



Empowering Investors: Reducing Herd Bias through Financial Literacy and Self-reflective Thinking

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Article History

Received Date: 03.07.2024

Revised Date: 24.09.2024

Published date: 30.09.2024

Abstract

Herd behavior, where investors mimic the trades of others rather than relying on their own information or analysis, is a widespread phenomenon that can lead to suboptimal investment decisions and market inefficiencies. Hence, understanding how to reduce this behavior is crucial for improving individual investment outcomes and sustainable market performance. Though the literature suggests that self-reflection and financial literacy have potential to mitigate herd bias, it is unclear as to how these two perspectives interact to minimize this irrational behavior. By drawing on insights from the adaptive market hypothesis, transformative learning theory, concept of bounded rationality and dual process theory, this study attempts to enhance the understanding of this phenomenon by introducing a conditional mediation model that promotes self-directed learning. It predicts that investors can reduce their herd bias through self-reflection on their past stock trading experiences, which they can practice by engaging intuitive logical thinking and strengthen further through their financial literacy. Since herding is generally predicted to be more prevalent in frontier stock markets, the study was conducted in a frontier market - the Colombo Stock Exchange. The data was obtained through a self-administered questionnaire from 253 active individual investors, and analyzed by applying the PROCESS procedure. The findings reveal the significance of self-reflection as a mediating variable across its antecedents, which provides strong evidence for its central role in reducing herd bias. Notably, the findings indicate that self-reflection has a stronger effect on reducing herd bias of investors with lower level of financial literacy. It implies that investors with low financial literacy are more susceptible to herd bias, and self-reflection facilitates them to recognize and minimize their herd bias. Accordingly, the study concludes that promoting self-reflection can empower individual investors to become more financially literate and thereby mitigate their herd bias.

Keywords: Conditional mediation, Education for sustainable development, Financial literacy, Herding, Investor learning behavior, Self-reflection

1. Introduction

The behavioral finance literature frequently shows that financial market participants behave irrationally due to variety of factors and forces that affect their decision making, for instance, cognitive and psychological limitations, social and cultural influences, time constraints and information asymmetry (Mittal, 2022; Zahera & Bansal, 2018). Their irrationality can result in mispricing of securities, and thereby inefficiencies in financial markets (Barber & Odean, 2013; Gokhale et al., 2015; Shefrin, 2002; Zahera & Bansal, 2018). Specifically, studies in the context of stock market have consistently shown that individual investors exhibit irrational behaviors, commonly referred to as “behavioral biases”, in their decision-making processes (Mittal, 2022).

One of the most prevalent behavioral biases is herd bias, where market participants mimic the actions of others, which often results in suboptimal investment decisions (Maheshwari et al., 2023). Herd bias can increase market volatility, leading to phenomena such as asset bubbles and market crashes. Consequently, securities prices deviate from their fundamental values, rendering financial markets inefficient (Badola et al., 2024). Therefore, identifying mechanisms to effectively mitigate this bias is critical. One research stream suggests that financial literacy can mitigate herd bias (Jain, 2023; Weixiang et al., 2022). Another line of inquiry supports for a learning approach, involving the “self-reflection” mechanism, to reduce herd bias (Shantha et al., 2018; Shantha, 2019a). As Shantha (2024) argues, these two perspectives are interrelated, meaning that financially literate investors are more capable of engaging in self-reflection, which, in turn, further enhances their financial literacy. However, these two perspectives have largely been studied in isolation, leaving a significant gap in understanding how financial literacy and self-reflection interact as mechanisms for minimizing herd bias (Shantha, 2024). This study aims to bridge this gap by providing insights into how financial literacy and self-reflection work together to minimize herd bias among individual investors.

To address this gap, this study pioneers the exploration of a conditional mediation model, where financial literacy is hypothesized to moderate the self-reflection mechanism in reducing herd bias. In other words, the model proposes that the effectiveness of self-reflection in reducing herd bias is conditional on the level of financial literacy. This conditional mediation model is innovative since it goes beyond the traditional, isolated analysis of financial literacy or self-reflection. Instead, it provides a holistic understanding of how these factors interact to mitigate herd bias more effectively. Further, this study employs a sophisticated methodological approach - the PROCESS procedure for SPSS proposed by Hayes (2018) to test how these factors interact to mitigate herd bias. Accordingly, the findings of the study offer new insights into how financial literacy and self-reflection work together to minimize behavioral biases such as herding in financial markets.

By investigating this phenomenon, this study intends to make significant contributions to both academia and practice in several ways. Academically, it provides new insights into the

financial literacy and behavioral finance literature, particularly on how herd bias can be mitigated to enhance individual investors' decision-making capabilities. For practitioners, it recommends a learning approach to be fostered among individual investors to minimize their herd bias, thereby reducing the associated negative consequences on their wealth. The study's findings will offer a clear understanding of cognitive and educational interventions that promote better investment practices. Stock exchanges, investment advisors and policy makers can utilize these implications when designing educational initiatives for individual investors. Individual investors can also apply the study's insights to enhance their sophistication and investment performance. Accordingly, this study plays a key role in advancing SDG 4: Quality Education by equipping individual investors with the knowledge and skills necessary for informed financial decision-making. This focus on education aligns with SDG 8: Decent Work and Economic Growth, as a more financially literate investor population contributes to the development of robust and resilient financial markets which, in turn, foster economic stability and growth, and promotes sustainable employment opportunities and long-term financial sustainability.

The rest of the paper is organized as follows: Section 2 reviews the relevant literature and develops the hypotheses. Section 3 details the research methodology. Section 4 discusses the respondents' demographic and behavioral characteristics, the measurement quality of the constructs of the conceptual model, and the hypothesis testing results. Section 5 concludes with the theoretical and practical implications of the study.

2. Literature Review

2.1 Investors' exposure to herd bias

According to Banerjee (1992), herding is defined as "everyone doing what everyone else is doing, even when their private information suggests doing something quite different." In the context of stock trading, herding refers to a situation where investors mimic the decisions and behavior of others, disregarding their own information and beliefs. Vieira and Pereira (2015) describe herding as "a group of investors ignoring their own information and beliefs and following the decisions of other investors, imitating them." Similarly, Patterson and Sharma (2007) explain that "herding occurs when a group of investors trades on the same side of the market in the same securities over the same period of time or when investors ignore their own private information and act as other investors do."

Bikhchandani and Sharma (2000) present three main reasons why herding occurs in financial markets, which are informational cascades, reputation, and compensation. Informational cascades happen when investors follow others because they believe those others have superior information. For instance, if an investor observes that several others are buying a particular stock, he might assume these investors possess valuable insights and decide to buy the same stock, even if his own information suggests otherwise. Herding can also occur to protect one's reputation. For example, if an investor is uncertain about his own decisions or if public information contradicts his private knowledge, he may follow what others are doing. In

this way, if the decision turns out poorly, the blame can be shared with others without damaging his reputation. Herding may happen when a manager's compensation is tied to his performance relative to others. This can lead managers to mimic the actions of their peers to avoid the risk of underperforming compared to their peers. For instance, if all managers are investing in a particular way, an individual manager might do the same to avoid looking bad if their different choice fails.

When concerning on the previous empirical studies, herd behavior has been extensively studied over the past few decades, focusing on its nature, underlying reasons, and effects on financial market performance (Guney et al., 2017; Spyrou, 2013). The studies on frontier markets indicate that herd behavior tends to intensify under various market conditions, such as during up and down-market movements, high and low volatility days, and periods of high and low trading volume (Guney et al., 2017; Shantha, 2018; Shantha, 2019b; Xiaofang & Shantha, 2018). In addition, changes in macroeconomic forces can influence herd behavior (Guney et al., 2017). Further, Economou (2020)'s study shows that cross-market herding within a region is more pronounced than herding within individual stock markets. This suggests that as stock exchanges become more financially integrated, herding behavior tends to be influenced by external markets rather than originating domestically. It means that investors are more likely to mimic behaviors from other markets rather than making it solely on domestic market conditions.

2.2 *Learning approach to mitigate herd bias*

This idea emerges from the evolutionary nature of market participants' behavior, as theorized by the Adaptive Market Hypothesis of Lo (2004, 2005, 2012). Lo (2004) posits that 'individuals make choices based on past experiences and their best guess as to what might be optimal, and they learn by receiving positive or negative reinforcement from the outcomes'. This suggests an experiential learning behavior, where investors can learn about their biases and adapt to market conditions over time. However, previous studies have shown inconclusive results regarding this experiential learning (Shantha et al., 2018).

To address this, Shantha et al. (2018) propose a model of investor learning behavior, arguing that past investment experiences alone do not effectively reduce behavioral biases. As predicted by Mezirow (1994)'s transformative learning theory, learning effects occur when experiences are cognitively reflected upon, which is referred to as 'self-reflection'. This involves a cognitive evaluation of the mental frames (e.g., beliefs, thoughts, and assumptions) underlying past decisions by reflecting on the associated experiences (Mezirow, 2018). This self-reflection enables investors to revise their biased mental frames, thus reducing their exposure to behavioral biases. Supporting this approach, Skagerlund et al. (2018) find that cognitive reflection drives superior decision-making. Shantha (2019a, 2024) also empirically shows that investment experience does not directly mitigate herd bias; instead, it works through

the mediation effect of self-reflection across its antecedents – investors' investment experience, desire for learning and authentic relationships with their investment advisors.

Self-reflection generally involves deliberate reasoning. However, the behavioral finance literature reveals that individual investors' behavior is often bounded by cognitive and psychological limitations, time pressure, the cost of information search and acquisition, limited attention, and social influences (Che Hassan et al., 2023; Filbeck et al., 2017; Khan et al., 2021). Consequently, investors may be less inclined to engage in deliberate reasoning during self-reflection. This notion is supported by the dual process theory of Chaiken and Trope (1999), suggesting that humans prefer intuitive reasoning over deliberate information processing (Evans & Stanovich, 2013). Intuition is a rapid, automatic process that does not involve extensive analysis, allowing individuals to understand a situation or problem instantaneously. These intuitive insights often originate from the subconscious mind, where vast amounts of information and experiences are processed outside of conscious awareness, integrating past experiences, patterns, and knowledge to generate quick judgments or decisions (Evans & Stanovich, 2013). De Neys and Pennycook (2019), through their review of experimental paradigms related to the dual process theory, show that biased individuals demonstrate some sensitivity to their errors by intuitively processing logical principles without engaging in deliberate reasoning. This "intuitive logical thinking" emerges through a learning process where previously applied logical principles become automatized, leading to subsequent logical intuition (De Neys, 2012; Kahneman, 2012).

In the context of herd bias, intuitive logical thinking becomes particularly important since it allows investors to navigate the pressures of social conformity and market. It equips investors with the ability to recognize these social influences quickly, enabling them to avoid decisions that are merely reactive to market sentiment. As investors consistently apply logical principles such as evaluating the intrinsic value of an asset or considering risk-return profiles, these processes become internalized over time. Accordingly, during self-reflection, it enables investors to critically assess their actions by intuitively questioning the validity of their choices, asking whether they are based on sound reasoning or external pressure. Consequently, when confronted with market volatility or the actions of other investors, investors with well-developed intuitive logical thinking can more easily recognize herd behavior and intuitively resist such bias in their decisions. Thus, intuitive logical thinking empowers investors to make independent decisions that are less influenced by the herd.

Accordingly, given individual investors' bounded rationality, they are more likely to engage in self-reflection through intuitive logical thinking to mitigate their herd bias. Therefore, based on the insights from the dual process theory and transformative learning theory and the learning behavior model proposed by Shantha et al. (2018), it can be expected that higher investment experience (IEXP) leads to a higher level of self-reflection (SREF), thereby reducing herd bias (HERD), as indicated by the hypothesis 1 (H_1).

H₁: IEXP reduces HERD through the mediation effect of SREF.

In addition to this cognitive aspect of learning, Shantha et al. (2018) suggest that investors' affective phenomena such as emotions experienced during past decisions, attention to mistakes, and interest in learning influence their learning process. Since their learning process is self-regulated, such affective phenomena are integrated with cognitive functioning, influencing the desire to learn (Isen, 2000). For instance, a positive mood can boost creativity and flexibility in learning, while interest and attention are likely to encourage active exploration of information (Lovric et al., 2008; Picard et al., 2004). Conversely, investors who feel frustrated, depressed, disinterested, or inattentive are less likely to engage in effective learning. Taylor (2000, 2007), through critical reviews of transformative learning theory and its empirical findings, also shows that the desire to learn enhances cognitive functioning during the self-reflection process. Based on these insights, it is hypothesized that investors' desire for learning (DLER) enhances their self-reflection, thereby reducing herd bias, as indicated by Hypothesis 2 (H₂).

H₂: DLER reduces HERD through the mediation effect of SREF.

Further, by reviewing the learning literature, Shantha et al. (2018) propose that investors' social relationships can enhance their self-reflection capability. Koole et al. (2011) show that social interactions improve the reflection process by creating a stimulating environment where learners can understand the meanings of their experiences and receive feedback on their behaviors. The practice-based model of transformative learning, proposed by Nohl (2015) also indicates that external feedback can either confirm or challenge interpretation of experiences, guiding toward a more effective learning process. Accordingly, social relationships facilitate investors to acquire necessary information and practical knowledge for perspective transformation. Particularly, trustworthy relationships enhance confidence in the knowledge and information received, thereby increasing their tendency to engage in self-reflection (Taylor, 2007). Given that novice and unsophisticated investors are prevalent in frontier markets, it is more likely that these investors can establish authentic relationships primarily with their advisors. Therefore, it is hypothesized that investors' authentic relationships with their investment advisors (ARAD) enhance their self-reflection, thereby reducing herd bias, as indicated by Hypothesis 3 (H₃).

H₃: ARAD reduces HERD through the mediation effect of SREF.

2.3 *Financial literacy as a mitigator of herd bias*

Lusardi and Mitchell (2011) define financial literacy as “the knowledge of basic financial concepts and the ability to perform simple calculations.” According to Huston (2010), it covers both the knowledge of personal finance and the practical application of that knowledge. Broadly, the concept of financial literacy encompasses cognitive, psychological, and behavioral dimensions. Cognitively, it involves understanding financial concepts and principles that facilitate the processing of information for making financial decisions. Psychologically, financial literacy shapes how individuals perceive and respond to financial

situations that affect their financial behaviors and attitudes. Behaviorally, financial literacy pertains to the practical application of this knowledge in making financial decisions.

Previous studies have predominantly examined the behavioral aspect of financial literacy. Their findings consistently demonstrate that financial literacy enhances analytical skills, positively impacting financial decisions and investment performance (Awais et al., 2016; Banks & Oldfield, 2007; Jappelli & Padula, 2013; Lusardi et al., 2010). Ashfaq et al. (2024) and Jain et al. (2023) find that financial literacy reduces individual investors' herd bias. The study of Jain et al. (2023) suggests a mediating effect of financial literacy on the association between herd bias and investment decision-making. On the contrary, Fernandes et al. (2014) found that financial literacy accounts for only 0.1% of the variance in individuals' financial behavior, and their cognitive ability plays a more significant role. Skagerlund et al. (2018) further show that cognitive reflection and emotional factors are major determinants of financial behavior of individuals. Therefore, the literature highlights the importance of considering both cognitive and psychological aspects of financial literacy when assessing its impact on financial behavior and its potential to mitigate behavioral biases.

Concerning the cognitive and psychological aspects of financial literacy, it can be expected that it improves the ability to understand and analyze information, facilitating investors to better engage in intuitive logical thinking. Accordingly, consistent with Shantha (2024), it can be argued that financial literacy, through its cognitive and psychological effects, strengthens investors' self-reflection capability to reduce their herd bias. Therefore, it infers that the indirect effects of investors' investment experience, desire for learning and authentic relationship with their advisers in reducing herd bias through the mediation of self-reflection is stronger for investors with higher financial literacy (FINL) compared to those with lower financial literacy, as indicated by Hypotheses H_{4a}, H_{4b} and H_{4c} below.

H_{4a}: FINL moderates the indirect effect of IEXP on HERD through the mediation of SREF.

H_{4b}: FINL moderates the indirect effect of DLER on HERD through the mediation of SREF.

H_{4c}: FINL moderates the indirect effect of ARAD on HERD through the mediation of SREF.

3. Methodology

The data was obtained by distributing a self-administrated questionnaire to a sample of 600 active individual investors of the Colombo Stock Exchange (CSE) during the period August-December 2023. Of the responses to the questionnaire, the valid responses were 253 which represents a response rate of 42.2%. The questionnaire comprises of nine items to obtain information on the demographic and investment characteristics of respondents. The model's constructs were measured by adopting scales from prior literature to ensure their content validity, as follows. The number of years of stock trading was used as the measurement of IEXP (Mishra & Metilda, 2015; Yalcin et al., 2016). As suggested by Kember et al. (2000), the

measures of SREF construct include three items of the process reflection and four items of the premise reflection. Kengatharan and Kengatharan (2014) used a four-item scale to measure HERD construct, which was adopted in this study. Five items relating to financial knowledge, skills and attitudes were employed to measure FINL construct (Dewi et al., 2020). The 10-item scale suggested by Fisher and King (2010) and Williams and Brown (2013) was adopted for measuring DLER construct. However, it was limited to eight items since two items were excluded due to low factor loading found by indicator relevance test procedure (Sarstedt et al. 2017; Wong, 2016). ARAD was measured with five-items by employing the scale suggested by Kale et al. (2000). However, low factor loading results to drop of one item when measuring ARAD. All the constructs other than IEXP were measured by using a five-point Likert scale: 1 for strongly agree and 5 for strongly disagree. A pilot study based on a sample of 15 respondents was conducted to further ensure their content validity.

In conducting the questionnaire survey, several measures were applied to protect participants' privacy and ensure the ethical integrity of the research process. First, the informed consent was obtained from all participants before they began the survey by clearly explaining the purpose of the study, the nature of the questions, and how their responses would be used. The participants were informed that their involvement was entirely voluntary, and they had the right to withdraw from the study at any time without any negative consequences. To ensure confidentiality, participants were assured that their responses would remain anonymous, and that no identifying information would be collected unless explicitly stated. The data was securely stored, accessible only to the researcher, and used solely for the purpose of the study. Further, the participants were informed that the findings would be reported in aggregate form, ensuring that no individual could be identified in the results.

When analysing the data, the constructs' reliability and validity were first ensured. The internal consistency reliability of the respective constructs was assessed based on their Cronbach's alpha values. The convergent validity was evaluated based on average variance extracted (AVE) values. The Fornell and Larcker criterion was examined to ensure the discriminant validity of the constructs. The chi-square and SRMR (standardized root mean square) were estimated to assess the goodness of fit of the model. The mediation and moderated mediation hypotheses were examined using the PROCESS procedure developed for SPSS (Hayes, 2018). It estimates the existence of mediation and conditional mediation effects based on the bootstrap confidence intervals at 95% level and 5,000 bootstrap samples. The mediation and conditional mediation effects are significant if the confidence intervals do not contain 0. Further, in testing the conditional mediation hypotheses, following the methodology suggested by Aiken and West (1991), the mediation effects were analyzed at three distinct levels of financial literacy: lower ($M - 1\text{ SD}$), average (M), and higher ($M + 1\text{ SD}$). This approach allowed for an in-depth examination of how varying degrees of financial literacy influence the strength of the mediation effects, providing a clearer understanding of the conditional mediation relationships in the model.

4. Results

4.1 Respondents' profile

Aligning with the Sri Lankan cultural norm that investment decisions are mostly made by men, the majority (64.8 percent) of the participants to the survey is male investors. Regarding their age distribution, the respondents below 35 years are nearly 38 percent, and those between 35 and 54 years are about 50 percent. The majority has a bachelor's degree or higher. In terms of their occupation, 75.9 percent of the respondents are employed in the private sector, while 10.3 percent are employed in the public sector. The self-employed and retired respondents are respectively 6.7 percent and 4.7 percent of the sample. Accordingly, the sample reasonably characterizes the demography of individual investor population in the CSE.

On average, respondents have 10.5 years of investment experience, with a standard deviation of 6 years. The sample comprises of both highly experienced investors (13 percent with over 18 years of experience) and those with limited experience (5.9 percent with 2 years or less). Only 13.4 percent of respondents involves in daily trading of stocks, while most of them trade once a week or less. Approximately 30 percent have a low-risk appetite, while another 30 percent exhibit high risk-taking behavior. Many respondents exhibit low preference for stock investments as reflected by 26.5 percent holding less than 5 percent of their wealth in stocks and 29.2 percent holding 5-15 percent. This low preference for stock investments is probably due to the significant investment losses and increased risk aversion caused by recent economic crises, political instability and adverse effects of COVID-19 pandemic.

4.2 Descriptive statistics

Descriptive statistics are presented in Appendix 1. Among the variables, DLER construct has the highest overall mean score of 4.027, followed by ARAD, which has a mean score of 3.838 on a five-point Likert scale. In contrast, HERD construct has the lowest mean score at 2.781, showing the respondents' lower tendency for herding during the period of the study. The skewness and kurtosis values for nearly all indicator items fall between +1 and -1, indicating that the data set is approximately normally distributed.

4.3 Reliability and validity

As shown in Appendix 1, after performing the indicator relevance test procedure suggested by Sarstedt et al. (2017), all indicator items demonstrate a satisfactory reliability level, as reflected by their standardized loadings above 0.7 and significant at the 1 percent level. Table 1 shows that both Cronbach's alpha and composite reliability values exceed 0.7, which signifies a strong internal consistency reliability for all constructs (Gefen et al., 2000). Accordingly, the constructs are reliable and can be employed for further analysis. In addition, the AVE values of all the constructs are above 0.5, which confirms their convergent validity. Further, as shown in Table 2, all constructs exhibit discriminant validity, as evidenced by HTMT ratios of less than 0.85 (Henseler et al., 2015). The model also confirmed a good fit, as indicated by Chi-square of 1585.02 ($p < 0.001$), and SRMR of 0.066 lower than the cut-off

value of 0.08 (Hu & Bentler, 1999). In addition, no multicollinearity issues were present as VIF values are below five (Hair et al., 2011).

Table 1. Measurement Quality of Constructs

Construct	Cronbach's alpha	AVE
ARAD	0.862	0.707
DLER	0.940	0.708
FINL	0.895	0.703
HERD	0.912	0.795
SREF	0.947	0.761

Table 2. Fornell-Larcker Criterion Analysis for Discriminant Validity

Construct	ARAD	DLER	FINL	HERD	INVE	SREF
ARAD	0.841					
DLER	0.588	0.841				
FINL	0.543	0.637	0.838			
HERD	-0.544	-0.661	-0.495	0.892		
INVE	0.293	0.392	0.307	-0.394	Single-item	
SREF	0.563	0.756	0.541	-0.747	0.448	0.872

Note: This table presents a comparison between each construct's the square root of AVE value (as printed in bold in the diagonal) and its correlations with the other constructs for assessing the discriminant validity. A construct's discriminant validity is confirmed when its square root of AVE is larger than its correlation values with other constructs (Fornell & Larcker, 1981).

4.4 Testing of hypotheses

Mediation analysis results

The results relating to the mediation analysis are presented in Table 3. Supporting the hypothesis H₁, it shows that the indirect effect of IEXP on HERD through SREF (as indicated by the path IEXP→SREF→HERD) is significantly negative ($p < 0.01$), indicating that investment experience reduces herd bias through the mediation of self-reflection. Since the direct effect of IEXP on HERD is insignificant, self-reflection has a full mediation on the effect of investment experience on herd bias (Zhao et al., 2010). These findings are consistent with those of Shantha (2019a) and Shantha (2024) on the CSE which reveal a full mediation effect of self-reflection. Accordingly, it is evident that not just past investment experiences of the investors, but self-reflection upon the experiences reduce their herd bias. It means that the biases do not get minimized when the self-reflection is absent, and for a given level of experience, a higher level of self-reflection results to a lower level of herd bias.

Table 3. Mediation Analysis Results

Path	Total effect	Direct effect	Indirect effect			
			Effect	LLCI	ULCI	t-statistic
IEXP→SREF→HERD	-0.3942**	-0.0743	-0.3198**	-0.4786	-0.2052	-4.5556
DLER→SREF→HERD	-0.6612**	-0.2263**	-0.4349**	-0.5577	-0.3204	-7.2003
ARAD→SREF→HERD	-0.5439**	-0.1807**	-0.3631**	-0.4749	-0.2580	-6.6259

Note: This table presents the results relating to the tests of hypotheses H1, H2 and H3. ** and * indicate the significance at 1 percent level and 5 percent level respectively. The confidence intervals at lower level (LLCI) and upper level (ULCI) are given at 95%. The number of bootstrap samples is 5,000.

In addition, supporting the hypotheses H₂ and H₃, the coefficients of the paths DLER→SREF→HERD and ARAD→SREF→HERD are significantly negative ($p < 0.01$). However, their direct effects are also significantly negative. Hence, self-reflection has partial mediation on the effects of investors' desire for learning and authentic relationship with their investment advisors on reducing herd bias (Zhao et al., 2010). When the sizes of their effects are considered, the indirect effect is larger than the direct effect, meaning that investors' desire for learning and authentic relationship with their investment advisors reduce their herd bias mainly through their self-reflection. Accordingly, the statistical significance of self-reflection as a mediating variable across its antecedents provides strong evidence for its central role in reducing herd bias. This supports and extends the literature on self-regulatory learning and decision-making, suggesting that self-reflection is a key mechanism through which individual investors can mitigate irrational herd behavior.

Conditional mediation analysis results

Table 4 presents the conditional mediation analysis results for testing hypotheses H_{4a}, H_{4b}, and H_{4c}. The results highlight how financial literacy moderates the indirect effects of investment experience, desire for learning, and authentic relationship with an investment advisor on herd bias through the mediation of self-reflection. With respect to the conditional indirect effect of IEXP, as shown in Panel A, the index of moderated mediation is statistically significant at the 1 percent level, which supports hypothesis H_{4a}. This indicates that financial literacy moderates the indirect effect of investment experience on herd bias through self-reflection. Following the approach by Aiken and West (1991), the indirect effects are examined at lower (M -1 SD), mean (M), and higher (M +1 SD) levels of financial literacy. Accordingly, at all three levels of financial literacy, the indirect effects are significantly negative ($p < 0.01$). Notably, these negative indirect effects decrease as financial literacy increases, suggesting that self-reflection's impact on reducing herd bias is stronger at lower level of financial literacy and weaker at higher level.

Similar patterns are observed in Panel B which presents the results relating to the conditional indirect effect of the desire for learning on herd bias through self-reflection. The index of moderated mediation is also statistically significant at the 1 percent level ($p < 0.01$). The indirect effects at lower, mean, and higher levels of financial literacy are significantly

negative ($p < 0.01$). These negative effects also decrease as financial literacy increases, indicating that financial literacy moderates the indirect effect of DLER on herd bias through self-reflection in a similar manner as it does for IEXP.

Panel C presents the conditional indirect effect of having an authentic relationship with an investment advisor on herd bias through self-reflection. The index of moderated mediation is statistically significant at the 1 percent level ($p < 0.01$). As with the previous analyses, the indirect effects at lower, mean, and higher levels of financial literacy are significantly negative ($p < 0.01$), and these negative effects decrease as financial literacy increases. This again suggests that financial literacy moderates the indirect effect of ARAD on herd bias through self-reflection, similar to the moderation observed for IEXP and DLER.

Table 4. Conditional Mediation Analysis Results

	Effect	Standard error	95% Confidence Interval		t-statistic
			LL	UL	
Panel A: Conditional indirect effect of IEXP on HERD through SREF					
Index of moderated mediation	0.0751**	0.0326	0.0347	0.1630	2.3037
Lower level (M -1 SD) of FINL	-0.3292**	0.0736	-0.5043	-0.2152	-4.4728
Mean level (M) of FINL	-0.2539**	0.0639	-0.4044	-0.1513	-3.9734
Higher level (M +1 SD) of FINL	-0.1787**	0.0699	-0.3383	-0.0528	-2.5565
Panel B: Conditional indirect effect of DLER on HERD through SREF					
Index of moderated mediation	0.1140*	0.0586	0.0354	0.2635	1.9454
Lower level (M -1 SD) of FINL	-0.5094**	0.0750	-0.6715	-0.3781	-6.7920
Mean level (M) of FINL	-0.3952**	0.0602	-0.5139	-0.2801	-6.5649
Higher level (M +1 SD) of FINL	-0.2809**	0.0924	-0.4353	-0.0682	-3.0400
Panel C: Conditional indirect effect of ARAD on HERD through SREF					
Index of moderated mediation	0.0844*	0.0402	0.0326	0.1900	2.0995
Lower level (M -1 SD) of FINL	-0.3971**	0.0642	-0.5406	-0.2844	-6.1854
Mean level (M) of FINL	-0.3126**	0.0578	-0.4322	-0.2016	-5.4083
Higher level (M +1 SD) of FINL	-0.2281**	0.0761	-0.3663	-0.0650	-2.9974

Note: This table presents the results relating to the indirect effects of investment experience (IEXP), desire for learning (DLER) and authentic relationship with investment advisor (ARAD) on herd bias (HERD) through self-reflection (SREF) conditional on financial literacy (FINL), as hypothesized by H4a, H4b and H4c. ** and * indicate the significance at 1 percent level and 5 percent level respectively. The number of bootstrap samples is 5,000.

These findings highlight the important role of self-reflection in reducing herd bias. The stronger effect of self-reflection on reducing herd bias among investors with lower financial literacy indicates its vital role in mitigating their herd behavior. These investors are more prone to herd bias due to their limited financial literacy. However, self-reflection facilitates them to identify the potential pitfall of herding, thereby reducing their tendency to follow the other

investors' behaviour. On the other hand, the effect of self-reflection on herd bias is less pronounced among investors with higher financial literacy. It can be expected since these investors already have the knowledge and skills to make informed decisions independently. While self-reflection still facilitates to decrease their herd behavior, its effect is weaker since these investors are fundamentally less vulnerable to herd bias.

5. Conclusion and recommendations

This study aims to explore a relatively under-explored issue of how individual investors can mitigate herd bias that occurs when investing in stocks. Though the literature suggests that self-reflection and financial literacy have potential to mitigate herd bias, it is unclear as to how these two perspectives interact and minimize this irrational behavior. By drawing on insights from the adaptive market hypothesis, transformative learning theory, concept of bounded rationality and dual process theory, this study attempts to enhance the understanding of this phenomenon by introducing a conditional mediation model that promotes self-directed learning. It predicts that investors can reduce their herd bias through self-reflection on their past stock trading experiences, which they can practice by engaging intuitive logical thinking and strengthen further through their financial literacy.

The results relating to the mediation analysis suggest that self-reflection mediates the effects of its antecedents namely investors' investment experience, desire for learning and authentic relationship with their investment advisors in reducing their herd bias, which provides strong evidence for its central role in reducing herd bias. Notably, the findings relating to the moderated mediation analysis indicate that self-reflection has a stronger effect on reducing herd bias of investors with lower level of financial literacy. It implies that investors with low financial literacy are more susceptible to herd bias, and self-reflection facilitates them to recognize and minimize their tendency to herd. Accordingly, it can be concluded that promoting self-reflection empowers individual investors to become more financially literate and thereby mitigate their herd bias.

This study offers significant contributions to academia and practice. It provides new insights into financial literacy and behavioral finance literature on how herd bias is mitigated to improve individual investors' decision-making capabilities. The study shows that a self-directed learning approach which involves self-reflection, as practiced by engaging intuitive logical thinking, can effectively reduce the tendency to herd. Hence, fostering self-reflection among individual investors is crucial for minimizing their herd bias. Accordingly, the findings of this study offer practical recommendations for stock exchanges, investment advisors, and policymakers to mitigate herd bias among individual investors, as follows. Stock exchanges can incorporate self-reflection tools such as guided journaling or interactive decision-tracking tools into their investor education platforms. These tools can prompt investors to record their investment decisions, track their thought processes, and critically assess their exposure to behavioral biases such as herding. They can also host webinars and workshops and provide online resources for guiding investors to practice self-reflection in real-world scenarios.

Investment advisors can adopt a consultative approach, integrating self-reflection checkpoints during portfolio reviews to prompt clients to reflect on the rationale behind their investment choices. They can also offer structured journaling templates or recommend digital tools designed to help clients document their decision-making processes, thereby identifying any herd behavior tendencies. During client onboarding, advisors can offer behavioral finance training that emphasizes the importance of self-reflection and critical thinking in making independent investment decisions. For policymakers, the study highlights the importance of incorporating self-reflection techniques into financial literacy programs. These programs can introduce specific courses or workshops focusing on the development of critical thinking and decision-making skills to counteract herd behavior. Further, metrics and evaluation techniques, such as tracking changes in investment decision quality or assessing reductions in herd tendencies over time, could be used to measure the effectiveness of these self-reflection practices.

Future studies should extend to other frontier markets as well as developed and emerging stock markets. In addition, as noted by Shantha (2019a), it is likely that the predictive power of self-reflection and thereby mitigation of herd bias may be driven by market conditions. Hence, it is recommended to conduct longitudinal studies to examine the role of cognitive, psychological, and social factors in mitigating herd bias under different market conditions.

Acknowledgements

I am grateful to two anonymous reviewers for their useful comments on the earlier version of the paper.

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Appendix 1: Descriptive statistics

Construct	Item label	Loading	Mean	Standard deviation	Excess kurtosis	Skewness
Investment Experience (INVE)	TradeYrs	Single-item	10.47	5.96	2.614	1.259
Authentic Relationship with investment advisors (ARAD) (Overall mean = 3.838)	Arad_1	0.829	3.933	0.884	0.716	-0.696
	Arad_2	0.862	3.870	0.967	-0.458	-0.447
	Arad_3	0.870	3.850	0.916	-0.934	-0.225
	Arad_5	0.797	3.700	0.798	0.909	-0.531
Desire for Learning (DLER) (Overall mean = 4.027)	Dl_1	0.879	4.241	0.839	-0.699	-0.682
	Dl_2	0.885	4.154	0.882	0.862	-0.932
	Dl_3	0.877	4.032	0.871	-0.971	-0.351
	Dl_4	0.887	4.004	0.887	-0.873	-0.316
	Dl_6	0.744	3.743	0.796	0.878	-0.451
	Dl_7	0.733	4.012	0.714	-0.082	-0.345
	Dl_8	0.829	3.972	0.921	-0.154	-0.494
	Dl_9	0.870	4.055	0.803	-0.932	-0.285
Financial Literacy (FINL)	Finl_1	0.807	3.644	0.932	-1.106	0.266

(Overall mean = 3.556)	Finl_2	0.882	3.534	0.988	-0.841	0.104
	Finl_3	0.873	3.640	0.983	-0.544	-0.032
	Finl_4	0.853	3.455	1.038	-0.519	-0.081
	Finl_5	0.773	3.506	0.818	-0.514	0.264
Herd bias (HERD) (Overall mean = 2.781)	Herd_1	0.934	2.652	1.202	-0.445	0.792
	Herd_2	0.915	2.700	1.214	-0.591	0.686
	Herd_3	0.923	2.561	1.236	-0.233	0.933
	Herd_4	0.782	3.209	1.241	-1.320	0.107
Self-reflection (SREF) (Overall mean = 3.785)	Sr_1	0.829	3.727	1.064	-0.724	-0.528
	Sr_2	0.805	3.593	1.073	-1.061	-0.214
	Sr_3	0.904	3.893	1.082	-0.375	-0.785
	Sr_4	0.913	3.897	1.073	-0.319	-0.798
	Sr_5	0.846	3.739	1.105	-1.086	-0.424
	Sr_6	0.906	3.846	1.123	-0.713	-0.653
	Sr_7	0.893	3.798	1.101	-0.707	-0.594

Note: All loadings are significant at $p < 0.001$.