Journal of Workplace Behavior (JWB)
Volume 7, Issue 1 (2026)
ISSN (E): 2710-2378
ISSN (P): 2710-2807
https://charisma-jwb.com/index.php/jwb

Title:	The Mediating Influence of Risk Tolerance on Behavioral Biases and Investment Decisions: Evidence from Pakistan
Author (s):	Syeda Afshan Gillani[1] and Muhammad Nawaz[2]
Affiliation (s):	Department of Business Administration, Iqra University Islamabad, Pakistan.[1&2]
History:	Received: May 02, 2026 Revised: May 25, 2026 Accepted: June 14, 2026 Published: June 30, 2026
Citation:	Gillani, S.A., and Nawaz, M. (2026), The Mediating Influence of Risk Tolerance on Behavioral Biases and Investment Decisions: Evidence from Pakistans, Journal of Workplace Behavior, 7(1), 01-14.
ORCID iD:	0009-0002-1908-2387[1] 0000-0003-1168-2142[2]
JEL Classification:	M10, M19 & M210
Copyright:	
Conflict of Interest:	The authors have no conflicts of interest to declare.
Funding:	The research is not supported from any source.
Ethical Consideration:	- Written permission was obtained for the scales used in the study. - Ethics committee approval was obtained from the Institutional Ethical Board. - Informed consent was obtained from all subjects involved in the study.

The Mediating Influence of Risk Tolerance on Behavioral Biases and Investment Decisions: Evidence from Pakistan

Syeda Afshan Gillani and Muhammad Nawaz
Department of Business Administration
Iqra University Islamabad, Pakistan.
syedaafshangillani@gmail.com

Abstract
The Pakistan Stock Exchange faces persistently low participation of investors in past few years and high market volatility, which hinder its development and stability. To address these challenges, the purpose of this study is to investigate how behavioral factors (Overconfidence Bias, Herding Bias and Self-control Bias) affect investors' investment decisions. The study also examines risk tolerance role as a mediator in the relationship between behavioral factors and investors' investment decisions. Non-probability sampling was used to collect responses from 310 investors and the data were analyzed using SPSS. Hypotheses were tested using regression with bootstrapped mediation analysis via PROCESS macro (Model 4) in SPSS. The findings of the study reveal that biases such as herding bias, overconfidence bias and self-control bias significantly and positively impact investors' decision making while risk tolerance partially mediates the effects of Overconfidence Bias and self-control bias on investment decisions while fully mediating the effect of herding bias on investment decisions. This study makes a significant theoretical contribution by validating a mediation model in an emerging market context. It extends behavioral finance theory by demonstrating that risk tolerance is not just an independent trait but a key psychological mechanism. Discussions, conclusions and implications of the study are presented based on the results.
Keywords: Behavioral factors, investment decisions and risk tolerance.

1. Introduction

After the global financial recessions of 2008, investor behavior has been recognized as a critical factor driving changes in the stock market, highlighting that trading behavior is often irrational (Jacobs, 2016). The objective of this paper is to examine how behavioral factors affect the investment decisions. Baker et al. (2019) have identified several behavioral biases within the context of behavioral psychology and finance that significantly impact investor decision-making. These biases often lead to irregularities in the way investors make choices. Ahmad and Shah (2020) found that human psychology plays a crucial role in driving investors toward imperfect decisions.

Behavioral finance introduced as a new branch of finance in order to explain the volatility and inconsistency in markets. Emotions, intentions, behavioral biases are taken as base for behavioral finance. Prospect theory by Kahneman and Tversky (1984) is the foundation theory that explains that investors give more weight to loss as compare to gains. Behavioral finance has become significant with significant theories such as Prospect Theory (Kahneman and Tversky, 1984), which proposes that people observe gains and losses in different ways, and their risk-taking is also associated with the framing of choices (Nguyen et al., 2016).

According to Shefrin (2001), from a behavioral finance perspective, psychological factors positively affect investors' decisions. So, the behavioral factor that impacts an individual's investing decision is worth exploring, primarily investors' behavioral biases (Quaicoe et al., 2021). Henceforth, by observing the behavior of investors in financial markets in recent decades, behavioral finance combined the theories of sociology and psychology with finance.

PSX offering a platform where thousands of small investors can potentially achieve significant gains, despite the inherent volatility. Additionally, large investors can influence market sentiment at their decision, resulting in more frequent market downturns. Therefore, it is crucial to investigate how behavioral biases of investors influence investment outcomes in the PSX. This research represents a unique opportunity to explore behavioral biases within an Asian market (Ullah et al., 2020).

This study also investigates the mediating effect of risk tolerance (RT) between behavioral factors and investors investment decisions. Despite the fact making important decisions about investments, RT plays a main role. In the risky situation, investors may make a mistake in making significant decisions about their business (Bashir et al., 2013). RT directly affects investors' investment decisions and assesses the important aspects of several assets in the portfolio (Cordell, 2002). Financial RT can be defined as an individual's desire to take a financial risk. Study by Falahati and Paim (2012) indicated that investors in the capital market typically show a higher RT compared to those who do not take part in capital markets. Ullah et al. (2024) found that RT leads to riskier investments. Mohta et al. (2024) study found significant impact on investment decisions by risk tolerance.

In this study author selected the context of individual investors in Pakistan, a setting where behavioral biases are considered a critical factor to rational financial outcomes (Kahneman & Tversky, 1979). Investment decisions here involve inherent uncertainty and require evaluation under conditions of local market volatility. Since these decisions are susceptible to cognitive and emotional biases, their unmitigated influence can result in significant suboptimal returns. On the other hand, Prospect Theory posits that individuals evaluate potential losses and gains asymmetrically. Taken together, it would be interesting to see, within this population, how specific behavioral biases shape investment decisions and how an individual's inherent risk tolerance mediates this relationship.

Several studies have been conducted on behavioral bias impact on investors' investment decisions in developed and developing countries. Mahmood et al. (2024) conducted studies in Pakistan and recommended future scholars to conduct research on different biases and investment decisions in their studies. Siratan et al. (2024) recommended future scholars could examine other aspects related to risk tolerance with investment decisions. To address these gaps, this study aims to: (1) examine the direct effects of behavioral biases on investment decisions; (2) investigate the mediating role of RT between behavioral biases and investment decisions**.**

Specifically, we hypothesize that: (H1) overconfidence bias positively affects investment decisions (ID) (H2) herding bias positively affects ID; (H3) Self-control bias positively affects ID; (H4–H7) risk tolerance mediates the effects of each bias on investment decisions.

2. Literature Review

2.1 Relationship between Overconfidence Bias(OCB) and Investment decisions (ID)

Bhandari and Deaves (2006) define overconfidence bias as the tendency for individuals to overestimate their own knowledge, abilities, and the reliability of the information they have. Mujianah et al. (2024) explains the term overconfidence Bias as a psychological condition in which, following the irrationality cognition, a person give more weight to his skills or knowledge that is actually opposite to the reality, such behavior leads to risky decisions. Skała (2008) studied the importance and relevance of Overconfidence Bias in finance and corporate behavior. Overconfidence Bias acts as an active player in corporate context by influencing internal financing structures and deals like mergers and acquisitions with other market participants. The study shed light on the importance of including psychological factor, "overconfidence" in financial studies to develop a more comprehensive understanding of market outcomes and behaviors. The integration of overconfidence Bias will lead to more accuracy in predicting outcomes in financial decisions.

Zafar et al. (2024) found a correlation between overconfidence Bias and financial investment decisions of investors. Adielyani and Mawardi (2020) demonstrated a significant and positive impact of

Overconfidence Bias on investment decisions in stock market. Another study by Hussain (2021), using survey method to collect data from traders of PSX and analyzing data by Smart PLS-SEM revealed that Overconfidence Bias strongly associated with decisions related to investment. Same results are declared by Qasim et al. (2019) for investors. Kirera and Mburugu (2019) explored the same relationship in Kenya. The study concluded that Overconfidence bias moderately impacts investment decisions of individual investors. After detailed literature review related to Overconfidence Bias and investment decisions following hypothesis has been established:

H1: Overconfidence Bias (OVC) has a positive impact on investment decision (ID).

2.2 Relationship between Herding Bias (HB) and Investment Decisions (ID)

Scharfstein et al. (2000) explains "herding", a phenomenon in which individuals imitate the actions of the other people, instead of relying on their own judgments or information. This collective herding action by market participants can impact overall market direction. Another definition of the term by Banerjee (1992) explained the term in these words, Herding Bias occurs when decision makers follow the crowd, giving weight to behavior or beliefs of others and neglect the necessary logic or information for evaluation. Such behavior amplifies the trends or increases the propagation of misleading information.

Adielyani and Mawardi (2020) found a positive significant impact of herding Bias on investment decisions. Qasim et al. (2019) also discovered the association between herding bias and investor's investing decisions. Also, research by Hayat et al. (2016) exposed that there exist a significant relation of Herding Bias and investor's decision relation. Study conducted by Waweru et al. (2008) concluded that institutional also rely on biases while making decisions. Also, these investors imitate the investing decisions and patterns of other institutional investors thus creating a Herding Bias in investment decisions. After detailed literature review related to herding bias and investment decisions following hypothesis has been established:

H2: Herding Bias (HB) has a positive impact on investment decision (ID).

2.3 Relationship between Self-control Bias (SCB) and Investment Decisions (ID)

Thaler et al. (1981) defined the concept of Self-Control by using the agency theory. By considering the individual as an organization, author stated that an individual has to manage his present life and also has to plan for the future. These two objectives remain in conflict with each other just like owners and manager's goals remain in conflict in agency relationship. Laibson (1997) explained that Self-control biases inconsistency in human preferences with passage of time. This behavior associated with hyperbolic discounting. Individuals affected by this low commitment attitude, exhibit inefficient investment behavior. Self-control bias refers to a behavioral tendency where individuals prioritize instant consumption over saving for the future. This lack of self-control is often evident in financial decisions.

Gulzar and Ali (2023) study found a significant connection between SCB and investment decisions. Stromback et al. (2017) also declared that levels of self-control change the financial behavior and financial well- being, individuals with high level of self-control tend to save more money from every pay check. Riaz and Iqbal (2015) revealed that self-control bias significantly impacts investors' investment decisions. Shakir (2014) conducted a study to explore the relationship of Self-control bias or illusion on making investment choices. The results concluded a significant impact of self-control bias on making investment choices. After detailed literature review related to self-control bias and investment decisions following hypothesis has been established:

H3: Self-Control Bias (SCB) has a significant impact on investment decision (ID).

2.4 Mediating role of Risk tolerance (RT) between Behavioral biases and Investment Decision

Lamichhane and Simkhada (2024) study found that risk tolerance attitude of investor significantly impacts on his investment decisions. The study concluded that there is a direct impact of RT level of

investors on investment decisions. Mohta et al. (2024) concluded significant relationship between RT and investment decisions. A study by Sharma and Gupta (2024) showed that investors with higher risk tolerance prioritized investment decisions more actively and diversified their portfolios across risk classes. Wohllebe and Ross (2025) study found that risk tolerance and behavioral factors incorporation into investment decisions help investors to better align their individual goals while managing their investment portfolios. But these studies used risk tolerance primarily as an independent variable rather than examining its role as a mediating variable.

Nidhi et al. (2020) conducted an empirical study to assess the relation of personality and behavioral biases on level of risk tolerance. The study concluded a positive relationship between Overconfidence Bias and risk tolerance. Ahmad and Shah (2020) concluded that Overconfidence Bias significantly linked with risk tolerance. Raheja and Dhiman (2019) also found a significant association of Overconfidence Bias and choice of investment. Rani et al. (2024) examine risk tolerance being a mediator between Overconfidence Bias and investment decisions. Study found that risk tolerance significantly mediates the relationship. Soraya (2023) conducted research to explore Overconfidence Bias direct and indirect relation of choices made by investors. The study found risk tolerance significantly mediates between association of behavioral biases and choice of investments. Therefore, risk tolerance acts as the psychological factor that translates Overconfidence Bias into actual risk-taking behavior. Therefore, the fourth and fifth hypothesis is:

H4: Risk tolerance has a significant impact on ID.

H5: Risk tolerance significantly mediates the relationship between Overconfidence Bias and investment decision.

2.5 Mediating role of Risk tolerance between Herding Bias(HB) and Investment Decisions (ID)

Nidhi et al. (2020) established a positive relation of herding bias and level of risk tolerance of investors. Jain et al. (2015) explored the relation of behavioral biases and investment decisions. They found that herding bias significantly impact on risk tolerance of investor and ultimately effect the financial decision of investors. Ahmed et al. (2022) demonstrated that herding increases risk tolerance by highlighting the role that risk perception mediates the relationship between herding and ID. Acharya and Yorulmazer (2023) studied behavioral biases during stress period. They concluded Herding Bias increases systemic risk and risk tolerance of the investors leading to invest in risky assets. Curto et al. (2023) also established Herding Bias has impacts on risk decision-making and risk tolerance enhances risk acceptance through the herding bias. Sachdeva et al. (2021) showed that herding influenced by cognitive psychology was linked to heightened risk tolerance, which acted as a mediator in equity allocation decisions. Nadhila et al. (2024) found that Herding Bias had an indirect impact on investment decisions through risk tolerance among individual investors. Investors follow others to avoid the guilt of making independent losses. This behavior makes them feel safer improving their risk tolerance and pushing them toward riskier investments. Therefore, the sixth hypothesis is:

H6: Risk tolerance significantly mediates the relationship between herding bias and ID.

2.6 Mediating role of Risk tolerance between Self-control Bias (SCB) and ID

Self-control bias is a behavioral tendency in which people tend to consume now rather than save to consume in the future. This inability to control oneself is usually reflected in financial choices. Kahneman and Tversky (1979) foundational study introduces Prospect Theory. Prospect theory explained the pattern of investments involving risk and uncertainty. The theory suggests that individual biases including self-control bias impact the risk tolerance and ultimately affect the investment decisions. Investors who are subject to self-control bias exhibit high level of risk tolerance that led to risky investments (Dickason & Ferreira, 2018).

Naveed et al. (2022) reported self-control as driver to invest in income generated short term assets. Such

investors take riskier decisions in equity markets. Salman et al. (2022) demonstrated that investors who failed to restrict on their long-term financial plans exhibit excessive risk-taking attitude. Self-control failure leads to high risk tolerance. Zhang and Wang (2017) study concluded that individuals with lower risk tolerance are more vulnerable to self-control bias in their investment behavior. Stromback et al. (2017) conducted study in Sweden and concluded that people with high self-control save more from their every pay-check that leads to better financial management. Sekscinska et al. (2021) examined the relation of self-control bias and financial decisions. The study concluded that investors with high self-control bias are more likely to engage in taking financial risks while making investments. Therefore, the seventh hypothesis is:

H7: Risk tolerance significantly mediates the relationship between SCB and ID.

3. Research Methodology

3.1 Sample and Data Collection Methods

Population for the study is retail investors of PSX. Survey method was used to collect data from the investors of PSX. Total 1000 questionnaires were distributed to investors across major cities, including Lahore and Islamabad. Investors were approached through brokerage firm offices, PSX branch visits during regular trading hours. 310 responses (31%) were qualified as valid responses and used for data analysis. In this study, the convenience sampling technique is used to collect primary data. The questionnaire was pilot-tested with 30 investors to assess clarity and relevance. Assurance for the protection of privacy given to participant regarding the data they provided on questionnaires.

Table 1. Demographic Characteristics of the Sample (N = 310)

Demograpy	Category	Frequency	Percentage
Gender	Male	232	74.8
	Female	78	25.2
Age	≤ 40 years	171	55.2
	41–45 years	73	23.5
	46–50 years	34	11
	> 50 years	32	10.3
Education	Inter	16	5.2
	Bachelor's	62	20
	Master's	210	67.7
	M.Phil.	13	4.2
	PhD	9	2.9
Monthly Income (PKR)	Below 50k	32	10.3
	51k–70k	75	24.2
	71k–90k	80	25.8
	91k–110k	42	13.5
	Above 110k	81	26.1
Investment Experience	1 to 5 years	121	39
	6 to 10 years	83	26.8
	11 to 15 years	65	21
	16 to 20 years	41	13.2

The sample characteristics shows the frequency and percentage of participants' gender, and it demonstrates that 232 were male and 78 were female participants. The male respondents were 74.8% and female respondents were 25.2%, respectively. The largest age group among participants was 41-45

years (23.5%), followed closely by 36-40 years (22.9%). The smallest age groups were above 50 years (10.3%) and 46-50 years (11.0%). The cumulative percentage shows that more than half of the respondents (55.2%) were aged 40 years or younger, while 44.8% were aged 41 years and above. The findings show that 16 respondents (5.2%) had an Inter degree, 62 respondents (20.0%) had a Bachelor's degree, 210 respondents (67.7%) had a Master's degree, 13 respondents (4.2%) had an M.Phil. degree, and 9 respondents (2.9%) had a PhD degree. The findings show the distribution of income levels among a sample of 310 individuals. The findings show that 32 individuals (10.3%) earn below 50k, 75 participants (24.2%) earn between 51k to 70k, 80 participants (25.8%) earn between 71k to 90k, 42 participants (13.5%) earn between 91k to 110k, and 81 participants (26.1%) earn above 110k. The findings show that 121 participants (39.0%) had 1 to 5 years of experience, 83 respondents (26.8%) had between 6 and 10 years of experience, 65 participants (21.0%) had 10 to 15 years of experience, and 41 participants (13.2%) had 15 to 20 years of experience.

3.2 Measures

In this study used scales from existing articles. All items were measured on a 5-point Likert scale.

3.2.1 Investment Decision

Investment decision was measured by 05-items scale, having alpha value of 0.708, adopted from the study of Rasheed et al. (2018). Cronbach's alpha value for investment decision was 0.78.

3.2.2 Overconfidence Bias

Overconfidence bias was measured by 08 items scale adopted from the study conducted by Lin (2011). Reliability value for Overconfidence Bias was 0.83.

3.2.3 Herding Bias

Herding Bias was measured by five items scale adopted from the study of Kishor (2020). Reliability value for Herding Bias was .75.

3.2.4 Self-Control bias

Self-control bias was measured by four-items from the study conducted by Kishor (2020). Reliability value for self-control bias was 0.75.

3.2.5 Risk Tolerance

Risk tolerance was measured by adopting 05-items scale developed by Kannadhasan et al. (2016). Reliability value for risk tolerance was 0.79.

4. Results

The study's results are presented in three sections. The first section includes the descriptive statistics, correlation analysis, and reliability assessment. The second section reports the regression analysis, and the final section presents the outcomes of the mediation analysis.

4.1 Descriptive Statistics, Correlations, and Reliabilities

Table 1 shows descriptive statistics, correlation analysis and reliabilities. ID has an average value of 3.64 and a standard deviation of 0.88. The mean value of OVC is 3.70 and a standard deviation of 0.81. HB has an average value of 3.69 and a standard deviation of 0.89. Self-Control Behavior has an average value of 3.59 and a standard deviation of 1.02. Risk Tolerance has an average value of 3.76 and a standard deviation of 0.93. Results in table 1 shows that the data is reliable and can be used for further examination. The results highlighted the Cronbach's-alpha value for investment decision was 0.78. Reliability value for Overconfidence Bias was 0.83, CA value for Herding Bias was .75 and Cronbach's alpha value for self-control bias and risk tolerance was 0.75 and .79. All correlations are statistically significant at the 0.01 level (2-tailed). The strongest relationship exists between ID and RT (.405). Table 1 below shows a positive relationship between ID and OVC, with a value of .259, $p < 0.01$. Similarly, a positive connection exists between ID and HB, with a value of .156, $p < 0.01$. The correlation between ID and SCB is also positive, with a value of .305, $p < 0.01$, while ID and RT show a positive relationship of .405, $p < 0.01$. Turning to OVC, the table indicates a positive relationship with risk tolerance. Furthermore**,** HB demonstrates a positive relationship with RT, at .312, $p < 0.01$. Finally, SCB and RT show a positive relationship of .365, $p < 0.01$.

Table 1
Descriptive Statistics, Correlations, and Reliabilities

Variables	Mean	SD	1	2	3	4	5
1. ID	3.64	0.88	(0.787)				
2. OVC	3.7	0.81	.259**	(0.834)			
3. HB	3.69	0.89	.156**	.261**	(0.753)		
4. SCB	3.59	1.02	.305**	.154**	.230**	(0.756)	
5. RT	3.76	0.93	.405**	.290**	.312**	.365**	(0.796)

ID=Investment Decision, OVC=Overconfidence Bias, HB=Herding Bias, SCB=Self-Control bias, RT=Risk Tolerance
Note (s): The diagonal value in bold represents alpha reliabilities. N=310
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

4.2 Regression Analysis

Table 2. Regression Analysis

Variables	B	R square	T value	Sig
OVC-ID	.282**	.067	4.711	.000
HB-ID	.154**	.024	2.774	.006
SCB-ID	.263**	.094	5.615	.000
RT-ID	.382**	.164	7.768	.000

Note: ***p ≤ 0.001, ** p ≤ 0.01, * p ≤ 0.05

The results show the (β) is 0.282, with a p-value of less than 0.01, indicating a positive relationship it shows that an increase in OVC leads to a proportional increase in ID. As a result, Hypothesis 1 is accepted, which shows that OVC has a positive impact on ID. The results also show a significant positive relationship between Herding Bias (HB) and investment decisions (ID). The (β) is 0.154, with a p-value of 0.006, which is less than 0.01, indicating a positive relationship. As a result, the hypothesis 2 is accepted, which shows that HB has a positive impact on ID.

Table 3. Mediation Analysis (OVC-RT-ID)

Variables	β	SE	t	p	LLCI	ULCI
OVC → ID	.282**	.0600	4.71	.000	.1645	.4005
OVC→ RT	.334**	.0629	5.31	.000	.2103	.4578
RT → ID	.340**	.0508	6.68	.000	.2400	.4401
OVC→RT→ ID	.168**	.0586	2.88	.004	.0535	.2842
Indirect Effects						
			B	**SE**	**LLCI**	**ULCI**
Bootstrap Findings	Indirect Influence		.1136	.0361	.0475	.1862

The results show a positive relationship between SCB and ID. The (β) is 0.263, with a p-value of less than 0.01, indicating a positive relationship. As a result, the hypothesis 03 is accepted, which shows

that SCB has a positive impact on ID. Finally, the results show a significant positive relationship between risk tolerance and investment decisions (ID). The beta coefficient (β) is 0.382 with a p-value of less than 0.01, indicating a positive connection. As a result, the hypothesis 04 is accepted, which shows that RT has a positive impact on ID. Hypotheses were tested using regression with bootstrapped mediation analysis via PROCESS macro (Model 4) in SPSS. Bootstrapping with 5,000 resamples was employed to generate 95% bias-corrected confidence intervals for indirect effects. The result shows the total effect between OVC (IV) and investment decision (DV) as the analysis shows the (β) for this relationship is 0.282*, with p value < 0.001 indicating a positive relationship. The result shows the direct effect between OVC (IV) and risk tolerance (MV) as the analysis shows the (β) for this relationship is 0.334** showing a significant positive relation. The result shows the direct effect between risk tolerance (MV) and ID (DV) as the analysis shows the (β) for this relationship is 0.340** indicating a significant positive relationship. The result shows the direct effect between Overconfidence Bias (IV) and investment decision (DV) after controlling for the mediator as the analysis shows the (β) for this relationship is 0.168**indicating a significant positive relationship. The LLCI is 0.0535 and ULCI is 0.2842 as both values have positive sign showing significant effect. This indicates that risk tolerance partially mediates the relationship of OVC and ID as the direct effect remains significant.

Table 4. Mediation Analysis (HB-RT-ID)

Variables	B	SE	t	p	LLCI	ULCI
HB→ ID	.153**	.0555	2.77	.005	.0447	.2631
HB→ RT	.326**	.0565	5.77	.000	.2149	.4371
RT → ID	.372**	.0519	7.18	.000	.2707	.4748
HB→RT→ ID	.032	.0541	0.59	.550	-.0741	.1389
Indirect Effects						
			B	**SE**	**LLCI**	**ULCI**
Bootstrap Findings	indirect influence		.1215	.0359	.0549	.1964

The result shows the total effect between Herding Bias(IV) and investment decision (DV) as the analysis shows the (β) for this relationship is 0.153**, with a pvalue of 0.005, indicating a significant relationship. The result shows the direct effect between Herding Bias (IV) and risk tolerance (MV) as the analysis shows the (β) for this relationship is 0.3260**, showing a significant positive relationship. The result shows the direct effect between risk tolerance (MV) and investment decision (DV) as the analysis shows the (β) for this relationship is 0.3728**, showing a positive relationship.

Table 5. Mediation Analysis (SCB-RT-ID)

Variables	B	SE	t	p	LLCI	ULCI
SCB→ ID	.263**	.0469	5.61	.000	.1710	.3554
SCB→ RT	.333**	.0485	6.87	.000	.2378	.4286
RT → ID	.320**	.0520	6.14	.000	.2176	.4224
SCB→RT→ ID	.156**	.0476	3.29	.001	.0630	.2502
Indirect Effects						
			B	**SE**	**LLCI**	**ULCI**
Bootstrap Findings	indirect influence		.1066	.0289	.0516	.1661

The result shows the direct effect between Herding Bias (IV) and investment decision (DV) after

controlling for the mediator as the analysis shows the (β) for this relationship is 0.0324, with a p-value of 0.5500, indicating a non-significant positive relationship. The LLCI is -0.0741 and ULCI is 0.1389 as the confidence interval crosses zero, showing that the direct effect is not significant. This indicates that risk tolerance fully mediates the relationship between Herding Bias and investment decision, as the direct effect becomes non-significant after including the mediator, while the indirect effect remains significant (BootLLCI = 0.0549, BootULCI = 0.1964).The result shows the total effect between self-control bias (IV) and investment decision (DV) as the analysis shows the (β) for this relationship is 0.263**, with a p-value < 0.001, indicating a significant relationship. The result shows the direct effect between self-control bias (IV) and risk tolerance (MV) as the analysis shows the (β) for this relationship is 0.333**, showing a significant positive relationship. The result shows the direct effect between risk tolerance (MV) and investment decision (DV) as the analysis shows the (β) for this relationship is 0.320**, indicating a significant positive relationship. The result shows the direct effect between self-control bias (IV) and investment decision (DV) after controlling for the mediator as the analysis shows the (β) for this relationship is 0.156**, with a p-value of 0.0011, indicating a significant positive relationship. The LLCI is 0.0630 and ULCI is 0.2502, as the confidence interval does not cross zero, showing that the direct effect remains significant. This indicates that risk tolerance partially mediates the relationship between SCB and investment decision, as both the direct effect and the indirect effect are significant. The indirect effect (BootLLCI = 0.0516, BootULCI = 0.1661) also does not contain zero, confirming that mediation is present.

5. Discussion

Decisions related to personal and family finance management are very important and essential (Sahi et al., 2013). This study suggested that the association between behavioral bias (Overconfidence Bias, Herding Bias, Self-Control Bias) and investment decision is positive and significant. The significant positive effect of Overconfidence Bias on investment decisions is consistent with Zafar et al. (2020) and Adielyani and Mawardi (2021). Zafar et al. (2024) found a correlation between Overconfidence Bias and financial investment decisions of investors. Adielyani and Mawardi (2020) demonstrated a significant impact of Overconfidence Bias on investment decisions.

The positive effect of herding Bias on investment decisions is consistent with Qasim et al. (2019) and Hayat et al. (2016). Qasim et al. (2019) discovered the connection between herding bias and investor's investing decisions. Also, research by Hayat et al. (2016) exposed the significant relation of Herding Bias and investor's decisions.

The positive effect of self-control bias on investment decisions is consistent with Gulzar and Ali (2023). Gulzar and Ali (2023) study found a significant connection between self-control bias and investment decisions.

Moreover, this study examined that risk tolerance positively mediates between the behavioral biases and financial decision-making. Risk tolerance partially mediates the Overconfidence Bias-investment decision relationship. This finding is consistent with Rani et al. (2024) and Soraya (2023).

Risk tolerance partially mediates the self-control-investment decision relationship, indicating that self-control bias influences investment decisions both directly and indirectly through risk tolerance.

Risk tolerance fully mediates between herding bias and investment decision. This finding aligns with Nadhila et al. (2023) and Sachdeva et al. (2021), who found that herding has an indirect impact on investment decisions through risk tolerance.

5.1 Theoretical Implications

This study makes a significant theoretical contribution by validating a mediation model in an emerging market context. It extends behavioral finance theory by demonstrating that risk tolerance is not just an independent trait but a key psychological mechanism through which biases like Overconfidence Bias

translate into action. Risk tolerance fully mediates between Herding Bias and investment decision while partially mediating Overconfidence Bias and self-control, revealing that biases operate through different psychological ways. This integrated model provides a more comprehensive framework for future research to understand the cognitive processes of investors.

5.2 Practical Implications

- Investors should not rely on gut feelings about risk. They are advised to use standardized risk tolerance measurements to understand their inherent risk appetite before making investment decisions. This objective assessment helps counter the distorting effects of Overconfidence Bias, which can inflate perceived risk tolerance, and herding, which can lead to taking on inappropriate risk by following the crowd.
- Financial advisors should integrate behavioral assessments into their client onboarding process. By identifying a client's susceptibility to specific biases (e.g., Overconfidence Bias, herding and Self-control bias), advisors can modify their advice accordingly.
- The SECP should encourage that all licensed brokers and asset managers provide certified investor education programs focused on behavioral finance. Furthermore, regulations can enforce plain-language, standardized risk disclosures on all investment products, making risks clearer and reducing the scope for biased interpretations.

5.3 Limitations and Future Directions

This study has several limitations. First of all, the researcher researched on particular behavioral biases (Overconfidence Bias, Herding Bias and self-control) and did not cover other psychological factors, such as regret aversion or loss aversion which may also impact investment decisions. Future research should include these biases to provide a more comprehensive behavioral model.

Secondly, the chosen sample may not fully reflect diverse investor population, as it could be limited to specific geographical area or profiles of investors, limiting the generalizability of the results. Future studies should use probability sampling techniques.

Thirdly, the cross-sectional method limits to establish causal relationships between different variables; longitudinal studies could provide more reliable results of how behavioral biases changes over time. Future studies may incorporate other biases, mediators and moderators (financial literacy, investment experience, gender and market conditions) which remained unaddressed in this study due to time and cost of study constraints.

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