The standard deviations are less than 1.5, and the skewness values are between -1.32 and 1.04 . Additionally, the kurtosis values are mostly less than 3, except for BFL. These statistics highlight the normality of the data distribution. Hence, ordinary least squares (OLS) regression could be employed to capture variation in the dependent variables. We also used the correlation coefficient to check for multicollinearity issues prior to OLS estimation. We observed the highest correlation coefficient of 0.49 between friends and family (FNF) coverage and media coverage. Since the correlation coefficient between variables is within a cutoff value of 0.90, we assume that there will be no multicollinearity issues in the estimations (Hair et al. 2013; Pallant 2011; Hoque et al. 2018).

Table 4 Descriptive Statistics

	AGE	GENDER	EDU	INC	INVEST	TF	PRINVEST	BFL	FML	FI	FNF	ADVISOR	AR	BROKERS	IP	OCC	media coverag	RT
Mean	3.92	0.69	4.61	3.29	8.11	2.71	2.91	2.89	1.89	3.52	3.46	3.40	3.40	3.50	3.28	2.68	3.42	3.29
Median	4.00	1.00	5.00	3.00	8.00	3.00	3.00	4.00	2.00	3.67	4.00	4.00	4.00	4.00	3.00	3.00	4.00	3.25
Maximum	5.00	1.00	6.00	5.00	31.00	5.00	5.00	5.00	5.00	6.00	5.00	5.00	5.00	5.00	5.00	6.00	5.00	5.00
Minimum	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.75
Std. Dev	0.91	0.46	1.15	1.04	1.37	0.91	1.05	1.47	0.84	0.74	1.01	1.03	1.04	1.00	1.08	0.96	1.06	0.58
Skewness	-1.04	-0.81	-1.32	0.01	0.79	0.06	0.77	-0.80	-0.24	-0.17	-0.43	-0.42	-0.27	-0.55	-0.07	1.04	-0.47	-0.12
Kurtosis	2.21	1.66	2.49	2.47	2.65	2.94	2.65	2.22	3.15	2.48	2.59	2.50	2.34	2.92	2.02	2.21	2.60	2.88

Investors allocation in risky investment (Portion), age, gender, education (Edu), occupations (Occ), Income level (Inc), investment experience (InvEx), trading frequency (TF) and preferred investment period (PrInvest); basic financial literacy (BFL) and financial market literacy (FML); Financial interest (FI), and Risk Tolerance (RT). Financial learning channels: financial advisors, brokers, friends & family, annual reports/financial statements, and media coverage

Table 5 Correlation Matrix

	PORTION	AGE	GENDER	EDU	INC	INVEST	TF	PRINVEST	BFL	FML	FI	FNF	ADVISOR	AR	BROKERS	IP	OCC	media coverag	RT
PORTION	1.00																		
AGE	0.27	1.00																	
GENDER	0.40	−0.09	1.00																
EDU	0.25	0.15	0.34	1.00															
INC	−0.18	0.23	−0.22	0.06	1.00														
INVEST	0.32	0.44	−0.07	0.00	0.20	1.00													
TF	0.14	0.05	0.26	0.40	−0.12	−0.13	1.00												
PRINVEST	−0.25	−0.01	−0.27	−0.33	0.36	0.12	−0.24	1.00											
BFL	0.23	0.03	0.36	0.36	−0.02	−0.19	0.27	−0.28	1.00										
FML	−0.10	0.05	−0.02	−0.01	0.22	0.00	−0.06	0.22	0.18	1.00									
FI	0.04	−0.08	0.09	0.11	0.17	−0.06	0.11	−0.03	0.20	0.06	1.00								
FNF	0.15	−0.04	0.09	0.14	0.05	−0.03	0.06	−0.08	0.19	0.02	0.15	1.00							
ADVISOR	0.10	−0.03	0.17	0.30	0.06	−0.10	0.20	−0.16	0.23	−0.03	0.18	0.37	1.00						
AR	0.05	0.01	0.07	0.14	0.14	−0.08	0.11	−0.05	0.15	0.07	0.08	0.31	0.52	1.00					
BROKERS	0.23	0.01	0.11	0.12	0.04	0.01	0.08	−0.06	0.19	0.01	0.15	0.46	0.29	0.12	1.00				
IP	0.21	0.15	0.13	0.34	0.23	−0.04	0.23	−0.13	0.46	0.09	0.23	0.28	0.40	0.28	0.26	1.00			
OCC	−0.03	0.10	−0.04	−0.12	0.10	0.07	−0.03	0.17	−0.04	0.06	0.06	−0.01	−0.11	−0.02	−0.06	−0.08	1.00		
Media coverag	0.11	0.03	0.12	0.18	0.03	−0.06	0.23	−0.05	0.19	0.02	0.06	0.50	0.48	0.39	0.22	0.25	−0.01	1.00	
RT	0.00	−0.01	−0.08	0.02	0.26	0.08	−0.08	0.18	0.05	0.18	0.13	0.05	0.07	0.10	−0.01	0.10	−0.01	0.02	1.00

Investors allocation in risky investment (Portion), age, gender, education (Edu), occupations (Occ), Income level (Inc), investment experience (InvEx), trading frequency (TF) and preferred investment period (PrInvest); basic financial literacy (BFL) and financial market literacy (FML); Financial interest (FI), and Risk Tolerance (RT). Financial learning channels: financial advisors, brokers, friends & family, annual reports/financial statements, and media coverage

Hypothesis testing

Direct impacts on risky investment behavior

We regard investment decisions and investment performance as indicators of risky investment behavior, and we treat these variables as dependent variables in our model estimations via Eqs. (1, 2). First, we assess the direct effects of financial literacy and financial information sources on investment decisions and investment performance. These findings are summarized in Tables 6 and 7 for investment decisions and investment performance, respectively.

Model 1 in Table 6 shows that several investor characteristics have an effect on investment decisions. Specifically, investors' allocation to risky investments (Portion), education level (EdU), occupation (Occ), income level (Inc), investment experience (InvEx), trading frequency (TF), and preferred investment period (PrInvest) were found to influence investment decisions. Additionally, Model 1 in Table 7 indicates that investors' allocation to risky investments (Portion), education level (EdU), income level (Inc), and investment experience (InvEx) influence investment performance. These empirical results confirm the importance of demographic and contextual factors in influencing investors' investment decisions and performance.

The findings of Models 2, 3, and 4 offer valuable insights into the distinct impacts of basic financial literacy and financial market literacy on investment decisions (Table 6) and investment performance (Table 7). Model 2 of Tables 6 and 7 report a significant positive impact of basic financial literacy on investment decisions and performance, respectively. However, for financial market literacy, Model 3 indicates that financial market literacy has an insignificant influence on investment decision-making and performance. Furthermore, when both types of financial literacy are included in Model 4, the results reveal that only basic financial literacy has a statistically significant positive effect on risky investment behavior. These empirical findings partially support Hypothesis H_1 . While basic financial literacy influences investment decisions and performance, financial market literacy does not have the expected significant impact. This suggests that basic financial literacy is more crucial than advanced financial literacy in the context of Bangladesh, where the overall financial literacy level remains relatively low. The nonsignificant impact of financial market literacy may imply that the majority of investors in Bangladesh lack advanced financial literacy, hence limiting its impact on their investment decisions and performance.

Models 5 to 9 of Tables 6 and 7 assess the impact of various financial information sources on investment decisions and performance, respectively. Table 6 shows that financial advisors, brokers, friends & family, annual reports/financial statements, and media coverage have positive effects on investment decisions. Similarly, in Table 7, these same financial information sources (financial advisors, brokers, friends and family, annual reports and financial statements, and media coverage) also positively affect investment performance. These empirical results provide strong evidence to support Hypothesis H_2 that the use of financial information from various sources positively impacts investors' risky investment behavior. Financial information obtained from multiple sources can enhance investors' knowledge and deepen their understanding of financial markets, allowing them to better evaluate risk and investment opportunities. Thus, the use of financial information from various sources contributes positively to

Table 6 Impacts of Financial Literacy and Financial Information Sources on Investment Decisions

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
BFL		0.18 (6.51)***		0.199 (6.81)***						0.17 (6.19) ***
FML			−0.01 (−0.23)	−0.089 (−1.90)						−0.09 (−2.01)
Advisor					0.19 (4.91)***					0.08 (1.78)*
Brokers						0.15 (4.02)***				0.04 (1.05)
Friends & Family							0.23(6.13)***			0.15 (3.47) ***
Annual Reports								0.17 (4.58) ***		0.088 (2.20) **
Media Coverage									0.12(3.31) ***	−0.03 (−0.94)
Portion	0.008 (4.54) ***	0.006 (3.78) ***	0.01 (4.51) ***	0.01 (3.61) ***	0.007 (4.28) ***	0.01 (3.54) ***	0.01 (3.64) ***	0.01 (4.30) ***	0.007 (4.26)	0.004 (2.59) ***
Age	−0.05 (−0.98)	−0.07 (−1.42)	−0.04 (−0.96)	−0.07(−1.35)	−0.03 (−0.71)	−0.03 (−0.73)	−0.02 (−0.41)	−0.05 (−0.96)	−0.05 (−0.98)	−0.03 (−0.69)
Gender	0.07 (0.68)	−0.05 (−0.59)	0.07 (0.70)	−0.05 (−0.55)	0.04 (0.51)	0.07 (0.75)	0.07 (0.83)	0.06 (0.59)	0.06 (0.63)	−0.03 (−0.42)
Edu	0.12 (3.01) ***	0.08 (2.10) **	0.12 (3.02) ***	0.08 (2.11) **	0.08 (2.22) ***	0.11 (2.95) ***	0.10 (2.67) ***	0.11 (2.88) ***	0.11 (2.79) ***	0.06 (1.57)
Occ	−0.08 (−2.17)	−0.09 (−2.38) ***	−0.08 (−2.16)	−0.09 (−2.36)**	−0.07 (−1.86)	−0.07 (−2.01)	−0.09 (−2.35)	−0.09 (−2.18) ***	−0.08 (−2.19) ***	−0.08 (−2.27) ***
Inc	0.28 (6.81)***	0.25 (6.19) ***	0.29 (6.78) ***	0.26 (6.38) ***	0.26 (6.20) ***	0.26 (6.40) ***	0.25 (6.29) ***	0.25 (5.98) ***	0.28 (6.63) ***	0.21 (5.2) ***
InvEx	−0.039 (−3.94) ***	−0.02 (−2.40)**	−0.03 (−3.95)	−0.02 (−2.39)	−0.03 (−3.59)	−0.03 (−3.74)	−0.03 (−3.75)	−0.03 (−3.48)	−0.03 (−3.70)	−0.02 (−2.01) ***
TF	0.13 (2.73) ***	0.10 (2.29) **	0.12 (2.71) ***	0.09 (2.18) ***	0.10 (2.35) ***	0.11 (2.63) ***	0.12 (2.80) ***	0.11 (2.48) ***	0.10 (2.18) ***	0.09 (2.08) ***
PrInvest	1.82 (6.09) ***	−0.04 (−1.28)	−0.08 (−1.89) *	−0.03 (−0.82)	−0.06 (−1.67) *	−0.08 (−1.98)	−0.07 (−1.77) *	−0.07 (−1.82) *	−0.09 (−2.10) ***	−0.02 (−0.48)
const	1.82 (6.09)***	1.71 (5.96) ***	1.83 (6.07) ***	1.78 (6.18) ***	1.38 (4.51) ***	1.41 (4.5) ***	1.18 (3.85) ***	1.41 (4.62) ***	1.58 (5.21) ***	0.92 (3.02) ***
R− Square	0.24	0.30	0.24	0.30	0.27	0.26	0.29	0.27	0.25***	0.37
F− Statistics	15.55***	19.52***	13.98***	18.198***	17.11***	16.08**	18.89***	16.70***	15.40***	16.65***
VIF (1/1-R2)	1.315	1.428	1.315	1.428	1.369	1.351	1.408	1.369	1.333	1.587

Model 1 reports the estimated results of Eq. 1a. Model 2–4 reports the estimated results of Eq. 1b. Model 5–9 reports the estimated results of Eq. 1c. Model 10 reports the estimated results of Eq. 1d. Number in parenthesis are t-statistics. In all model, Investment Decisions is dependent variables

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively

Table 7 Impacts of Financial Literacy and Financial Information Sources on Investment Performance

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10
BFL		0.26 (8.09) ***		0.26 (7.90) ***						0.23 (7.37) ***
FML			0.08 (1.61)	−0.01 (−0.24)						−0.001 (−0.028)
Advisor					0.28 (6.5) ***					0.21 (4.27)
Brokers						0.17 (3.98) ***				0.05 (1.21)
Friends & Family							0.20 (4.72) ***			0.081 (1.90) **
Annual Reports								0.18 (4.15) ***		0.04 (0.92)
Media Cover-age									0.15 (3.41) ***	−0.03 (−0.66)
Portion	0.74 (1.79)	0.58 (1.78) *	0.67 (1.89) **	0.59 (1.79) *	0.05 (0.16)	0.27 (0.7)	0.15 (0.43)	0.31 (0.85)	0.46 (1.29)	−0.33 (−0.95)
Age	0.01 (3.68) ***	0.007 (3.72) ***	0.009 (4.67) ***	0.08 (3.68) ***	0.01 (4.31) ***	0.01 (3.60) ***	0.08 (3.85) ***	0.01 (4.36)	0.01 (4.31) ***	0.05 (2.87) **
Gender	0.08 (0.90)	0.04 (0.89)	0.07 (1.22)	0.04 (0.90)	0.09 (1.75) **	0.09 (1.58)	0.10 (1.79) **	0.07 (1.36)	0.07 (1.32)	0.08 (1.58)
Edu	−0.03 (−1.92) *	−0.20 (−1.93) *	−0.05 (−0.41)	−0.20 (−1.92) **	−0.06 (−0.56)	−0.02 (−0.24)	−0.02 (−0.21)	−0.04 (−0.40)	−0.04 (−0.37)	−0.20 (−2.0) **
Occ	0.17 (2.68) **	0.11 (2.69) **	0.17 (3.68) ***	0.11 (2.68) **	0.12 (2.74) ***	0.16 (3.68) ***	0.15 (3.46) ***	0.17 (3.62)	0.16 (3.51) ***	0.07 (1.85) *
Inc	−0.06 (−1.71) *	−0.07 (−1.72) *	−0.07 (−1.50)	−0.08 (−1.71) *	−0.04 (−1.05)	−0.06 (−1.30)	−0.07 (−1.57)	−0.07 (−1.46)	−0.06 (−1.49)	−0.05 (−1.34)
InvEx	0.34 (6.13)	0.29 (6.14) ***	0.32 (6.55) ***	0.29 (6.13) ***	0.29 (6.11) ***	0.31 (6.41) ***	0.31 (6.36) ***	0.30 (6.05)	0.32 (6.63) ***	0.23 (5.09) ***
TF	−0.04 (−1.89) *	−0.02 (−1.89) *	−0.04 (−3.65) ***	−0.02 (−1.89) *	−0.03 (−3.29) ***	−0.04 (−3.53) ***	−0.04 (−3.55) ***	−0.038 (−3.30) ***	−0.04 (−3.48) ***	−0.01 (−1.45)
PrInvest	0.13 (2.01) **	0.10 (2.03) **	0.14 (2.61) **	0.10 (2.02) **	0.10 (2.07) **	0.13 (2.45) **	0.13 (2.58) **	0.12 (2.32)	0.10 (1.99)	0.08 (1.69) *
const	−0.07 (−0.45)	−0.02 (−0.51)	−0.08 (−1.68) *	−0.02 (−0.46)	−0.05 (−1.06)	−0.07 (−1.45)	−0.06 (−1.27)	−0.06 (−1.30)	−0.07 (−1.58)	−0.00 (−0.10)
R-Square	0.24	0.34	0.24	0.34	0.31	0.27	0.28	0.27	0.26	0.40
F-Statistics	16.23 ***	23.23 ***	14.93 ***	21.08 ***	20.32 ***	16.68 ***	17.52 ***	16.86 ***	16.12 ***	18.94 ***
VIF (1/1-R2)	1.315	1.515	1.315	1.51	1.449	1.369	1.388	1.369	1.351	1.667

Model 1 reports the estimated results of Eq. 1a. Model 2–4 reports the estimated results of Eq. 1b. Models 5–9 reports the estimated results of Eq. 1c. Model 10 reports the estimated results of Eq. 1d. Number in parenthesis are t-statistics

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively

investment decisions and performance. Furthermore, when we included both types of financial literacy and the various financial information sources in a single model (Model 10 in Table 6), we observed that basic financial literacy and three financial information sources (advisors, friends and family, and annual reports and financial statements) were shown to positively impact investment decisions. On the other hand, Model 10 of Table 7 reports that investors' basic financial literacy and information sourced from financial advisors positively impact investment performance. The empirical results of Model 10 highlight the importance of basic financial literacy and financial information sources for investment decision-making and performance, lending support to both hypotheses H_1 and H_2 . These findings emphasize the need to promote financial literacy, as it may enhance investors' ability to assess information received effectively from multiple sources, leading to better investment decisions and performance.

Results for the moderating role of financial literacy in the relationship between financial information and risky investment behavior

Tables 8 and 9 present the results of the moderating effect of financial literacy on the association between financial information sources and risky investment behavior, i.e., investment decisions (Table 8) and investment performance (Table 9). In these tables, we focus on the moderating effects reported in Panel B. The financial information sources from advisors, brokers, friends & family, annual reports and media coverage are entered separately into models 1 to 5, respectively. Model 6, however, combines all the financial information sources into one model.

As shown in Table 8, Models 1 and 2 provide evidence that basic financial literacy fully moderates the influence of two formal financial information sources—advisors and brokerages—on promoting investment decisions. This suggests that for such information to be useful, investors need a basic level of financial literacy to be able to effectively evaluate and act upon the information received from financial advisors and brokers, leading to informed investment decisions. Model 3 presents the results for information sourced from friends and family, revealing a contrasting moderating effect of financial literacy. While both types of financial literacy (basic literacy and financial market literacy) strongly and positively impact investment decisions, financial market literacy partially weakens the impact of friends and family on investment decision-making. The weakening effect suggests that highly financially literate investors recognize the limitations of information sourced from friends and family and thus are less likely to be influenced by such informal sources. The results of Models 1 to 3 strongly support Hypothesis H_3 . However, as shown in Models 4 and 5, neither measure of financial literacy moderated the relationship between investment decisions and information sourced from financial statements or media coverage. This suggests that financial literacy might not be as critical in understanding media content and information published in annual reports, as such information is intended for a general audience. Hence, financial literacy plays no significant role in moderating information sourced from annual reports and media outlets. Notably, when all financial information sources are entered together in Model 6, the previously found moderating effects disappear, except for the moderation effects of friends and family. This suggests that when investors have access to multiple information sources, the

Table 8 Moderating Effect of Financial Literacy on the Nexus between Financial Information Sources and Investment Decisions

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Const	2.30 (6.88) ***	2.12 (5.83) ***	1.04 (2.84)	1.87 (5.27) ***	1.93 (5.61) ***	0.76 (1.49)
Panel A: Direct Effects						
BFL	0.09 (1.21)	0.05 (0.69)	0.21 (2.52) ***	0.21 (2.48) **	0.21 (2.71) **	0.15 (1.20)
FML	−0.05 (−0.42)	0.18 (1.31)	0.41 (2.72) ***	0.05 (0.38)	0.13 (0.93)	0.35 (1.51)
Advisor	0.12 (1.24)					0.006 (0.06)
Brokers		0.17 (1.59)				0.04 (0.39)
Friends & Family			0.50 (4.68) ***			0.44 (3.77) ***
Annual Reports				0.25 (2.50) **		0.09 (0.87)
Media Coverage					0.22 (2.30) **	0.03 (1.05)
Panel B: Moderating Effects						
BFL*Advisor	0.04 (1.75) *					0.02 (0.58)
FML*Advisor	−0.004 (−0.10)					0.03 (1.23)
BFL*Brokers		0.05 (2.42) ***				−0.02 (−0.63)
FML*Brokers		−0.08 (−1.93) *				−0.02 (−0.75)
FL*Friends & Family			0.009 (0.395)			−0.12 (−2.68) ***
FML*Friends & Family			−0.15 (−3.36) ***			0.006 (0.24)
BFL*Annual Reports				0.01 (0.52)		−0.01 (−0.22)
FML*Annual Reports				−0.04 (−1.05)		−0.03 (−1.13)
BFL*Media Coverage					0.01 (0.59)	0.01 (0.37)
FML*Media Coverage					−0.06 (−1.52)	0.76 (1.49)
R-Square	0.26	0.24	0.28	0.25	0.22	0.33
F-Statistics	33.53***	29.83***	35.96***	31.45***	27.15***	13.88***
VIF(1/1-R2)	1.351	1.315	1.388	1.333	1.282	1.492

This table report the estimated results of Eq. 2. Number in parenthesis are t-statistics

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively

informational impact from formal sources such as advisors and brokers is diluted by the influence of informal sources from friends and family. This is particularly true for Bangladesh, where the financial literacy level is low, leading many investors to rely on informal sources for their investment decision making. However, basic financial literacy fully moderates this effect by weakening the influence of friends and family on investors' investment decisions. This means that investors with basic financial literacy are able to recognize and differentiate the value of information obtained from formal versus informal sources, leading them to rely less on information from friends and family. The empirical results in Table 8 provide partial support for hypothesis H₃ related to investment decisions.

Table 9 presents the results of hypothesis H₃ related to investment performance. As reported in Table 9, Model 1 reveals that financial market literacy negatively moderates

Table 9 Moderating Effect of Financial Literacy on the Nexus between Financial Information Sources and Investment Performance

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Const	1.07 (2.80) ***	1.94 (4.57) ***	1.01 (2.31) **	1.42 (3.42) ***	1.44 (3.59) ***	0.24 (0.405)
Panel A: Direct Effects						
BFL	0.18 (1.90) *	0.061 (0.61)	0.12 (1.18)	0.13 (1.31)	0.26 (2.82) ***	0.008 (0.05)
FML	0.30 (2.04) **	0.21 (1.28)	0.58 (3.23) ***	0.36 (2.15) **	0.27 (1.57)	0.78 (2.86) **
Advisor	0.38 (3.46) ***					0.31 (2.63) **
Brokers		0.11 (0.88)				−0.05 (−0.42)
Friends & Family			0.39 (3.12) ***			0.28 (2.07) **
Annual Reports				0.28 (2.35) **		0.09 (0.74)
Media Coverage					0.26 (2.27) ***	0.01 (0.25)
Panel B: Moderating Effects						
BFL*Advisor	0.034 (1.24)					−0.05 (−1.04)
FML*Advisor	−0.08 (−1.99) **					0.04 (1.51)
BFL*Brokers		0.075 (2.66) ***				0.01 (0.094)
FML*Brokers		−0.06 (−1.29)				0.02 (0.79)
BFL*Friends & Family			0.05 (1.99) **			−0.140 (−2.52) **
FML*Friends & Family			−0.17 (−3.34) ***			0.04 (1.42)
BFL*Annual Reports				0.05 (1.96) **		−0.07 (−1.33)
FML*Annual Reports				−0.11 (−2.30) **		−0.04 (−1.62)
BFL*Media Coverage					0.01 (0.66)	0.02 (0.70)
FML*Media Coverage					−0.07 (−1.61)	0.24 (0.40)
R-Square	0.2420	0.2572	0.2719	0.270	0.2426	0.3459
F-Statistics	31.87***	32.46***	35.033***	34.80***	30.05***	15.13***
VIF (1/1-R ²)	1.319	1.346	1.373	1.369	1.320	1.528

This table report the estimated results of Eq. 2. Number in parenthesis are t-statistics

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively

the impact of financial advisors on investment performance. However, the moderation effect is only partial, as financial market literacy on its own also significantly influences investors' investment performance. This suggests that while financial market literacy empowers investors to obtain better investment performance, their advanced literacy level may also introduce some biases that make them less likely to rely on or act upon insights from financial advisors. Model 2 demonstrates that basic financial literacy fully and positively moderates the brokerage house's effect on investment performance, whereas financial market literacy plays no significant role. Model 3 shows that both types of financial literacy moderate the relationship between information sourced from friends and family and investment performance. However, they differ in terms of their directional influence and moderation strength. While basic financial literacy positively

and fully moderates the effect of friends and family on investment performance, financial market literacy has negative and partial moderation effects. On its own, financial market literacy exerts a significant positive influence on investment performance. These findings suggest that investors' basic financial literacy alone does not improve their investment performance. However, when combined with information from friends and family, knowledge sharing leads to better investment performance. In contrast, investors with financial market literacy are self-sufficient and able to improve investment performance on the basis of their advanced financial knowledge. The partial negative moderation effect suggests that investors' advanced financial literacy may regard information from friends and family as ungrounded, leading them to overlook such informal information. In Model 4, similar moderating effects are observed in the relationship between annual reports or financial statements and investment performance. These empirical results support hypothesis H_3 . However, the results of Model 5 indicate the absence of a financial literacy moderating effect for the media coverage channel, which is not supportive of Hypothesis H_3 . This could be explained by the nature of the information sourced from media coverage, which is meant for the general public and may not require significant financial knowledge to process such information. Finally, when we consider all the moderation effects in Model 6, we find that basic financial literacy negatively moderates the influence of friends and family on investment performance. This finding reinforces the importance of having basic financial literacy, especially when information from friends and family is the closest influence. Basic financial knowledge enables investors to assess information quality, making them less susceptible to the influence of friends and family. Collectively, these empirical results partially support hypothesis H_3 related to investment performance.

In summary, our overall findings that basic financial literacy strengthens the effects of some financial information sources whereas advanced financial literacy weakens the impacts are well supported by studies in behavioral finance. Lusardi and Mitchell (2014) argue that there is often a significant mismatch between people's "self-assessed knowledge" and their "actual knowledge", implying the presence of cognitive biases in their decisions. Mahapatra et al. (2019) reported that financial cognition (financial knowledge, financial attitudes and risk attitudes) and mental accounting influence investors' personal financial planning, suggesting that psychological factors drive financial decisions. By identifying several behavioral tendencies that guide investors in their investment decisions, Sahi et al. (2013) provide evidence that biases are inherent in investors' behavior. For example, some people tend to verify and confirm information before making investment decisions, whereas others tend to depend on financial professionals for their investment decisions. Our findings indicate that investors require basic financial literacy to be able to verify and benefit from certain financial information sources. However, the weakening informational impact for individuals with advanced financial literacy suggests that individuals with higher financial literacy are better able to serve as their own advocates and recognize the limitations of information sourced from certain sources. The findings are generally supportive of bounded rationality theory (Simon 1955), which states that an individual's decision-making is bounded by cognitive ability, information access, and time constraints. In our study context, the findings indicate that as financial literacy increases, it acts as a cognitive filter that changes how individuals process

and use financial information from various sources. Bursztyn et al. (2014) find that the investment decisions of financially sophisticated individuals are less affected by their peers' choices, suggesting that higher financial literacy reduces individuals' susceptibility to herd behavior. This aligns with our findings that advanced financial literacy weakens the information impacts of family and friends on investment decisions. Takeda et al. (2013) find that in the Japanese stock market, investors with high investment literacy are less prone to exhibit overconfident behavior and are less likely to engage in undisciplined investment decisions. Accordingly, it is important to recognize that financial literacy plays a role in reducing the impacts of investors' behavioral biases. Baker et al. (2019) find that the financial literacy level is related to specific behavioral biases among individual investors in India and that they exhibit different behavioral biases, including overconfidence, anchoring bias, emotions, and heuristics, among others. Barber and Odean (2000) find that overconfident bias in individual investors results in excessive trading activity and poor investment performance. The above studies suggest that behavioral biases, although not directly observable, may manifest in an individual's decision-making. In Bangladesh, where the majority of individual investors have low financial literacy levels, a lack of financial knowledge may make investors more vulnerable to these biases, leading to less than optimal investment decisions and performance. Thus, it is crucial to highlight that the value of financial literacy education extends beyond making good financial decisions. It also helps individuals reduce behavioral biases that distort their judgments, thus promoting more informed and objective financial choices.

Tables 10 and 11 present subgroup analyses for the moderating impacts of financial literacy on investment performance, with high- and low-risk tolerance groups, respectively. Here, we compare the model to the models in Tables 10 and 11, for instance, Model 1 in Table 10 (high risk tolerance) versus Model 1 in Table 11 (low risk tolerance). We found that the moderating effects of basic financial literacy and financial market literacy are contingent upon investors' risk tolerance levels. In Tables 10 and 11, for the high-risk and low-risk tolerance groups, respectively, financial information sources from advisors, brokers, friends & family, annual reports and media coverage are entered separately into Models 1 to 5. Model 6, however, combines all the financial information sources into one model. The overall findings show that for investors with high risk tolerance, financial market literacy significantly moderates the impact of information on their investment performance, whereas for those with low risk tolerance, basic financial literacy plays a moderating role. These findings imply that investors process and react to financial information on the basis of their perceived risk and financial literacy level. Model 1 of Tables 10 and 11 shows that the financial literacy of both high- and low-risk-tolerant investors does not influence how they respond to information sourced from financial advisors. This suggests that investors who trust the information provided by advisors are expected to act in the best interest of their clients because of their fiduciary duties. In Model 2, basic financial literacy positively moderates the effects of brokers for high-risk tolerance investors but not for low-risk tolerance investors. High-risk investors tend to have greater financial knowledge that allows them to assess the information provided by brokers, leading to better investment performance. In contrast, investors with low risk tolerance are generally more conservative and less likely to critically assess information from their brokers.

Table 10 Moderating Effect of Financial Literacy and Financial Information Sources on Investment Performance of High Risk Tolerance Investors

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Panel A: Direct Effects						
FL	0.21(1.72) *	0.06(0.49)	0.27(2.16) **	0.31(2.34) **	0.37(3.07) **	0.09(0.43)
FML	0.27(1.30)	− 0.11(− 0.48)	0.66(2.86) **	0.16(0.68)	0.05(0.22)	0.45(1.18)
Advisor	0.28(1.73) *					0.12(0.64)
Brokers		− 0.214(− 1.26)				− 0.47(− 2.63) **
Friends & Family			0.52(3.16) **			0.66 (3.29) ***
Annual Reports				0.22(1.31)		0.11(0.60)
Media Coverage	0.03(0.97)				0.15(0.99)	− 0.14(− 0.72)
Panel B: Moderating Effects						
BFL*Advisor	− 0.09(− 1.51)					0.08(1.79) *
FML*Advisor	0.009(0.64)					− 0.06(− 0.91)
BFL*Brokers		0.08(2.29) **				0.06(1.74) *
FML*Brokers		0.01(0.23)				0.11(1.67) *
BFL*Friends & Family			0.01(0.43)			− 0.01(− 0.24)
FML*Friends & Family			− 0.21(− 3.24) ***			− 0.25(− 3.35) ***
BFL*Annual Reports				0.006(0.17)		− 0.01(− 0.33)
FML*Annual Reports				− 0.06(− 0.94)		− 0.027(− 0.38)
BFL* Media Coverage					− 0.01(− 0.40)	− 0.05(− 1.25)
FML* Media Coverage					− 0.03(− 0.46)	0.08(1.15)
R-Square	0.46	0.44	0.46	0.44	0.43	0.51
F-Statistics	16.71***	15.28***	16.54***	15.27***	14.80***	10.22***
VIF (1/1 − R ²)	1.851	1.786	1.851	1.785	1.754	2.040

This table report the estimated results of Eq. 2. Number in parenthesis are t-statistics

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively

In Model 3, financial market literacy negatively moderates the impact of information from friends and family on investment performance, with strong moderation effects for high-risk tolerance investors (Table 10) but weak effects for investors with low risk tolerance (Table 11). These findings suggest that high- and low-risk tolerance investors with advanced financial literacy possess stronger analytical skills, enabling them to assess and recognize less credible information from friends and family. In Model 4, while financial market literacy does not moderate the informational impact of annual reports for high-risk tolerance investors, the moderation effect is weak only for the low-risk tolerance group. However, basic financial literacy plays no moderating role for either the high-risk or low-risk groups. For financial information sourced from media coverage in Model 5, both types of financial literacy assume no moderating role. Finally, in Model 6 of Tables 10 and 11, when all financial information sources are combined into one model, the findings highlight important associations between types of financial literacy and the risk tolerance levels of investors. For investors with high risk tolerance, advanced financial literacy drives their investment performance, whereas for those with low risk tolerance, it is basic financial literacy that influences

Table 11 Moderating Effect of Financial Literacy and Financial Information Sources on Investment Performance of Low Risk Tolerance Investors

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Panel A: Direct Effects						
BFL	0.13(0.86)	0.11(0.69)	− 0.16(− 0.99)	− 0.096(− 0.66)	0.02(0.13)	0.06(0.29)
FML	0.18(0.74)	0.31(1.23)	0.49(1.71) *	0.27(1.13)	0.46(1.67) *	0.56(1.38)
Advisor	0.44(2.63) ***					0.39(2.14) *
Brokers		0.50(3.05) **				0.28(1.47)
Friends & Family			0.24(1.30)			0.03(0.12)
Annual Reports				0.20(1.24)		0.03(0.13)
Media Coverage					0.29(1.88) *	0.11(0.55)
Panel B: Moderating Effects						
BFL*Advisor	0.007(0.15)					− 0.04(− 0.78)
FML*Advisor	− 0.06(− 0.85)					− 0.04(− 0.50)
BFL*Brokers		0.009(0.22)				− 0.03(− 0.62)
FML*Brokers		− 0.11(− 1.36)				0.03(0.32)
BFL*Friends & Family			0.09(2.02)			0.14(2.26) **
FML*Friends & Family			− 0.15(− 1.74) *			− 0.16(− 1.39)
BFL*Annual Reports				0.08(1.88) *		0.06(1.19)
FML*Annual Reports				− 0.09(− 1.29)		− 0.03(− 0.41)
BFL* Media Coverage					0.04(0.98)	− 0.10(− 1.94) *
FML* Media Coverage					− 0.13(− 1.70)	0.02(0.21)
R-Square	0.46	0.34	0.31	0.30	0.28	0.44
F-Statistics	16.71***	6.15***	5.30***	5.25***	4.56***	4.62***
VIF (1/1−R ²)	1.851	1.515	1.449	1.428	1.388	1.785

This table report the estimated results of Eq. 2. Number in parenthesis are t-statistics

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively

investment performance. Specifically, in Table 10, we find that for high-risk tolerance investors, advanced financial literacy significantly weakens the impacts of information from friends and family. In Table 11, for low-risk tolerance investors, while basic financial literacy significantly strengthens the influence of friends and family, it has a weak negative effect on information sourced from media coverage. Hence, the way in which investors process and respond to financial information from various sources is driven by their financial literacy level and risk perceptions. These empirical results add a new context to retail investors' investment performance and support hypothesis H₄ that the moderating effects of financial literacy on investment performance are contingent on the risk tolerance level of investors.

Tables 12 and 13 present subgroup analyses for the moderating impacts of financial literacy in groups with high and low financial interest levels. Like how the degree of risk tolerance affects the moderating effects of financial literacy, investors' financial interest

Table 12 Moderating Effect of Financial Literacy and Financial Information Sources on Investment Performance of Investor with High Financial Interest

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Panel A: Direct Effects						
BFL	0.19(1.599)	−0.07(−0.52)	0.07(0.51)	0.28(2.23) **	0.21(1.84) *	−0.13(−0.67)
FML	0.39(2.05) **	0.18(0.78)	0.64(2.78) **	0.37(1.74) *	0.56(2.43) **	0.87(2.41) **
Advisor	0.39(2.78) **					0.23(1.42)
Brokers		−0.097(−0.60)				−0.48(−2.66) **
Friends & Family			0.38(2.37) **			0.33(1.44)
Annual Reports				0.43(2.85) **		0.32(1.90) *
Media Coverage	0.02(0.72)				0.35(2.48) **	0.07(0.36)
Panel B: Moderating Effects						
BFL*Advisor	−0.11(−2.006) **					0.015(0.35)
FML*Advisor	−0.076(−0.82)					−0.04(−0.64)
BFL*Brokers		0.10(2.84) **				0.095(2.59) **
FML*Brokers		−0.05(−0.70)				0.09(1.22)
BFL*Friends & Family			0.05(1.43)			0.04(0.95)
FML*Friends & Family			−0.19(−2.82)			−0.18(−2.00) **
BFL*Annual Reports				0.001(0.03)		−0.02(−0.45)
FML*Annual Reports				−0.11(−1.85)		−0.07(−1.099)
BFL*Media Coverage					0.02(0.60)	−0.02(−0.59)
FML*Media Coverage					−0.16(−2.49) **	−0.05(−0.62)
R-Square	0.42	0.38	0.399	0.41	0.38	0.47
F-Statistics	15.51***	13.40***	14.27***	14.73***	13.45***	9.76***
VIF (1/1−R ²)	1.724	1.612	1.663	1.694	1.613	1.887

This table report the estimated results of Eq. 2. Number in parenthesis are t-statistics

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively

levels also influence these effects. For investors with high financial interest, financial literacy moderates the impacts of information obtained from several sources on investment performance. For example, basic financial literacy weakens and strengthens the information effects of advisors and brokers, respectively, whereas advanced financial literacy weakens the influence of media coverage. In contrast, for investors with low financial interest, financial literacy has a limited moderating role. Only basic financial literacy serves as a moderator, and it moderates information sourced from annual reports only. Basic financial literacy seems to be more useful for leveraging information from annual reports among individuals who are less interested in financial matters. Conversely, financial market literacy allows highly financially interested investors to use a broader variety of financial information sources to improve their investment performance. Overall, the findings indicate that both types of financial literacy significantly moderate the impact of information from various sources on investment performance, and this applies to investors with high and low financial interest. These empirical results support Hypothesis H₅

Table 13 Moderating Effect of Financial Literacy and Financial Information Sources on Investment Performance of Investor with Low Financial Interest

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Panel A: Direct Effects						
FL	0.21(1.41)	0.36(2.47) ***	0.22(1.55)	0.02(0.11)	0.30(2.03)	0.54(2.56) **
FML	0.25(1.08)	0.42(1.98) **	0.62(2.34) **	0.09(0.38)	− 0.18(− 0.80)	0.90(2.27) **
Advisor	0.44(2.44) **					0.34(1.74)
Brokers		0.57(3.44) ***				0.45(2.53) **
Friends & Family			0.57 (3.0) **			0.58 (2.87) **
Annual Reports				− 0.05(− 0.29)		− 0.13(− 0.68)
Media Coverage					0.05(0.31)	− 0.03(− 0.197)
Panel B: Moderating Effects						
BFL*Advisor	0.03(0.58)					0.07(1.31)
FML*Advisor	− 0.11(− 1.43)					− 0.07(− 0.80)
BFL*Brokers		− 0.03(− 0.69)				− 0.07(− 1.62)
FML*Brokers		− 0.15(− 2.34)				− 0.098(− 1.35)
BFL*Friends & Family			0.020(0.50)			0.04(0.68)
FML*Friends & Family			− 0.21(− 2.68)			− 0.21(− 2.57) **
BFL*Annual Reports				0.08(1.84) **		0.01(0.25)
FML*Annual Reports				− 0.04(− 0.56)		− 0.03(− 0.32)
BFL* Media Coverage					− 0.009(− 0.20)	− 0.13(− 2.47) **
FML* Media Coverage					0.04(0.65)	0.10(1.52)
R-Square	0.48	0.47	0.47	0.42	0.42	0.60
F-Statistics	8.80***	8.40***	8.66***	7.07***	6.96***	7.04***
VIF (1/1-R2)	1.923	1.8867	1.8867	1.724	1.724	2.500

This table report the estimated results of Eq. 2. Number in parenthesis are t-statistics

***, **, and * denote statistical significance at 1%, 5%, and 10%, respectively

that the moderating effects of financial literacy on investment performance are contingent on the financial interest level of investors.

Multicollinearity testing for robustness

To ensure the reliability of our results, we performed multicollinearity tests. Although the correlation matrix revealed no concerning degrees of multicollinearity, we conducted multicollinearity tests for Model 6 of Tables 8 and 9, which include the variables most relevant to our main analysis, to examine how financial literacy moderates the relationship between various financial information sources and risky investment behaviors. This is to ensure that the interpretations of the findings would not be compromised. The estimated variance inflation factors (VIFs) confirm the absence of major multicollinearity in

Table 14 Multi Collinearity Testing for Model 6 of Table 8

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.322504	28.7169	NA
PORTION	2.83E-06	14.5005	1.76242
AGE	0.002175	30.6811	1.51524
GENDER	0.008161	4.89050	1.53551
EDU	0.001418	28.0227	1.61904
OCC	0.001356	9.67209	1.08747
INC	0.001640	17.0631	1.52919
INVEX	8.82E-05	6.66514	1.59252
TF	0.001881	13.3926	1.36624
PRINVEST	0.001605	13.5833	1.55212
BFL	0.017253	15.7129	3.99961
FML	0.055171	20.7657	3.77034
Advisor	0.011322	12.6131	1.57460
Brokers	0.011788	13.2058	1.45706
Friends & Family	0.016952	19.3760	1.07908
Annual Reports	0.012362	13.8078	1.44846
Media Coverage	0.012660	14.8351	1.21294
BFL*Advisor	0.000847	10.4692	2.19833
FML*Advisor	0.001853	8.0100	1.58624
BFL*Brokers	0.000633	8.5586	2.02349
FML*Brokers	0.001954	9.9744	2.01009
BFL*Friends & Family	0.000850	10.3566	1.93523
FML*Friends & Family	0.002471	12.5808	4.21351
BFL*Annual Reports	0.000705	8.0878	4.01678
FML*Annual Reports	0.002043	9.5528	3.48566
BFL*Media Coverage	0.000711	9.2310	4.85606
FML*Media Coverage	0.001977	9.3484	2.36464

Dependent variable is investment decision

our analyses, as the VIF values are all well below the recommended 5. These are reported in Tables 14 and 15 for Tables 8 and 9, respectively.

Discussion and implications

Empirical results discussion

This study explored the relationships between financial literacy, financial information sources, and risky investment behavior in an emerging economy context such as Bangladesh. Our study focused mainly on how these factors have direct and moderating impacts on risky investment behavior and whether the moderating effects are contingent on investors' financial interest and risk tolerance levels.

Regarding the influences of demographic and investor profiles, we find that investors' allocation to risky investments (Portion), education level (EdU), occupation (Occ), income level (Inc), investment experience (InvEx), trading frequency (TF), and preferred investment period (PrInvest) have impacts on investment decisions. We also find that investors with higher education levels, higher incomes, and more experience tend to achieve better performance. Furthermore, the high correlations among investing

Table 15 Multi Collinearity Testing for Model 6 of Table 9

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.423177	281.7169	NA
PORTION	3.72E-06	14.50056	1.76242
AGE	0.002854	30.68116	1.51524
GENDER	0.010708	4.890505	1.53551
EDU	0.001860	28.02270	1.61904
OCC	0.001779	9.672094	1.08747
INC	0.002153	17.06319	1.52919
INVEX	0.000116	6.665140	1.59252
TF	0.002468	13.39260	1.36624
PRINVEST	0.002107	13.58334	1.55212
BFL	0.022638	15.7129	2.99961
FML	0.072393	20.7657	3.77034
Advisor	0.014856	12.6131	1.57460
Brokers	0.015467	13.2058	1.45706
Friends & Family	0.022244	19.3760	1.07908
Annual Reports	0.016221	13.8078	1.44846
Media Coverage	0.016611	14.8351	1.21294
BFL*Advisor	0.001111	10.4692	2.19833
FML*Advisor	0.002431	8.01003	1.58624
BFL*Brokers	0.000831	8.55865	2.02349
FML*Brokers	0.002563	9.97444	2.01009
BFL*Friends & Family	0.001116	10.3566	2.93523
FML*Friends & Family	0.003243	12.5808	2.21351
BFL*Annual Reports	0.000926	8.08788	2.01678
FML*Annual Reports	0.002680	9.55280	2.48566
BFL* Media Coverage	0.000933	8.23100	2.85606
FML* Media Coverage	0.002594	9.34843	2.36464

Dependent variable is investment performance

experience, trading frequency, and longer investment horizons with greater risk-taking and greater financial returns are consistent with the notion that knowledge and a proactive investment approach could yield superior results (Akhter and Hoque 2022; Grinblatt et al. 2012; Hermansson et al. 2022). These demographic and investor-specific factors need to be considered when formulating investment plans, assessing investing behavior, or deploying financial literacy initiatives. Additionally, these findings are in line with several past studies that document the impacts of education level (EdU), occupation (Occ), income level (Inc), investment experience (InvEx), trading frequency (TF), and preferred investment period (PrInvest) on investment behaviors (Akhter and Hoque 2022; Chu et al. 2017; Hermansson et al. 2022; Jain et al. 2023; Lan et al. 2018; Mayfield and Shapiro 2010).

With respect to Hypothesis H1, we discovered that basic financial knowledge positively affects investment performance and investment decisions. This implies that a strong financial understanding of investment principles, risk-return concepts and the attributes of financial products enables individuals to make well-informed decisions (Chu et al. 2017; Hermansson et al. 2022; Li et al. 2020). Human capital theory

supports these positive findings, which are in line with previous studies conducted in advanced countries (Chu et al. 2017; Hermansson et al. 2022). In the context of Bangladesh, we found that financial market literacy or advanced financial literacy has no significant influence on decision-making or investment performance, which contradicts the findings of Li et al. (2020). This difference implies that, in developing nations such as Bangladesh, where financial education is still lacking, having basic financial knowledge is much more important for understanding financial market literacy. That is, the majority of investors in Bangladeshi capital markets lack adequate financial market knowledge, which is insufficient to impact investment choices and performance. This reasoning is consistent with earlier descriptive results showing a financial market literacy score of only 31%. Without a fundamental understanding of essential principles, financial market knowledge adds little value, and the overall basic financial literacy in Bangladesh has remained only at an average level. In the context of capital markets, such as Bangladesh, where there is a general lack of financial understanding, it is not surprising that neither financial literacy measure has a significant effect on investors' investment behavior. This is in contrast to wealthier nations, where such measures may have greater influence. In Bangladesh, where cultural and socioeconomic barriers still exist, it is important to prioritize grassroots education programs that focus on fundamental financial concepts. This foundational knowledge is necessary before individuals can effectively make informed decisions regarding local markets and financial instruments. However, when we consider the presence of various information sources, financial market literacy has some impact on investment decisions and investment performance. Hence, our findings are supported by those of Mushafiq et al. (2023), and we add novel insight that basic and advanced financial literacy impact the investment choices of Bangladeshi investors.

With respect to Hypothesis H2, we find that many financial information sources—advisors, brokers, social networks, reports, and media—have a positive effect that resonates with the theory of informational efficiency in classical finance theory. Moreover, our findings indicate that investors utilize multiple channels to gather relevant data for investment decision-making to obtain better returns. The current results are broadly consistent with those of previous studies examining the role of financial information sources. Nuzula et al. (2019) identified several specific channels that have a significant effect on investment decisions and performance. This study provides new evidence on the impact of various sources, such as financial advisors, brokers, friends & family, annual reports and financial statements, and media coverage, on the investment decisions and performance of retail investors in Bangladesh. Nuzula et al. (2019) and Tauni et al. (2016) support the importance of formal information sources, such as financial advisors, in influencing investment choices and decisions. Hermansson et al. (2022) discovered a positive correlation between media coverage from prominent information channels and stock market participation. These results confirm that financial information sources are strongly related to important financial outcomes, such as stock market participation, investment decision-making, and investment performance, across different markets.

For Hypothesis H3, the findings on the moderating effects of basic financial literacy align with the notions of human capital theory and information processing theory that

cognitive resources shape how individuals process information from different sources. We found that basic financial literacy fully moderates the impact of information from formal information sources by strengthening the influence of advisors and brokerages on promoting riskier investment decisions, whereas financial market literacy partially weakens the impact of friends and family on risk-taking. These findings suggest that basic financial literacy reinforces the already positive relationship of using financial professionals as a primary source of guidance in making risky investment decisions (Lone and Bhat 2022; Liu and Zhang 2021). In contrast, the negative moderating impact of financial market knowledge suggests that greater specialized financial market knowledge reduces investors' reliance on informal social networks when making investment choices (Lone and Bhat 2022; Liu and Zhang 2021). Moreover, we find that financial market literacy negatively moderates the impact of financial advisors on investment performance. While basic financial literacy positively moderates the effects of friends and family and annual reports on investment performance, financial market literacy has negative and partial moderation effects. Additionally, these results are supported by (Hermansson et al. 2022), who highlight that financial literacy influences the nexus between financial news and stock market participation. These findings also align with those of Ullah et al. (2024). In contrast, we have added new empirical evidence that the influence of financial information sources on investment decisions is contingent on basic financial literacy and financial market literacy. The findings are generally supportive of theories of bounded rationality (Simon 1955) and cognitive limitations (Kahneman 2003), indicating that the investment performance outcomes from the influences of different information sources depend on an individual's cognitive resources, which determine how financially literate a person is. The tendency of financial literacy to influence investors' risk preferences and decisions when seeking advice from advisors, brokerages, or social networks is well aligned with the explanation of prospect theory in decision making.

According to hypothesis H4, the results offer novel insights demonstrating that the varying moderating effects depend on investors' risk tolerance level. Our findings indicate that investors' financial knowledge and risk preferences shape how they process and interpret financial information from various sources. Financial literacy benefits low-risk tolerant investors by enabling them to be more cautious in processing information, hence reducing their perceived risk. On the other hand, greater risk tolerance lessens the moderating effect of financial literacy, as high-risk tolerant investors are generally more comfortable with uncertainty, and their financial literacy empowers them to be more discerning in the use of information from various sources. This emphasizes that the contextual relevance of financial literacy depends on investors' personal risk choices, which are well aligned with prospect theory and human capital theory (Becker 2009). Hence, it can be concluded that financial literacy levels appear to have a stronger impact on the investment behavior of investors with lower risk tolerance than on those with higher risk tolerance. The empirical results imply that low-risk tolerant investors with a basic understanding of finance are generally more conservative and cautious, whereas high-risk tolerant investors are more willing to embrace uncertainty and complex information from various sources.

In terms of the moderating role of financial interest, which relates to Hypothesis H5, we find that basic financial literacy seems to be more useful for leveraging information

from annual reports among persons who are less interested in financial matters. Additionally, financial market literacy allows highly financially interested investors to use a broader variety of financial information learning sources. This emphasizes that the benefits and relevance of financial literacy vary across different contexts. These empirical results add a new perspective to retail investors' investment performance and expand the findings of Hermansson et al (2022).

Collectively, our findings that investors' financial literacy type affects how they use financial information from various sources have relevance outside of Bangladesh as well. The role of financial literacy (basic financial literacy and advanced financial literacy) varies by country. While the conditions of each country may differ from those of Bangladesh, the general principle that well-informed investors use information more effectively than uninformed investors does holds true across all contexts. We find that for information to be useful, investors need to have at least basic financial literacy to assess effectively and act on the financial information they receive effectively, leading to better decisions and performance. While our evidence points to the limited impact of advanced financial literacy, mainly due to the low financial literacy level of most investors in Bangladesh, the findings indicate that the investment decisions and performance of investors with advanced financial literacy are less likely to be influenced by information sourced from informal sources. We believe that such a tendency may also apply to other countries, although to varying degrees, depending on the overall financial literacy rates and access to formal information sources. Our findings imply that investors with greater financial literacy are more discerning and selective in using the information they receive. In developed countries where financial literacy rates are higher, investors tend to rely more on formal information sources than on informal ones. However, in countries with lower financial literacy levels, such as Bangladesh, financial information sourced from informal sources may still play a significant role for investors.

Theoretical implications

This study contributes to the literature and practice in several ways. First, to the best of our knowledge, this study is the first attempt to examine different types of financial literacy and their impacts on risky investment behavior in Bangladesh. Our study extends the work of Miazee et al. (2014) and Akhter and Hoque (2022), who focused on stock participation. We demonstrated the different impacts of basic and advanced financial literacy on risky investment behavior. We also extend the literature in the context of Bangladesh and developing economies by showing how various financial information sources affect investment and financial decisions. Second, Hermansson et al. (2022) reported that financial literacy moderates the relationship between financial news and risky investment. Nonetheless, their study did not account for the role of different levels of financial literacy, such as basic and advanced financial literacy, when examining the moderating role of financial literacy. Thus, this study fills this gap by investigating the moderating role of financial literacy in influencing the link between financial information sources and risky investment behavior. Third, while Liao et al. (2017) and Li et al. (2020) discussed the varying levels of financial literacy in promoting risky investment behavior in China, they did not consider the influence of financial literacy on different levels of risk tolerance. Henceforth, the present study fills this research gap by examining

how the role of financial literacy in risky investment behavior varies given investors' risk tolerance levels in the Bangladesh context. Fourth, within the financial literacy literature, very few studies have examined how financial interest impacts individuals' financial decisions (Hermansson and Jonsson 2021). Generally, individuals' interest in financial matters can affect their financial literacy levels (basic and advanced financial literacy). Individuals with strong financial interest tend to expand beyond basic financial knowledge and actively search for financial information from various sources to improve their financial skills and knowledge. Given that an aggregate level of financial interest may have broader implications for individuals' participation and the dynamics of financial markets, we also analyze how our findings vary across groups with low and high financial interest. This is particularly relevant, as the understanding of financial interest offers guidance to policymakers in cultivating individuals' financial interest as part of a greater effort to promote financial literacy. Overall, our study provides a comprehensive framework for assessing the roles of financial literacy, financial information sources, financial interest, and risk tolerance in investment behavior.

Practical implications

Our findings yield several practical and policy implications. First, the findings revealed that investors in Bangladesh possess an average level of basic financial literacy and a low level of financial market literacy. Additionally, our results indicate that basic financial knowledge significantly affects both investment performance and decision-making. This suggests that, in Bangladesh and other developing economies where complete financial education may still be lacking, basic financial literacy is crucial to help investors make informed investment decisions. In fact, countries facing similar societal challenges should prioritize providing basic financial education as the first step in enhancing investment outcomes. These initiatives should emphasize fundamental concepts such as savings, diversification, and risk return and employ easily comprehensible materials with practical applications. Furthermore, initiatives focusing on developing advanced or financial market literacy may have a limited impact on their own, as basic financial literacy provides the foundation for the acquisition of more advanced financial literacy skills. Therefore, individuals must be educated with foundational knowledge and skills as prerequisites to increase the basic financial literacy threshold rather than having knowledge of complex financial products.

Second, there are numerous formal and informal information channels from printed to digital media that enable individuals to easily access information for investment decision making. With respect to formal information channels, disclosure quality is extremely important. While accurate financial statements are vital, many Bangladeshi firms involve substandard reporting, which could mislead investors and distort market perceptions. Regulators have established a separate Financial Reporting Council responsible for maintaining surveillance of financial report quality to solve this problem. Strict reporting guidelines and standards help this council ensure that reports properly and honestly show the financial status of the companies. Additionally, maintaining investor confidence and market integrity also strongly depends on the ethical behavior of financial advisors and stockbrokers. Stockbrokers and financial advisors should maintain strong ethical standards, accurate information, and the best interests of their clients. This

presumption is particularly crucial in a market setting, as the dissemination of misleading facts can lead to poor investment decisions. To ensure that stockbrokers and financial advisers follow ethical norms and thereby foster moral behavior, regulatory agencies should organize training courses and apply stricter compliance regulations. However, it should also be noted that the value and practicality of the information depends on investors' financial literacy level. Hence, our findings on the moderating role of financial literacy highlight the importance of financial education programs for enabling individuals to make informed financial decisions and achieve better investment outcomes, leading to long-term wealth creation. Additionally, these programs can help strengthen investors' financial knowledge, enabling them to navigate the complexity of financial markets. However, financially ill individuals may not be able to capitalize as much from financial information, regardless of information source.

Third, our results show that investors' risk tolerance determines the varying moderating impacts of basic financial literacy and financial market literacy, highlighting that financial literacy and risk tolerance shape how investors interpret information. In Bangladesh, where many investors have limited access to financial knowledge, improving basic financial literacy could enable more risk-tolerant people to make wiser investment decisions. This implies a pressing need for basic financial education in Bangladesh and in other countries with similar socioeconomic development, as it serves as foundational knowledge for enhancing the nation's overall financial literacy rate.

Fourth, our findings also illustrate that the influence of financial literacy on investment success depends on investors' financial interest. In Bangladesh, where financial participation varies greatly among the population, educational initiatives should be developed to address the needs of individuals with both high and low financial interest. For individuals with low financial interest, basic financial knowledge enables them to comprehend financial information from annual reports. However, for those with high financial interest, advanced or financial market literacy empowers them to efficiently use financial information from various sources.

Finally, the insights from this study suggest that effective implementation of financial educational initiatives to increase financial literacy requires the use of targeted programs that consider individuals' knowledge and skill levels, their unique risk-return profiles and circumstances. Importantly, financial education policies and programs must recognize the needs differences of individuals in different socioeconomic contexts to achieve the desired financial literacy for the targeted groups. Thus, there is no one-size-fits-all solution for addressing financial illiteracy, and it is crucial to acknowledge this when implementing financial education policies across different countries.

Conclusion

This study develops and proposes a conceptual framework to investigate the complex relationships among financial literacy, information sources, and risky investment behavior among Bangladeshi retail investors and to determine whether the relationships are contingent on investors' financial interest and risk tolerance levels. In doing so, we collect data on 474 retail investors in Bangladesh via a self-administered structured survey approach. We operationalized our conceptual framework and tested the hypotheses via multivariate regression models by considering the moderating roles of factors. Our study

yielded several important findings, highlighting multiple functions of financial literacy, including its moderating role, information utilization by investors and impacts on risky investment behaviors. The results on direct impacts align with human capital views, evidence of moderating roles is supportive of information processing capabilities, and findings related to contingency on risk preferences reflect behavioral decision-making theories. Combining all these points of view in an emerging market context provides an integrated perspective of the links among financial literacy, information utilization, and investment behavior. Overall, our findings imply that financial literacy influences how effectively information utilization impacts risky investment behaviors, making some investors more cautious than others. This suggests that financially literate investors may approach risk differently, thereby moderating the impact of information on their investment behaviors, implying that financial literacy can shift investors' risk perceptions in financial decision making.

First, we find that investors demonstrate a moderate level of basic financial literacy (BFL), with a score of 57.63%, but poor financial market literacy (FML), with a score of only 31.47%. Second, we confirmed that while BFL has a direct positive effect on both investment decisions and performance, FML by itself plays no significant role, reaffirming the lack of advanced financial literacy among investors in Bangladesh. Third, all financial information sources—advisors, brokers, friends & family, financial reports, and media coverage—positively influence investors' decision-making and investment performance. Fourth, BFL fully moderated the positive effects of advisors and brokers on risk-taking decisions. In contrast, FML fully moderates this effect by weakening the influence of brokers and partially weakens the influence of friends and family. Fifth, this study revealed that FML weakened the effects of advisors, friends and family, and annual reports on investment performance. In contrast, BFL strengthened the influence of brokers, friends and family and annual reports on improving investors' investment performance. These findings emphasize that basic financial literacy resonates more with investors in Bangladesh than does advanced financial literacy, which is consistent with the low financial literacy rate in Bangladesh. Finally, this study revealed that the moderating effects of financial literacy on the impacts of financial information sources on investment decisions and investment performance are conditioned on investors' risk tolerance and financial interest levels. Collectively, our findings suggest that the ways in which investors process and react to various types of financial information are driven by their financial literacy level, perceived risk, and financial interests.

Limitations and future research directions

While this study provides valuable insights into the moderating effects among financial literacy, information sources, and investment behavior, it is not without limitations, opening up opportunities for future research. First, the study used a cross-sectional research methodology, restricting the capacity to establish causal conclusions and track dynamic changes across time. Future research may consider using a longitudinal approach to examine the dynamics of these moderators and investigate the long-term effects of financial literacy and information utilization on investment decisions and performance.

Second, this study examined the moderating effects on the investigated relationships, recognizing two investor traits—risk tolerance and financial interest levels. Although these investor-specific traits provide valuable contextual insights, future studies may consider investigating the moderating influences of other personal factors, such as income level and formal education level. An analysis of how these other demographic and socioeconomic elements affect the moderating effects among financial literacy, information sources, and investing behavior would deepen the understanding of the studied relationships.

Third, the present research was carried out in the capital market of Bangladesh, an emerging economic environment. Similar research can be conducted in other developed or developing market environments, allowing for comparative analysis and the study of possible contextual differences. This may enhance the understanding of the generalizability of the results and their limitations, if any of the proposed conceptual frameworks exist.

Fourth, in providing a more in-depth investigation of the phenomenon, future studies could also consider using a mixed-methods approach combining quantitative and qualitative techniques. In addition to the quantitative insights, qualitative questions such as in-depth interviews or focus group discussions may bring to light complex viewpoints and provide deeper insights into investor decision-making procedures.

Abbreviations

BSEC	Bangladesh Securities and Exchange Commission
BFL	Basic financial literacy
EdU	Education
FLC	Financial learning channels
FL	Financial literacy
FML	Financial market literacy
Inc.	Income level
IB	Investment behavior
InvEx	Investment experience
Occupations	Occupations
OLS	Ordinary least squares
PrInvest	Preferred investment period
SDGs	Sustainable development goals
TF	Trading frequency

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Author contributions

Mohammad Enamul Hoque: Conceptualization, Data curation, Visualization Writing- Original draft preparation, Writing- Reviewing and Editing, Supervision, Low Soo-Wah: Investigation, Methodology, Original draft preparation, Writing- Reviewing and Editing, Mohammad Mujibul Haque: Investigation, Methodology, Writing- Reviewing and Editing.

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Data will be provided upon reasonable request.

Declarations

Ethics approval and consent for publications

Not applicable.

Informed consent

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Competing interests

The authors declare no competing interests.

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