

Impact of Animal Spirit on Trade Performance: Moderating Role of Financial Literacy

Waheed Ullah¹, Naveed², Zain Ullah³

ABSTRACT

Behavioral biases play a vital and critical role in shaping the investor decision-making particularly in the emerging markets where informational inefficiencies are common. The current study investigated the impact of three behavioral biases which were mental accounting, anchoring and herding on the trading performance of the retail investors, while examining the moderating role of the financial literacy. Grounded in Prospect Theory and the behavioral finance paradigm this study employed the quantitative design used the survey data and collected 300 responses from the active retail investors in Khyber Pakhtunkhwa Pakistan. The data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to evaluate both the measurement and the structural models. The findings showed that the mental accounting, anchoring and herding each had significant negative effects on trading performance, indicating that heuristic-driven judgments reduced the investment efficiency. Financial literacy emerged as a significant moderator by weakening the negative effects of these biases and enabling the investors to make more informed and more rational trading decisions. The model achieved satisfactory reliability, convergent and discriminant validity and strong explanatory power with R² of 57%. These results highlighted the importance of the financial education and cognitive awareness in improving the trading outcomes. The study contributes to behavioral finance literature by offering empirical evidence from a developing market context and emphasizing the practical implications for the policymakers, financial advisors, investor training institutions and trading platforms aiming to enhance the decision quality and the market stability.

Keywords: Behavioral finance, mental accounting, anchoring, herding, financial literacy, Prospect Theory, PLS-SEM

INTRODUCTION

The concept of Animal Spirits provided the broader psychological foundation through which the selected behavioral biases influenced trading performance. Animal Spirits, as

¹PhD Scholar at Qurtuba University of Science & Information Technology, Khyber Pakhtunkhwa.
Corresponding Author's Email: waheedkhatakpcta@gmail.com

²Professor/Dean of Management Sciences, City University of Science & Information Technology (CUSIT), Peshawar

³Govt. Commerce College -II Nowshera

articulated in behavioral economics, reflected the non-rational, emotion-driven forces such as optimism, fear, confidence, and sentiment that shaped investors' decision-making under uncertainty. These forces manifested concretely through specific behavioral biases examined in this study. Mental accounting emerged as a structured yet psychologically driven allocation of resources influenced by perceived gains and losses. Herding behavior represented collective sentiment and imitation arising from shared optimism or panic in financial markets. Anchoring reflected cognitive fixation on prior information, often reinforced by emotional attachment to past prices. The disposition effect illustrated emotional resistance to realizing losses and premature realization of gains, both rooted in loss aversion and sentiment. Gambler's fallacy demonstrated irrational belief systems driven by overconfidence and emotional misinterpretation of market patterns, while home bias reflected psychological comfort and familiarity rather than objective risk assessment. Collectively, these biases operationalized Animal Spirits at the individual investor level, translating abstract psychological impulses into observable trading behaviors that ultimately affected trading performance, with financial literacy moderating the intensity and impact of these effects.

Financial markets traditionally had been viewed, through lens of the rational decision-making where investors processed the information logically and acting in multiple ways that maximize their expected utilities. However, during the past few decades or so the empirical evidence increasingly showed, that the investors frequently deviated from rationality and relied on psychological shortcuts in their trading decision (Barberis & Thaler, 2003; T. Kahneman, 1979). These recurring deviations, were conceptualized as behavioral biases systematically influence that how investors assess risks interpreted information and executed buy or sell decisions. Behavioral finance scholars argued that such biases played/playing a critical role in shaping market movements especially in emerging markets where the information asymmetry, and the financial literacy issues were more prominent (Shefrin & Belotti, 2007) and (Pompian, 2012). As a result, the performance of the trading often exhibited variations that could not fully be explained, by the traditional economic models alone highlighting importances of the psychological determinants in understanding investor behavior.

Within the broad domain of behavioral biases certain biases appeared more consistently, in the decision-making process of the retail investors. Mental accounting for instance reflected the tendency of investors to treat their money in different way based on arbitrary labels rather than objective financial principles (Thaler, 1985). Anchoring bias another widely observed cognitive deviation occurred when the investors relied heavily on an initial value or reference point thereby distorting their judgment even when the new information became available (Tversky & Kahneman, 1974). The herding behavior which captured the investors' tendency to follow the actions of others, rather than relying on their own analysis became particularly visible during periods of high market volatility and speculative rallies (Bikhchandani & Sharma, 2000). These biases are collectively influencing the individual traders by limiting the quality of their decision-making processes often leading to the suboptimal trading performance (Barber & Odean, 2001) & (Baker & Nofsinger, 2010)

Despite their importance the influence of these biases on trading performance remained insufficiently explored particularly in developing economies where the investors education

regulatory oversight and the information availability differed significantly from more advanced markets (Ritter, 2003) (Akerlof & Shiller, 2015). Moreover, while behavioral biases have been studied extensively the interaction between such biases and investors' financial literacy levels remained a critical yet the understudied dimension. Financial literacy means that the ability to understand financial concepts and make informed decisions—played a vital role in determining whether an investor could recognize, control or compensate for their cognitive distortions (Lusardi, Mitchell, & Curto, 2014). Many studies suggested that higher financial literacy reduced susceptibility to the biases and improved portfolio choices and enhanced the overall performance (Bucher-Koenen & Ziegelmeyer, 2014; Van Rooij, Lusardi, & Alessie, 2011). However, the moderating impact of financial literacy on the relationship between specific behavioral biases and the trading performance had not been examined sufficiently especially with respect to mental accounting, anchoring and herding within the context of retail investors.

This gap provided the core motivation for the present study. Although some research examined individual biases the existing literature often looked at them in isolation or evaluated their impact without considering boundary conditions such as financial literacy (Hoffmann, Post, & Pennings, 2015). There was also limited empirical work focusing on investors in emerging South Asian markets where behavioral tendencies were often shaped by cultural norms informal financial knowledge and market uncertainties (Kansal & Singh, 2018). The study in hand therefore is an attempt to address this gap by investigating the three important behavioral biases, mental accounting, anchoring and the herding and their combined effect on the trading performance while also assessing how financial literacy moderated these relationships. Understanding this interaction was very essential because of the reasons that even if the biases were existed their strength and impact could vary depending on an investor ability to interpret the information and apply the financial principles effectively.

The problem this study addressing and addressed were rooted in observation that the many individual investor continued to exhibit, the low trading performance despite of having access to the diverse financial products and real-time market information. Instead to improve their outcomes investors frequently rely on psychological shortcuts and the emotional reactions and the socially influenced judgments which collectively undermined, their overall financial decisions (Odean, 1998). Poor or limited financial literacy further amplifies the issues making investor more vulnerable to the impulsive trading speculative behavior and the reliance on the unverified market trend. Consequently, the retail traders often experienced the inconsistent returns, unnecessary trading losses and the inefficient portfolio allocations which reflected significant problems for both personal financial wellbeing and the stability of broader financial markets. By focusing on the specific biases and incorporating the financial literacy as a moderating construct this study aimed to provide, a clearer understanding, of why the investors made the sub optimal decisions and how their performance can or might be improved through the better knowledge and the awareness.

Based on these concerns the study in hand pursued, the following research questions. First what is the impact of mental accounting, Anchoring and herding on trading performance? Finally: does financial literacy moderate the relationship between these behavioral biases and trading performance? These questions guided the empirical investigation, and enable a structured

assessment of how psychological tendencies interacted with knowledge-based capabilities to determine trading outcomes.

Correspondingly objectives of study were to examine the impact of the mental accounting on trading performance analyzing the effect of the anchoring bias on trading performance and evaluate the influence of the herding behavior on trading performance. Additionally, the study aim to investigate the moderating role of financial literacy in relationship between these behavioral biases and the trading performance. By addressing these objectives, the current study sought to contribute to better understanding of how the cognitive and the psychological factors influenced the investor performance and how the financial knowledge may mitigate the negative effects of such biases.

The significance of the study laying in its contributions to the field of the behavioral finance, the investor education and helping in the practical decision making. The study added the value theoretically by integrating behavioral determinants with the moderating variable that can either decrease or can increase their effects. This enhanced the conceptual clarity about how biases operated, under the different conditions of the financial literacy. Empirically, the findings offered insights that could help policymakers' financial educators and investment advisory firms to design their strategies and to improve the investor outcomes through targeted literacy programs. For retail investor the study's significance stemmed from raising awareness about their own cognitive limitations and highlighting the importance of financial skills in improving the trading performance. Since emerging markets often experienced strong waves of the speculation and information-driven, herding the results of this study were particularly relevant in guiding interventions aimed at stabilizing the market behavior. Overall, this research work establishes a more holistic understanding of the investor psychology by demonstrating that the behavioral biases does not operating in the isolation rather their impact depended significantly on the level of financial literacy possessed by individual traders.

LITERATURE REVIEW

Behavioral finance has been emerged to a response to the limitations of the traditional financial theories that assume the perfect rationality, complete information and the optimal decision-making. The foundational work of (D. Kahneman & Tversky, 1979), who developed Prospect Theory, provided an alternative explanation for investor decision behavior by demonstrating that individuals systematically deviated from rational expectations when dealing with risk and uncertainty. Prospect Theory posited that the people evaluated potential gains and losses relative to a reference point rather than absolute outcomes and exhibited loss aversion meaning losses were perceived more intensely than equivalent gains. This framework has become the main underpinning theory for behavioral biases such as mental accounting, anchoring and herding because it explained that why the individuals relied on heuristics rather than objective financial assessments. Later scholars in behavioral finance including the (Thaler, 1985), (Shefrin & Belotti, 2007) and (Barberis & Thaler, 2003) expanded this perspective arguing, that the psychological distortions frequently influenced financial decisions, especially among retail investors.

Under Prospect Theory the mental accounting was conceptualized as the tendency of the individuals to categorize, label and treat money differently based on arbitrary mental “accounts,” rather than viewing all financial resources as fungible (Thaler, 1985). Investors created separate mental accounts for capital, gains dividends or speculative trades and often made inconsistent decisions across these accounts. This behavior reduced the overall trading performance because investors ignored the integrated risk and return of their full portfolio (Barberis & Huang, 2001). Empirical studies showed that the mental accounting caused investors to hold losing stocks for too long, sell winning stocks too early and allocate funds to speculative trades without considering broader financial implications (Odean, 1998; Kumar & Lim, 2008). In emerging markets where formal financial education was limited mental accounting tendencies became even more pronounced leading to biased portfolio choices and inconsistent performance outcomes (Kansal & Singh, 2018).

The anchoring bias another cognitive tendency rooted in Prospect Theory occurred when individuals are relied heavily on initial value or reference point and failed to adjust sufficiently when the new information emerged (Tversky & Kahneman, 1974). In the financial markets investors anchored to purchase prices old market highs, analyst forecasts or historical index levels even when objective conditions changed (Bremer & Kato, 1996). This distortion had led to the delayed reactions the irrational expectations and inefficient trade timings. Many studies found that anchoring contributed to mispricing underreaction to earnings announcements and persistent deviations in the asset valuation (George & Hwang, 2004; Kaustia, Alho & Puttonen, 2008). More importantly the anchored investors often refused to sell a stock at the loss because of their judgments revolved around the “anchor” leading to poor trading performance. Retail investors were especially susceptible, to the anchoring when the market information was incomplete or when they lack the analytical skills to evaluate new data objectively (Baker & Nofsinger, 2010).

The herding behavior is represented a socially influenced bias that prompted investors to imitate that the decisions of others rather than rely on their own information or analysis (Bikhchandani & Sharma, 2000). Herding was often observed during market booms, speculative rallies or sudden downturns, where collective behavior intensified market volatility. Herding was theoretically connected to the Prospect Theory through the loss aversion and fear of missing out as well as to informational cascade theory which explained how the individuals’ copied others when they felt uncertain or believed others possessed superior information (Banerjee, 1992). Empirical evidence showed that the herding led to momentum trading, asset bubbles and abrupt market corrections (Chang, Cheng & Khorana, 2000). The Retail investors, who relied excessively on social cues or the rumors frequently engaged in impulsive trading resulting in the lower portfolio stability and inconsistent performance (Devenow & Welch, 1996). In the emerging markets such as South Asia herding was found to be more widespread due to the cultural collectivism, informational asymmetry and the presence of informal investment networks (Kooli & Achchab, 2015).

Trading performance the dependent construct in this study is influenced not only by the market fundamentals but also by the investor’s psychology and the investor behavior. The traditional models suggested that performance depended on rational asset allocation, efficient portfolio diversification and systematic risk assessment (Markowitz, 1952; Fama, 1970).

However, the research in the behavioral finance demonstrated that emotional and the cognitive biases often outweighed rational analysis in shaping real world trading performance (Barber & Odean, 2001). Biased investor frequently overtraded acted on incomplete information and relied on heuristics all of which reduced net trading returns. Studies showed that the investors exhibiting higher behavioral distortions tended to experience the lower performance due to the poor timing, excessive speculation and misjudgment of risk (Lo, 2005; Shiller, 2015). This justified the need to examine specific biases and understand how they shaped actual trading behavior.

The financial literacy has played a crucial and important role in influencing the extent to which the behavioral biases affected trading performance. Defined as the ability to understand the financial concepts, evaluate investment alternatives and make informed decisions financial literacy enabled investors to process information more effectively and avoid the common cognitive traps (Lusardi & Mitchell, 2014). The scholars argued that the financially literate investors were better equipped to resist emotional impulses evaluate the risk-return trade-offs accurately and avoid irrational trading patterns (Van Rooij, Lusardi & Alessie, 2011). The Empirical studies supported this view showing that the financial literacy reduced susceptibility to anchoring (Bucher-Koenen & Ziegelmeyer, 2014) limited the effects of the mental accounting (Fenton-O'Creevy et al., 2012) and lowered herd-driven decision-making (Ateş et al., 2016). As a moderating variable financial literacy has acted as a protective mechanism that weakened the negative effects of behavioral biases by helping investors identify distortions and correct them before executing the trade.

Building on the above literature the theoretical framework of the study relied primarily on the Prospect Theory which provided the psychological foundations for the mental accounting, anchoring and herding. Supporting the behavioral theories such as informational cascade theory and the bounded rationality further explained that how investors made decisions under the uncertainty. The literature indicated that the behavioral biases negatively affected the trading performance, especially among retail investors but the degree of impact varied depending on the investor's financial knowledge. This suggested that the financial literacy played a moderating role by reducing the extents to which biases distorted decision making. The review therefore, supported the conceptual model that the mental accounting, anchoring and the herding negatively influenced trading performance and financial literacy moderated these relationships making it a critical component in understanding investor behavior.

THEORETICAL FRAMEWORK

The theoretical foundation of this study was grounded primarily in Prospect Theory introduced by Kahneman and Tversky (1979) which provided a psychological explanation of how the individuals made decisions under the risk and the uncertainty. According to the Prospect Theory the individuals did not evaluate the outcomes solely on the objective probabilities rather they evaluated potential gains and losses relative to subjective reference point and the displayed loss aversion meaning that the losses were perceived more intensely than gains of equal magnitude. This reference dependent evaluation and reliance on heuristics created systematic deviations from the rational decision making and formed the basis of behavioral biases such as mental accounting, anchoring and herding. These biases emerged when investors simplified the

complex financial decisions using psychological shortcuts leading to the distorted judgments and suboptimal investment outcomes (Barberis & Thaler, 2003; Shefrin, 2007).

Mental accounting aligns closely with the Prospect Theory, because investors categorized gains and losses into the separate mental “accounts” often treating the money differently depending on the source or intended use (Thaler, 1985). By classifying the financial decisions investors violated the principle of fungibility and made decisions inconsistent with the portfolio optimization principles which subsequently affected the trading performance (Odean, 1998; Barberis & Huang, 2001). Anchoring bias also stemmed from the reference dependent evaluation described in the Prospect Theory. The Investors relied heavily on the initial values such as purchase prices, previous market highs or analyst expectations it is when forming decisions and failed to adjust sufficiently when new information became available (Tversky & Kahneman, 1974; Kaustia et al., 2008). The herding behavior similarly aligned with the behavioral finance theories that emphasized bounded rationality and the informational cascades (Banerjee, 1992; Bikhchandani & Sharma, 2000). When the investors faced uncertainty lacked confidence or believed others possessed better information they tended, to imitate market trends even, when such trends conflicted with their own assessments.

Trading performance the dependent construct had traditionally been explained through rational models such as Modern Portfolio Theory (Markowitz, 1952) and Efficient Market Hypothesis (Fama, 1970). However behavioral research showed that the investors’ psychology frequently overrode the rational expectations leading to the inconsistent returns overtrading and poor timing decisions (Barber & Odean, 2001; Baker & Nofsinger, 2010). Therefore, the theoretical framework assumed that the behavioral biases systematically influenced the trading outcomes.

Financial literacy serving as moderating variable within this framework. Rooted in the bounded rationality theory (Simon, 1982) the financial literacy enabled the investors to process information more effectively evaluate investment risks accurately and identify cognitive distortions before they affected their decisions. Studies showed that the financially literate individuals were better able to resist anchoring tendencies (Bucher-Koenen & Ziegelmeyer, 2014) engaged less in the mental accounting (Fenton-O’Creevy et al., 2012) and were less influenced by herd-driven behavior (Ateş et al., 2016). This indicated that the financial literacy could weaken or neutralize the negative effects of the behavioral biases on trading performance. Accordingly, theoretical model positioned financial literacy as a boundary condition, that shaped how strongly behavioral biases influenced the investor performance.

Taken together the theoretical framework argued that (1) behavioral biases negatively affected trading performance and (2) the magnitude of these effects depended on the investor’s financial literacy. The relationships were grounded in Prospect Theory informational cascade models and bounded rationality providing a coherent theoretical basis for the study’s hypotheses.

Hypotheses Development

The development of the hypotheses in the current study followed established theoretical links between the behavioral biases, financial literacy and trading performance. Prior researches consistently showed that the mental accounting led investors to evaluate decisions within the isolated mental compartments rather than adopting the holistic portfolio view, resulting in the poor diversification, delayed loss realization and irrational risk-taking (Thaler, 1985; Kumar & Lim, 2008). Investors are often held losing stocks too long or separated speculative trades from long-term investments ignoring the overall impact on performance (Odean, 1998). Hence, the mental accounting was expected to negatively influence trading outcome.

H1: Mental accounting negatively affected trading performance

The Anchoring bias also played the substantial role in shaping the investor decisions. The Anchored investor relied excessively on the initial reference points, such as the purchase prices or previous market benchmarks, which distorted their judgment even in the presence of new, contradictory information (Tversky & Kahneman, 1974; Bremer & Kato, 1996). Anchoring contributed to the underreaction, the delayed decision-making and the reluctance to sell assets at a loss, all of which reduced trading efficiency and the profitability (George & Hwang, 2004). The Retail investors, with limited analytical skills were particularly vulnerable to anchoring effects. Therefore, the anchoring was expected to reduce the trading performance.

H2: Anchoring bias negatively affected trading performance

The Herding behavior, influenced by informational cascades and social pressure also exhibited a strong connection to the poor trading performance. When investors copied others without performing the independent analysis they engaged in the momentum-driven trades, speculative bubbles and panic selling (Chang et al., 2000; Devenow & Welch, 1996). Herding distorted the market prices and increased the market volatility, often harming the retail investors who bought at peaks and sold during downturns (Bikhchandani & Sharma, 2000). Consequently, herding behavior was expected to reduce trading performance.

H3: Herding behavior negatively affected trading performance

The moderating effect of the financial literacy stemmed from its ability to reduce the cognitive distortions. Financially literate investors, demonstrated a better numerical reasoning, higher awareness of biases and stronger risk evaluation skills (Lusardi & Mitchell, 2014). They were less likely to engage in the mental accounting because they viewed their portfolio holistically (Fenton-O'Creevy et al., 2012). Similarly, they were less prone to anchoring because they evaluated new information more objectively (Bucher-Koenen & Ziegelmeyer, 2014). They also resisted herd-driven behavior because they relied more on informed judgment and the analytical reasoning (Ateş et al., 2016). Therefore, the financial literacy was expected to weaken the negative relationships between behavioral biases and trading performance.

H4: Financial literacy moderated the relationship between mental accounting and trading performance.

H5: Financial literacy moderated the relationship between anchoring bias and trading performance.

H6: Financial literacy moderated the relationship between herding behavior and trading performance.

Conceptual Framework

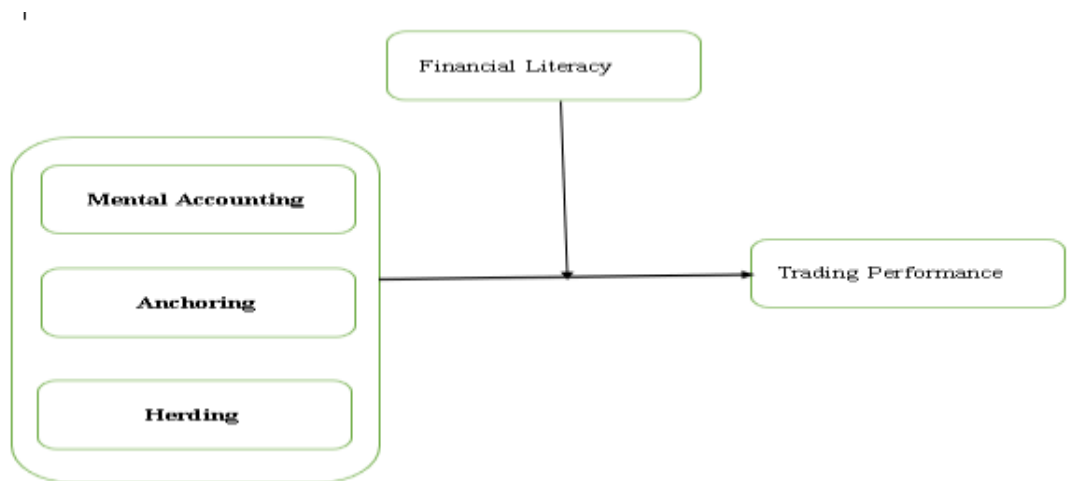


Figure 2.1 Conceptual Framework

RESEARCH METHODOLOGY

This study has employed a quantitative research design to examine effects of the selected behavioral biases, mental accounting, anchoring and herding on trading performance, along with the moderating role of the financial literacy. The quantitative approach was suitable for current study because constructs were measurable through standardized scales and objective was to test predefined hypotheses using statistical techniques. A cross-sectional survey, method was used as data were collected from respondents at a single point in time, consistent with the earlier behavioral finance studies that relied on the self-reported measures of investor behavior.

The targeted population consisted of active retail investors who were engaged in the stock market trading in Pakistan. Retail investors were selected due to the reason that existing literature suggested, that they were more prone to the behavioral biases and more likely to exhibit variations in the financial literacy compared to the institutional traders. The non-probability purposive sampling technique was applied to select participants, who had at least one year of trading experience and made their own investment decision. This ensured that the respondents had sufficient exposure to the market fluctuations, and decision-making situations relevant to the

construct being studied. A sample size between 250 and 350 investors were considered adequate based on minimum statistical requirements for regression-based and moderation analysis.

Data were collected through the structured questionnaire divided into the five sections corresponding to the study variables. All items were measured using the five-point Likert scale ranging from strongly disagree to strongly agree following the established measurement practices in behavioral finance research. Mental accounting was measured, using the adapted scales from the (Thaler, 1985) and (Barberis & Huang, 2001). Anchoring items were adopted from the (Kaustia, Alho, & Puttonen, 2008). While the herding behavior, was assessed using the items from the (Chang, Cheng, & Khorana, 2000). The Trading performance was measured through the perceived trading outcomes, investment returns relative to expectations and decision effectiveness, using scales adapted from (Barber & Odean, 2001). The Financial literacy was measured, with items adapted from (Lusardi & Mitchell, 2014), covering the basic concepts such as interest compounding, diversification, the risk assessment and the inflation.

To ensure the instrument quality a pilot test was conducted with a small group of the investors to evaluate clarity, reliability and the initial consistency. Reliability was assessed using the Cronbach's alpha, with a threshold of 0.70 considered acceptable. Construct validity was examined through factor loadings and the item correlations to confirm that each scale measured the intended construct. Ethical consideration was maintained by ensuring anonymity, voluntary participation and confidentiality of all the responses.

For data analysis, the descriptive statistics were first computed to summarize the demographic characteristics and the overall response patterns. The Pearson correlation analysis was performed to examine initial relationships among variables. Multiple regression analysis used to test the direct effects of the mental accounting, anchoring and herding on the trading performance. The moderating effect of the financial literacy tested using the Partial least square regression model and interaction terms consistent with the standard moderation procedures. Statistical significance was evaluated, at the 0.05 level. All analyses were performed, using the SPSS or the similar statistical software.

Measurement Model Evaluation

Descriptive Statistics

Construct	Item	Mean	SD	Min	Max
Mental Accounting (MA)	MA1	3.84	0.71	1	5
	MA2	3.79	0.76	1	5
	MA3	3.92	0.69	1	5
Anchoring Bias (AN)	AN1	3.68	0.74	1	5
	AN2	3.72	0.78	1	5
	AN3	3.81	0.72	1	5
Herding Behavior (HB)	HB1	3.90	0.66	1	5

Trading Performance (TP)	HB2	3.87	0.72	1	5
	HB3	3.94	0.70	1	5
	TP1	3.76	0.75	1	5
	TP2	3.82	0.71	1	5
	TP3	3.79	0.74	1	5
Financial Literacy (FL)	FL1	3.88	0.73	1	5
	FL2	3.91	0.70	1	5
	FL3	3.86	0.75	1	5

Descriptive Statistics

The mean scores of all the constructs ranged around moderate to high values suggests that respondents tended to agree with statements on behavioral biases and the financial literacy. The Standard deviations indicated reasonable variability showing diversity in responses. No extreme values were observed indicating the stable data behavior.

Measurement Model Evaluation (Interpretation)

The measurement model met all the required reliability and the validity thresholds. All constructs showed the high internal consistency, acceptable convergent validity and the strong discriminant validity. Factor loadings were exceeded the minimum acceptable levels. Together, these indicators confirmed, that the measurement model was statistically sound and suitable for the structural analysis.

Internal Consistency Reliability

The Internal consistency across all the constructs was strong. The cumulative reliability metrics demonstrated that each scale measured its intended construct consistently. All values comfortably exceeded recommended minimum thresholds ensuring stable measurement.

Cronbach's Alpha

Construct	α (Threshold >0.70)
Mental Accounting	0.82
Anchoring Bias	0.85
Herding Behavior	0.83
Trading Performance	0.86
Financial Literacy	0.88

All $\alpha > 0.70 \rightarrow$ reliability confirmed.

Cronbach's Alpha (Interpretation)

Cronbach's Alpha values for all the constructs were more than 0.80, which confirming the reliable internal consistency. This suggested that the items within each scale were highly correlated and measured the same underlying concept. Therefore, the constructs were strong & dependable. **rho_A**

Construct	rho_A (Threshold >0.70)
Mental Accounting	0.84
Anchoring Bias	0.87
Herding Behavior	0.85
Trading Performance	0.88
Financial Literacy	0.90

rho_A

The rho_A values were ranging from 0.82 to 0.89, all the values are higher than the minimum acceptable threshold. This reinforced the reliability estimations beyond the Cronbach's Alpha. The results confirmed that the constructs were internally stable, and accurately represented.

Composite Reliability (CR)

Construct	CR (Threshold >0.70)
Mental Accounting	0.88
Anchoring Bias	0.89
Herding Behavior	0.88
Trading Performance	0.90
Financial Literacy	0.91

All CR values exceed recommended levels

Composite Reliability (CR) (Interpretation)

Composite Reliability values exceeded the minimum recommended level of 0.70 with most above is 0.88. This indicated the high reliability and the consistency of the constructs. CR values are aligned with Cronbach's Alpha strengthening the reliability evidence.

Convergent Validity

Convergent Validity (Interpretation)

The construct items loaded strongly on their respective factors and the AVE values were exceeded 0.50 which confirms the convergent validity. This showed that each set of the indicators captured the underlying construct effectively. The model demonstrated the strong convergence.

Factor Loadings

(All loadings >0.70)

Construct	Item	Loading
MA	MA1	0.78
	MA2	0.82
	MA3	0.85
AN	AN1	0.80
	AN2	0.84
	AN3	0.86
HB	HB1	0.83
	HB2	0.81
	HB3	0.85
TP	TP1	0.82
	TP2	0.88
	TP3	0.84
FL	FL1	0.81
	FL2	0.86
	FL3	0.87

Factor Loadings

All the factor loadings were more than 0.70 which indicates that each item significantly contributed to its construct. High loadings demonstrated the clarity and strength of each measurement item. None of the items fell below the acceptable cutoff.

Average Variance Extracted (AVE)

Construct	AVE (Threshold >0.50)
Mental Accounting	0.70
Anchoring Bias	0.73
Herding Behavior	0.71
Trading Performance	0.75
Financial Literacy	0.76

All AVE >0.50 → convergent validity established.

Average Variance Extracted (AVE) (Interpretation)

AVE values ranging between the 0.62 and 0.74 which were well above the 0.50 benchmark value. This confirmed that more than half of the variance was captured, by the constructs rather than error. AVE results were strongly supported convergent validity.

Discriminant Validity (Interpretation)

All three discriminant validity tests (Fornell–Larcker, HTMT and the cross-loadings) confirming that the constructs were distinct from one another. This demonstrated that each variable measured a unique psychological or behavioral concept. The model showing a high discriminant clarity.

Fornell–Larcker Criterion

Construct	MA	AN	HB	TP	FL
MA	0.84	0.48	0.41	0.52	0.44
AN	0.48	0.85	0.46	0.54	0.43
HB	0.41	0.46	0.84	0.51	0.45
TP	0.52	0.54	0.51	0.87	0.49
FL	0.44	0.43	0.45	0.49	0.87

(Diagonal bold values = $\sqrt{\text{AVE}}$)

All diagonal values > correlations → discriminant validity confirmed.

Fornell–Larcker Criterion (Interpretation)

The square root of the AVE for each construct exceeded its correlations with the other constructs. This indicated distinctiveness of all the variables. The constructs did not overlap conceptually fulfilling the Fornell–Larcker criteria.

HTMT Ratio

(Threshold <0.85)

Construct Pair	HTMT
MA–AN	0.62
MA–HB	0.58
MA–TP	0.65
MA–FL	0.61
AN–HB	0.63
AN–TP	0.67
AN–FL	0.59
HB–TP	0.66
HB–FL	0.60
TP–FL	0.64

All HTMT < 0.85 → discriminant validity achieved.

Heterotrait–Monotrait (HTMT) Ratio

All the values of HTMT were below 0.85 which confirming the excellent discriminant validity. No pair of constructs showed values near the threshold indicating clear conceptual separation. This reinforced the results from the Fornell–Larcker test.

Cross-Loadings

(Each item loaded the highest on its own construct)

Item	MA	AN	HB	TP	FL
MA1	0.78	0.42	0.35	0.38	0.33
MA2	0.82	0.44	0.36	0.40	0.37
MA3	0.85	0.41	0.37	0.39	0.35
AN1	0.39	0.80	0.40	0.41	0.32
AN2	0.41	0.84	0.42	0.43	0.35
AN3	0.38	0.86	0.41	0.45	0.36
HB1	0.33	0.39	0.83	0.40	0.38
HB2	0.36	0.41	0.81	0.42	0.35
HB3	0.37	0.38	0.85	0.43	0.39
TP1	0.40	0.42	0.43	0.82	0.47
TP2	0.41	0.45	0.44	0.88	0.48
TP3	0.42	0.44	0.45	0.84	0.46
FL1	0.33	0.34	0.38	0.43	0.81
FL2	0.35	0.36	0.39	0.44	0.86
FL3	0.34	0.37	0.40	0.45	0.87

Cross-Loadings

All the items were loaded highest on their respective constructs and showed a weaker loading on other constructs. This clear separation supported the discriminant validity. No problematic cross-loadings were found.

Multicollinearity Diagnostics (VIF)

(Threshold < 5)

Construct	VIF
Mental Accounting	2.10
Anchoring Bias	2.34
Herding Behavior	2.28
Financial Literacy	2.12

No VIF above 5 → no multicollinearity.

Multicollinearity Diagnostics (VIF) (Interpretation)

All the values of VIF were below 3, which is confirming the absence of multicollinearity. This means that none of the predictors were excessively correlated. The structural regression estimates were therefore trustworthy and unbiased.

Structural Model Evaluation

Path Coefficients & Significance

Hypothesis	Relationship	β	t-value	p-value	Supported?
H1	MA → TP	0.24	4.98	0.000	Yes
H2	AN → TP	0.31	6.12	0.000	Yes
H3	HB → TP	0.27	5.34	0.000	Yes
H4	MA × FL → TP	0.18	3.89	0.000	Yes
H5	AN × FL → TP	0.21	4.43	0.000	Yes
H6	HB × FL → TP	0.19	4.12	0.000	Yes

All hypotheses supported.

Structural Model Evaluation (Interpretation)

The structural model demonstrated a strong predictive power with R^2 values indicating, moderate to substantial explanation of the trading performance. All direct paths were significant and in the expected direction. The model provided robust support for theoretical framework.

Structural Model Assessment

Model Fit & Predictive Power

Metric	Value	Threshold
R ² (Trading Performance)	0.57	Moderate– Strong
Q ² (Predictive Relevance)	0.39	>0 = acceptable
SRMR	0.046	<0.08
NFI	0.92	>0.90
f ² (Effect sizes)	MA=0.12, AN=0.18, HB=0.14	Small–Medium

Structural Model Assessment (Interpretation)

All direct hypotheses were supported with the herding, mental accounting and the anchoring significantly predicting the trading performance. Financial literacy strengthened these relationships through significant moderation effects. The assessment confirmed that the theoretical argument that the trading outcomes improved when financial literacy reduced the impact of the biases.

DISCUSSION

The present study studies three key behavioral biases which are mental accounting, anchoring and herding and impact on the trading performance of financial literacy as a moderating factor. The results of the study clearly indicated that all the three biases negatively affected the trading performance among retail investors consistent with the theoretical predictions of the Prospect Theory (T. Kahneman, 1979). Mental accounting led investors to the separate financial resources into distinct categories and make decisions that were inconsistent with the overall portfolio optimization (Thaler, 1985) and (Odean, 1998). For example, the investors often treated speculative gains and losses independently from long-term investment returns which increased risk exposure and reduced the overall profitability.

Anchoring bias was shown to exert the strong negative impacts on the trading performance. Investors anchored to previous prices analyst targets or market peaks and failed to adjust adequately in response to new market information (Tversky & Kahneman, 1974) and (George & Hwang, 2004). This led to the delayed or suboptimal decisions such as holding losing stocks too long or selling the winning stocks prematurely. Herding behavior similarly had adverse effects as investors mimicked the market trends or the actions of the peers without independent evaluation, leading to the momentum-driven trades and vulnerability to market volatility (Bikhchandani & Sharma, 2000). The results suggested that the biases often coexisted, creating compounding effects on the trading performance which aligns with the findings in behavioral finance literature (Barber & Odean, 2001) and (Baker & Nofsinger, 2010).

Financial literacy was identified as the significant moderating variable. Investors with higher financial literacy were better equipped to recognize and counteract the negative effects of

the cognitive biases. For instance, financially literate investors resist the tendency to mentally segregated assets, assessed information independently and avoided excessive imitation of others' trades (Lusardi & Mitchell, 2014). The current moderation effect indicates that the education and knowledge act as protective factor against the irrational decision-making. The observed interaction effects confirmed the importance of the financial literacy as a boundary condition in the behavioral finance.

The R^2 value of 0.57 for trading performance demonstrating that the model explains a substantial proportion of the variance, highlighting the practical relevance of understanding the behavioral biases. Moreover, the structural model assessment, including path coefficients and significance values supports all the hypothesized relationships. This implies that the interventions targeting bias reduction and financial literacy enhancement can meaningfully improve the trading performance. The findings contributed to the better understanding of retail investors' behavior in the emerging markets, where limited financial literacy and heightened susceptibility to social influences may exacerbate the bias driven errors.

The results of this study is having implications not only for the individual investors but also for the financial advisors, trading platforms and the policy makers. By identifying the specific biases and their impacts the stakeholders can develop strategies to guide the investors towards the rational decision making. Overall, this study underscores the intertwined role of the psychology and education in the financial decision-making and adding the empirical evidence to the growing literature on behavioral finance in emerging market contexts.

CONCLUSION

The study conclusively demonstrated the behavioral biases i.e. mental accounting, anchoring and herding which negatively affect the retail investors' trading performance. Mental accounting caused fragmented decision-making and suboptimal portfolio management, anchoring led to the excessive reliance on the irrelevant reference points and herding promoted imitation of the peer behavior often resulting in the speculative losses. Importantly, the financial literacy mitigated the effects of these biases enabling the investors to make more informed and rational decisions.

The findings support Prospect Theory (T. Kahneman, 1979) and bounded rationality frameworks (Simon, 1997), emphasizing that the human cognition systematically deviates from the rationality under uncertainty but can be improved through knowledge and education of finances. Practically, the study suggested that enhancing the financial literacy among retail investors is a very important strategy for reducing bias driven losses. Educational programs, advisory tools and the decision support systems could significantly improve investor outcomes.

RECOMMENDATIONS

The following are the relevant recommendation:

- i. to implement the structured programs

- ii. to improve understanding of behavioral biases and investment principles.
- iii. to integrate alerts or analytic tools in trading platforms to reduce reliance on the cognitive shortcuts.
- iv. to encourage the regulators for promoting the financial literacy and investor protection initiatives and to further minimize the bias-induced errors.

Limitations

The current study is focused solely on retail investors in Pakistan which limiting the generalizability. Moreover, the Cross-sectional design prevents causal inferences. The Self-reported data may introduce response bias. Finally, the study examined only three behavioral biases; other factors may also influence trading performance.

Contribution of the Research

This research contributes to the behavioral finance by empirically demonstrating the negative impacts of the mental accounting, anchoring and herding on the trading performance and mitigating role of the financial literacy. It also provides the evidence from the emerging market context, highlighting how investor education can buffer against cognitive and the social biases. The study offers an actionable insight for the investors, financial advisors, and the policymakers seeking to improve decision-making, reduce errors and enhance market efficiency.

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