

Impact of Behavioral Biases on Investment Decision - A Study in the Context  
of Bangladesh

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## **Abstract**

### **Impact of Behavioral Biases on Investment Decision - A Study in the Context of Bangladesh**

**Anika Ema**

This paper delves into behavioral biases in finance which often cause investors to diverge from rational decision-making. These biases, rooted in psychology, profoundly influence investment outcomes and market dynamics. By understanding their impact, investors can better navigate financial decisions and mitigate potential pitfalls. Recognizing and addressing these biases not only enhances individual investment strategies but also contributes to a deeper understanding of market behavior. Ultimately, this research aims to provide insights that enable more informed and effective investment practices in the face of psychological influences on decision-making.

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# 1. Introduction

In the realm of finance and investment, decision-making processes are often assumed to be rational and objective. Traditional financial theories, such as the Efficient Market Hypothesis (EMH) and Modern Portfolio Theory (MPT), are grounded in the belief that investors act logically to maximize their returns based on available information. However, an increasing body of research in behavioral finance challenges this notion by highlighting that investors are frequently influenced by cognitive and emotional biases, which can lead to systematic deviations from rational behavior.

Behavioral biases are inherent tendencies that cause individuals to make decisions that are not always in their best financial interest. These biases stem from various psychological factors, such as heuristics, emotions, and social influences, which affect how individuals perceive, interpret, and act upon financial information. Common examples of these biases include overconfidence, loss aversion, herd behavior, and confirmation bias. Each of these biases can significantly impact investment decisions, leading to outcomes that diverge from those predicted by traditional financial models.

The impact of behavioral biases on investment decisions is profound and multifaceted. Investors influenced by overconfidence, for instance, may overestimate their ability to predict market movements and take on excessive risks. Loss aversion can cause investors to hold onto losing investments longer than rational analysis would suggest, in an effort to avoid the emotional pain associated with realizing a loss. Herd behavior can lead to market bubbles and crashes as individuals follow the actions of the majority, often disregarding their own analysis. Confirmation bias can result in selective information processing, where investors seek out information that supports their pre-existing beliefs and ignore contradictory evidence. Through this study various behavioral biases that impact investment decisions will be explored. By examining how these biases shape decision-making processes and investment outcomes, the analysis aims to shed light on their practical implications for investors.

This study will basically focus on the financial sector of Bangladesh, a Third World developing country. A survey was conducted exclusively among Bangladeshi investors. By deploying a comprehensive survey, valuable data is gathered to identify and analyze various biases that

investors exhibit. By focusing solely on Bangladeshi investors, this study seeks to provide a nuanced understanding of the unique factors at play in this specific national and cultural setting.

Key biases such as overconfidence, loss aversion, regret aversion, herding, anchoring, availability, confirmation, representativeness, hindsight, self-attribution, disposition effect, illusion of control, gambler's fallacy, and conservatism will be defined in the subsequent section. Findings of this study indicate that availability, regret-aversion, illusion of control, anchoring and overconfidence are particularly prominent in the Bangladeshi context. These biases significantly impact the financial sector, leading to suboptimal investment decisions and market inefficiencies. Interestingly, some gender differences in behavioral pattern are also found out through this study. For example, female investors are more loss averse and wait for the surrounding confirmation more; this is because of the cultural factor which practices more conservatism towards female. Also, it has been seen that some biases can be mitigated with more experiences of investing. Biases like loss aversion, availability, overconfidence appear more pronounced in Bangladesh compared to developed countries, possibly due to differing economic conditions and investor education levels. Understanding these biases is crucial for both individual investors and financial professionals. By recognizing and mitigating the influence of behavioral biases, investors can make more informed and rational decisions.

In conclusion, this thesis underscores the importance of acknowledging and addressing behavioral biases in the investment decision-making process. By shedding light on the psychological factors that drive investor behavior, this research contributes to a more nuanced understanding of financial markets and offers practical recommendations for improving investment strategies.

The rest of this paper is organized as follows. Section 2 presents a literature review, summarizing relevant studies and theoretical frameworks. Section 3 outlines the methodology, detailing the research design, data collection, and analysis procedures. Section 4 presents the results and key findings of the study. Finally, Section 5 provides recommendations based on the findings and concludes the paper.

## 2. Literature review

Behavioral finance is a field that merges psychological insights with economic theory to understand how individuals make financial decisions. Unlike traditional finance, which assumes rational behavior, behavioral finance acknowledges that investors often act irrationally due to various cognitive and emotional biases. This section reviews key theories and empirical findings regarding some of the most prominent behavioral biases affecting investment decisions.

Overconfidence bias refers to the tendency of individuals to overestimate their knowledge, abilities, and the accuracy of their predictions. According to Odean (1998), overconfident investors trade more frequently, believing they can outperform the market despite substantial evidence suggesting otherwise. Barber and Odean (2001) found that such frequent trading reduces net returns, as transaction costs erode any potential gains. The illusion of control, self-attribution bias, and miscalibration are cognitive mechanisms that contribute to overconfidence, leading investors to underestimate risks and overestimate returns.

Loss aversion, a concept introduced by Kahneman (1979) in his Prospect Theory, posits that people experience losses more intensely than gains of the same magnitude. This bias leads investor to hold onto losing investments too long (disposition effect) while quickly selling winning investments. Shefrin and Statman (1985) observed that loss-averse investors are reluctant to realize losses, resulting in suboptimal portfolio performance. The emotional pain associated with losses drives this behavior, underscoring the significant impact of emotions on financial decisions.

Herd behavior describes the tendency of individuals to mimic the actions of a larger group, often disregarding their own analysis. Banerjee (1992) and Bikhchandani, Hirshleifer, and Welch (1992) demonstrated that investors might follow the crowd, leading to market anomalies like bubbles and crashes. Shiller (2000) argued that herd behavior is driven by social and psychological factors, such as the fear of missing out (FOMO) and the desire for social conformity. This bias highlights the social influence on investment decisions, where individual judgments are often overshadowed by collective actions.

Confirmation bias involves the tendency to seek, interpret, and remember information that confirms one's pre-existing beliefs while disregarding contradictory evidence. Nickerson (1998) highlighted that confirmation bias affects information processing, leading to skewed judgment and

decision-making. Investors influenced by this bias might overvalue supporting information and undervalue disconfirming evidence, resulting in biased investment choices. Empirical studies by Rabin and Schrag (1999) show that confirmation bias can lead to persistent market inefficiencies as investors cling to outdated beliefs despite new evidence.

Availability bias occurs when individuals overestimate the likelihood of events based on their recent experiences or readily available information. Tversky and Kahneman (1973) explained that people rely on immediate examples that come to mind when evaluating a topic or decision. This can lead to an overemphasis on recent market trends or memorable events, causing investors to make irrational decisions. Barberis et al. (1998) found that availability bias can result in overreaction to news, leading to volatility and mispricing in financial markets.

Regret aversion is the tendency to avoid decisions that could lead to regret. Loomes and Sugden (1982) proposed that individuals anticipate regret and make choices to avoid it, often leading to conservative investment behavior. Investors may stick to familiar investments or avoid making decisions altogether to prevent future regret. This emotional bias can result in missed opportunities and suboptimal diversification. Empirical research by Bell (1982) supports the idea that regret aversion significantly impacts financial decision-making, as investors strive to minimize the emotional pain associated with potential regret.

Conservatism bias refers to the tendency to insufficiently revise one's beliefs when presented with new evidence. Edwards (1968) highlighted that individuals tend to underweight new information and overly rely on their prior beliefs. This bias can lead investors to stick with outdated or suboptimal investment strategies, as they are slow to adjust their views in response to new market data. Barberis, Shleifer, and Vishny (1998) demonstrated that conservatism bias contributes to market underreaction, where stock prices adjust slowly to new information.

Hindsight bias is the tendency to perceive events as having been more predictable after they have occurred. Fischhoff (1975) described how individuals often believe they "knew it all along" once an outcome is known, which can distort their memory and judgment. In financial markets, this bias can lead investors to overestimate their predictive abilities and become overconfident in their future predictions. Biais and Weber (2009) found that hindsight bias affects investment decisions by creating an illusion of predictability, which can encourage risk-taking based on false confidence.

Gambler's fallacy is the erroneous belief that future probabilities are influenced by past events in independent random processes. Clotfelter and Cook (1993) observed this bias in gambling and lottery behaviors, where individuals mistakenly believe that a series of losses increases the likelihood of a future win. In the context of investing, this bias can lead investors to make decisions based on perceived patterns that do not exist. Ho, Lee, and Lin (2019) showed that gambler's fallacy can influence trading behavior, causing investors to expect reversals after streaks of gains or losses, potentially leading to poor investment choices.

Empirical studies consistently show that behavioral biases have significant impacts on investment decisions and market outcomes. For instance, Ritter (2003) found that investor psychology contributes to market anomalies, such as initial public offering (IPO) underpricing and post-earnings announcement drift. Similarly, Baker and Wurgler (2006) demonstrated that sentiment-driven investors can lead to mispricing and influence market returns. These findings underscore the importance of understanding behavioral biases for both individual investors and financial professionals.

Several strategies have been proposed to mitigate the effects of behavioral biases. Education and awareness are crucial, as understanding these biases can help investors recognize and counteract them. Thaler and Sunstein (2008) suggested that simple changes in how choices are presented can significantly influence decision-making, promoting more rational behavior.

The literature on behavioral finance highlights the profound impact of cognitive and emotional biases on investment decisions. Overconfidence, loss aversion, herd behavior, confirmation bias, availability bias, and regret aversion are key biases that can lead to suboptimal financial outcomes. Understanding these biases is essential for developing effective strategies to mitigate their influence, thereby enhancing investment performance and market efficiency. This review provides a foundation for the empirical analysis that follows, aiming to further explore the presence and impact of these biases among investors.

### 3. Methodology

#### 3.1 Research design

This study employs a quantitative research design to investigate the impact of different behavioral biases on investment decisions. The primary data collection method is a survey questionnaire developed to capture various aspects of behavioral biases among investors.

#### 3.2 Population and sample

The target population for this study includes investors in Bangladesh, a developing country where research on behavioral biases in investment decisions is relatively limited. The sample consists of 226 respondents, randomly selected to provide a representative cross-section of the investor population in Bangladesh. This sample size is deemed sufficient to perform reliable statistical analysis and draw meaningful conclusions.

Categorical variables on the collected data are presented below:

Category		Respondents (%)
Gender	Male	65%
	Female	35%
Age	Below 25	6%
	25-35	75%
	35-45	10%
	45-55	5%
	55 Above	4%
Investing Experience in Stock Market	Yes	53%
	No	47%
Length of Investing Experience	Less than 2 years	49%
	2-5 years	29%
	More than 5 years	22%

### 3.3 Survey instrument

The survey questionnaire was meticulously developed to assess the impact of various behavioral biases on investment decisions. The questions were designed to capture data on fourteen key biases mentioned below. The questionnaire also included demographic questions to perform some categorical analysis, for example- gender based biases, impact of investment experience on biases.

Questionnaire used in this study was developed based on established research in the field, drawing primarily from the following studies: "Behavioral Biases Affecting Investment Decisions of Capital Market Investors in Bangladesh" by Yasmin and Ferdaous (2023), "Exploring the Impact of Behavioral Anomalies in Investment Decisions of Investors of Capital Market in Bangladesh: A Behavioral Finance Approach" by Arafin et al. (2019), and "Effect of Behavioral Biases on Investment Decisions of Individual Investors in Kenya" by Athur (2009). While the questions were aligned with these foundational papers, they were slightly modified to better capture the specific nuances of the current study's focus on the impact of behavioral biases on investment decisions.

#### **Detailed explanation of key biases and survey questions based on that-**

- 1. Anchoring bias:** Anchoring bias describes people's tendency to rely too heavily on the first piece of information they receive on a topic. Regardless of the accuracy of that information, people use it as a reference point, or anchor, to make subsequent judgments.

**Survey question:** When you consider buying a stock, do you look at its historical highest price as a reference point?

#### **Response options:**

- Yes (carries '1' binary code on the t-test calculation)
- No (carries '0' binary code on the t-test calculation)

- 2. Confirmation bias:** The tendency to interpret new evidence as confirmation of one's existing beliefs or theories.

**Survey question:** When researching investments, do you prefer sources that confirm your existing beliefs or opinions?

#### **Response options:**

- Yes, I prefer something closer to my existing beliefs (binary code '1')
- No, I try to remain neutral in this case (binary code '0')

**3. Availability bias:** A cognitive bias that makes us judge the likelihood of an event based on how easily we can recall similar events

**Survey question:** How much weight do you give to the recent performance of a stock or the market in making your investment decisions?

**Response options:**

- I put 100% weight in recent performance (binary code '1')
- I put 75% weight on recent performance (binary code '1')
- I put emphasize both on historical and recent performance (50%-50%) (binary code '1')
- I put 25% weight on recent performance, emphasize on historical trend (binary code '0')
- I put all my weights on historical trend (binary code '0')

**4. Representativeness bias:** The representativeness heuristic is a cognitive bias that occurs while assessing the likelihood of an event by comparing its similarity to an existing mental prototype.

**Survey question:** My past history influences my present investment decisions.

**Response options:**

- Strongly agree (binary code '1')
- Agree (binary code '1')
- Not sure (binary code '0')
- Disagree (binary code '0')
- Strongly disagree (binary code '0')

**5. Hindsight bias:** Hindsight bias is the tendency to overestimate one's ability to have foreseen an outcome of an event after learning it.

**Survey question:** Previous profits generated from similar investments by the company made it very attractive to me to invest in it.

**Response options:**

- Strongly agree (binary code '1')
- Agree (binary code '1')

- Not sure (binary code '0')
- Disagree (binary code '0')
- Strongly disagree (binary code '0')

**6. Conservatism bias:** A bias which refers to the tendency to revise one's belief insufficiently when presented with new evidence

**Survey question:** When you receive new information that contradicts your existing investment beliefs or strategies, how likely are you to adjust your portfolio immediately?

**Response options:**

- Very likely (binary code '1')
- Likely (binary code '1')
- I stay neutral, no response (binary code '0')

**7. Illusion of control bias:** The illusion of control is the tendency for people to overestimate their ability to control events.

**Survey question:** Do you believe that your specific actions, such as the timing of trades or the choice of stocks, significantly influence the success of your investments, more so than overall market conditions?

**Response options:**

- Yes (binary code '1')
- No (binary code '0')

**8. Gambler's fallacy:** The belief that, if an event (whose occurrences are independent and identically distributed) has occurred less frequently than expected, it is more likely to happen again in the future (or vice versa).

**Survey question:** After a stock has been decreasing in value for several consecutive periods, do you believe it is more likely to increase in value in the next period because it has been down for so long?

**Response options:**

- Yes, very likely (binary code '1')
- Likely (binary code '1')

- No judgement (binary code '0')
- Less chance (binary code '0')
- No chance at all (binary code '0')

**9. Loss aversion bias:** An emotional bias that explains why individuals feel the pain of loss twice as intensively as the equivalent pleasure of gain.

**Survey question:** If you are in a situation where you have to make any decision regarding your gain and loss, which option will you go for? Remember there is 50-50 chance of gaining or loosing.

**Response options:**

- 5% loss / 5% gain (binary code '1')
- 10% loss / 10% gain (binary code '1')
- 15% loss / 15% gain (binary code '1')
- 20% loss / 20% gain (binary code '0')
- 25% loss / 25% gain (binary code '0')

**10. Regret aversion bias:** An emotional bias where a decision maker often chooses the option that would carry the least regret even if it's not the most optimal.

**Survey question:** Imagine you have the opportunity to invest in a promising new stock. However, you remember a past experience where a similar decision led to a significant loss. How likely are you to invest in the new stock, considering your past experience?

**Response options:**

- Very likely to invest (binary code '0')
- Less likely to invest (binary code '1')
- I will avoid that stock totally (binary code '1')

**11. Over-confidence bias:** The tendency to overestimate own knowledge and abilities in a certain area.

**Survey question:** Imagine you have been consistently successful with your stock picks over the past years, significantly outperforming the market. Now, you come across a high-risk investment

opportunity that promises substantial returns. How confident are you in your ability to evaluate this opportunity accurately and achieve similar success?

**Response options:**

- Very confident (binary code '1')
- Confident (binary code '1')
- Neutral (binary code '0')
- Less confident (binary code '0')
- No confidence at all (binary code '0')

**12. Herding bias:** A bias where people rationalise a course of action based on the fact that many other people are doing the same.

**Survey question:** When you see a trend where many people are investing in a particular stock or sector, how likely are you to follow suit?

**Response options:**

- Always (binary code '1')
- Very likely (binary code '1')
- Often (binary code '1')
- Less often (binary code '0')
- Never (binary code '0')

**13. Self-attribution bias:** A cognitive bias where individuals attribute their successes to internal factors like talent or effort, while blaming external factors like luck or other people for their failures.

**Survey question:** When an investment you chose performs poorly, do you typically attribute the poor performance to external factors rather than to your own decision-making?

**Response options:**

- Always (binary code '1')
- Very often (binary code '1')
- Often (binary code '1')
- Less often (binary code '0')
- Not at all (binary code '0')

**14. Disposition effect:** The tendency of investors to sell assets that have increased in value, while keeping assets that have dropped in value.

**Survey question:** You own two securities- Security A and Security B. Your long-term strategy suggests that you should hold onto them for longer periods. But suddenly you see the price of security A has increased in value whereas the price of security B has decreased in value. Do you intend to sell security A immediately.

**Response options:**

- Very likely (binary code '1')
- Less likely (binary code '0')
- No, I will hold it longer (binary code '0')

### **3.4 Data collection**

Data collection was conducted using an online survey platform, ensuring broad reach and convenience for respondents. The survey was distributed through various channels, including social media, email lists, and investment forums, to maximize participation from diverse investor groups.

The survey included clear instructions and assurances of confidentiality to encourage honest and accurate responses. Participants were informed that their responses would be used solely for academic research purposes and that their identities would remain anonymous.

### **3.5 Data analysis**

The collected data are analyzed using R software, a powerful statistical tool widely used in academic research. R software was chosen for its robust data analysis capabilities and extensive range of statistical packages.

In this study, t-statistics and Chi-Square statistics methods are used to perform the tests. The t-test is a statistical method used to determine whether there is a significant difference between the means of two groups, which is particularly useful in this study to assess the impact of behavioral

biases on different demographic segments, specifically when the sample size is relatively small, and the population standard deviation is unknown. Chi-Square test is particularly useful for determining whether there is a significant association between two categorical variables.

The first statistical method, t-statistics is used to assess whether the bias variables have impact on respondents' investment decision. For this, different null hypotheses are developed based on 14 survey questions. To perform the t-statistic analysis, responses are converted into binary codes (0, 1). Responses those have biases are coded as '1' and the responses those are bias less are coded as '0'. Null hypotheses are developed as  $\mu \leq 0.5$  which indicate, respondents don't have biases. For example, for testing the Confirmation bias, below hypothesis is formulated-

Null hypothesis: There is no confirmation bias among the respondents ( $\mu \leq 0.5$ )

Alternate hypothesis: There is confirmation bias among the respondents ( $\mu > 0.5$ )

Survey question: When researching investments, do you prefer sources that confirm your existing beliefs and opinions?

Response options:

1. Yes, I prefer something closer to my existing beliefs
2. No, I try to remain neutral in this case

First response is code as '1' as it has biasness, where the second response is coded as '0' which indicates no bias. The t-statistics is performed using R software with 95% confidence interval; therefore, if the p-value is less than the significance level 0.05, null is rejected which means respondents have confirmation bias in their investment pattern. On the contrary, if the calculated p-value is greater than the significance level 0.05, we fail to reject the null hypothesis which means there is no confirmation bias among the respondents' investment patterns.

To perform the t-statistics analysis, few Likert scale responses of survey questions are converted into binary codes to facilitate the binary analysis. Judgement is used to categorize the responses as biased or unbiased.

The Chi-Square analysis is performed to assess whether there is any association between related biases. For example, to test the association between Loss-aversion and Regret-aversion biases, below hypothesis is formulated-

Null hypothesis: There is no association between Loss aversion and Regret aversion biases (they are independent).

Alternate hypothesis: There is an association between Loss aversion and Regret aversion biases.

Contingency table is developed between these two biases using the survey responses. Then the Chi-Square test is run using the R software. In this analysis also, 95% confidence interval is taken to compare the p-value. If the calculated p-value is less than the significance level 0.05, we reject the null hypothesis which indicates there is an association between these biases, otherwise the opposite.

All these statistical analyses are performed using the software 'R version 4.2.1' ensuring precise and reproducible results.

### **3.6 Ethical considerations**

The study adhered to ethical research standards, ensuring the voluntary participation of respondents and obtaining informed consent from all participants. Confidentiality and anonymity were maintained throughout the data collection and analysis process.

### **3.7 Limitations**

While the study provides valuable insights into the behavioral biases of investors in Bangladesh, there are certain limitations. The sample size, although adequate for statistical analysis, may not fully capture the diversity of the entire investor population. Additionally, the reliance on self-reported data may introduce response biases.

## 4. Results and key findings

Testing is conducted using the whole sample size first, then categorical division is applied, i.e. same kind of analysis is done dividing the sample size based on gender differences and experience of investing. Association between related biases are tested also in the analysis part.

### 4.1 Hypothesis testing results for whole sample size (no categorical division)

Fourteen (14) behavioral biases are examined in this section through a total of 14 quantitative questions. Each question reflects a particular bias. The result of this analysis reveals that while 11 biases showed significant impact on decision-making processes, 3 biases did not exhibit any notable effect.

#### Significant biases:

- Anchoring bias
- Confirmation bias
- Availability bias
- Representativeness bias
- Hindsight bias
- Conservatism bias
- Illusion of control bias
- Gambler's fallacy bias
- Loss aversion bias
- Regret aversion bias
- Over-confidence bias

Each of these biases demonstrated a statistically significant impact on the investment decisions of the participants.

#### Non-significant biases:

- Herding bias
- Self-attribution bias
- Disposition effect

For these three biases, the analysis showed no significant impact on investment decisions. The p-values for these biases were greater than the significance threshold of 0.05, indicating that any observed effects could be attributed to random variation rather than a true underlying impact.

For a comprehensive breakdown of the statistical tests, including t-statistic values, confidence intervals, and p-values for all 14 biases, please refer to Appendix A. Also, a detailed explanation of the survey questions based on each bias and corresponding responses are presented there.

Through this study we have seen that significant impact was found for most of the biases. This suggests that a majority of investors are influenced by a wide range of behavioral biases when making investment decisions. The presence of these biases highlights a critical gap in traditional financial theories, which often assume that investors act rationally and make decisions based solely on available information and logical evaluation. The reality, as evidenced by this study, is that investors' decisions are frequently influenced by psychological factors and cognitive biases.

## **4.2 Hypothesis testing results based on categorical divisions**

### **4.2.1. Based on gender differences**

All the behavioral bias variables are checked separating the male and female respondents, and differences are found in two variables- Confirmation Bias and Loss-aversion Bias. Both biases exist for female investors, but not for male investors. Data summaries are presented in the table 3 in Appendix A.

Findings of this study aligns with the previous research made by Jinakoplos and Bernasek (1998) that female investors tend to be more risk-averse than their male counterparts. This heightened risk aversion may lead them to seek out information that confirms their existing beliefs, providing a sense of security and reducing perceived uncertainty in their investment decisions. This study is based on Bangladesh; therefore, this conservatism attitude of women makes sense. In a third world developing country like Bangladesh, females are more conservative to take decision by their own because of the cultural believes and practices. Though the scenario is changing day by day. According to Mittal and Vyas (2011), women may exhibit lower confidence in their investment decisions compared to men. To compensate for this, female investors might prefer information that reinforces or confirms their initial decisions, thus reducing cognitive dissonance and increasing their confidence. Also, social and cultural influences might play a role in shaping the confirmation bias observed in female investors. In cultures where women are socialized to be more cautious and seek consensus, there may be a stronger inclination towards confirming existing beliefs.

#### **4.2.2. Based on investment experiences**

Respondents who have experience of investing at least of 2 years have improved their conservatism bias. Additionally, investors who have at least 5 years of experience have been able to control their Over-confidence bias according to this analysis. Detailed analyses are presented in table 4 in Appendix A.

This finding aligns with the result of an empirical study that was conducted by Anson and Tomy, (2019) which concludes overconfidence as a behavioral irregularity that tends to disappear or significantly weaken with enough experience. Also, a microstructure model was developed by Gervais and Odean (2001) where they found that a trader's expected level of overconfidence increases in the early stages of his career, then with more experience, he comes to better recognize his own ability. This suggests that experience plays a crucial role in mitigating the impact of these behavioral biases. These findings are logical because less experienced investors may initially stick to familiar information and be slow to update their beliefs with new evidence. However, after 2 years of investing, they likely encounter diverse market conditions and feedback that necessitate adaptation. This learning process helps them become more responsive to new information, reducing Conservatism bias. With more than 5 years of experience, investors have had ample opportunities to observe the consequences of their decisions. Repeated exposure to the realities of market dynamics and the outcomes of their choices helps them calibrate their confidence levels more accurately and embrace information from broader sources. Also, as investors gain experience, their cognitive skills develop. They acquire better analytical and critical thinking skills, which help them assess new information more objectively and reduce the tendency to stick to outdated beliefs.

#### **4.3 Hypothesis testing results based on association of behavioral bias variables**

Using the Chi-Square formula, three emotional biases (Loss aversion, Regret aversion and, Gambler's fallacy) are assessed to find out whether there is any dependency of these biases with each other. No association is found for any pair. For detailed analysis, please refer to Appendix B.

Also, associations between related cognitive biases (Availability-Representativeness, Over confidence-Hindsight, Conservatism-Confirmation, and Over confidence-Illusion of control) are

tested too. Dependency is found between Conservatism & Confirmation pair and Over confidence & Illusion of control pair. But for the other two pairs, no association has been found. For detailed analysis, please refer to Appendix B.

These findings have important implications for both theory and practice. The independence of these biases indicates that each bias is influenced by unique factors and that interventions must be tailored to address specific biases rather than a generalized approach. Strategies effective for reducing one bias might not be effective for others. Additionally, the lack of association highlights the need for further research to explore potential moderators or situational variables that might influence these relationships. Future studies should consider larger and more diverse samples, longitudinal designs, and refined measurement instruments to deepen the understanding of how these biases interact.

## **5. Recommendations and conclusion**

### **5.1 Recommendations:**

The analysis presented in this thesis reveals the significant impact of behavioral biases on investment decision-making, which traditional rational financial theories often overlook. Considering the high impact of behavioral biases and the complexities of their nature, below endeavors can be taken to incorporate behavioral finance tools in rational theories and practices.

#### **(a) Developing hybrid financial models:**

Financial models should include metrics that measure psychological factors, such as investor sentiment indices and confidence levels. These metrics can help predict market movements and investor behavior more accurately.

#### **(b) Enhanced investor education and training:**

**Behavioral finance education:** Financial education programs should include modules on behavioral finance, highlighting common biases and their impact on investment decisions. This will help investors recognize and mitigate their biases.

**Practical training:** Incorporating case studies and simulations that expose investors to real-world scenarios where behavioral biases play a role can enhance their decision-making skills and reduce the impact of these biases over time.

**(c) Advisory and decision-support tools:**

**Behavioral analytics tools:** Developing and utilizing tools that analyze and highlight potential behavioral biases in investor behavior can help financial advisors provide more tailored advice. These tools can offer insights into an investor's risk tolerance, decision patterns, and psychological tendencies.

**Personalized advisory services:** Financial advisors should receive training in behavioral finance to better understand their clients' biases. By incorporating behavioral insights, advisors can offer more personalized and effective guidance.

**(d) Policy and regulatory recommendations:**

**Regulatory frameworks:** Policymakers should consider the implications of behavioral finance when designing regulations and guidelines for financial markets. Rules that promote transparency, reduce complexity, and protect investors from common biases can lead to more stable and fair markets.

**Investor protection:** Regulatory bodies can implement measures to protect investors from making biased decisions, such as requiring clear disclosures and providing tools to help investors understand the risks and biases associated with their decisions.

**(e) Future research directions:**

**Cross-cultural studies:** Conducting further research on how behavioral biases vary across different cultures and economic contexts can provide a more global understanding of investor behavior. This can help tailor financial models and advisory services to different demographic groups.

**Longitudinal studies:** Long-term studies that track changes in investor behavior and biases over time can offer deeper insights into the development and mitigation of biases. This can inform the design of better educational and advisory programs.

## 5.2 Conclusion

This study of behavioral biases provides substantial insights into the decision-making processes of investors. Findings from this analysis reveal that a significant number of investors exhibit a range of behavioral biases, challenging the assumption of complete rationality in traditional financial theories. This research findings underscore the necessity of incorporating behavioral insights into financial models and investment strategies. By acknowledging and addressing the psychological influences on investor behavior, financial advisors, policymakers, and educators can better guide investors towards more rational and effective decision-making processes.

The observed gender differences in behavioral biases suggest that personalized financial advice and education are essential for addressing the unique needs of different investor groups. Tailored interventions can help mitigate the specific biases prevalent among female and male investors, promoting more balanced and informed investment decisions.

Moreover, the influence of investment experience on reducing certain biases highlights the importance of investor education and practical exposure. As investors gain more experience, they develop better cognitive skills and strategies to manage biases, leading to more rational decision-making.

Finally, our investigation into the associations between emotional and cognitive biases revealed that most biases operate independently, with significant associations found only between conservatism-confirmation and overconfidence-illusion of control pairs. This independence implies that each bias is influenced by unique factors and requires tailored interventions.

In conclusion, understanding behavioral biases is essential for comprehending the complexities of investment decision-making. While traditional financial theories provide a foundational framework, acknowledging the influence of behavioral biases offers a more nuanced

understanding of investor behavior. Future research should continue to explore these biases, their interactions, and effective strategies for mitigating their impact to enhance investment decision-making and financial outcomes.

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## Appendix A

### T-test result of significant biases:

**Table 1: t-test analysis data of significant biases**

Bias Variable	Sample Mean	t-stat value	p-value	95% Confidence Interval	Decision Rule
Anchoring bias	0.7699115	9.6193	< 2.2e-16	[0.7235673, ∞]	Reject null, bias exists
Confirmation bias	0.6150442	3.5465	0.0002375	[0.5614663, ∞]	Reject null, bias exists
Availability bias	0.8672566	16.236	< 2.2e-16	[0.8298965, ∞]	Reject null, bias exists
Representativeness bias	0.6769912	5.6773	2.098e-08	[0.6255007, ∞]	Reject null, bias exists
Hindsight bias	0.6150442	3.5465	0.0002375	[0.5614663, ∞]	Reject null, bias exists
Conservatism bias	0.5752212	2.2826	0.01169	[0.5207927, ∞]	Reject null, bias exists
Illusion of control bias	0.7787611	10.074	< 2.2e-16	[0.7330564, ∞]	Reject null, bias exists
Gambler’s fallacy	0.6238938	3.8365	8.108e-05	[0.5705556, ∞]	Reject null, bias exists
Loss aversion bias	0.6084071	4.0138	4.07e-05	[0.5637978, ∞]	Reject null, bias exists
Regret aversion bias	0.8097345	11.837	< 2.2e-16	[0.7665151, ∞]	Reject null, bias exists
Over-confidence bias	0.7079646	8.827	< 2.2e-16	[0.6690515, ∞]	Reject null, bias exists

### T-test result of non-significant biases:

**Table 2: t-test analysis data of non-significant biases**

Bias Variable	Sample Mean	t-stat value	p-value	95% Confidence Interval	Decision Rule
Herding bias	0.5486726	1.4671	0.07187	[0. 4938789, ∞]	Fail to reject null, bias doesn’t exist
Self-attribution bias	0.5132743	0.39837	0.3454	[0.4582386, ∞]	Fail to reject null, bias doesn’t exist

Disposition effect	0.2610619	-8.1602	1	[0.2127, ∞]	Fail to reject null, bias doesn't exist
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### Analysis based on gender difference:

Analyses are shown below only for two biases- Confirmation bias and Loss aversion bias where the differences have been seen.

**Table 3: t-test analysis data based on gender difference**

Bias Variable	Analysis	Female Respondents	Male Respondents
Confirmation bias	Sample Size	80	146
	Sample Mean	0.7	0.5642857
	t-stat value	3.8791	1.5285
	p-value	0.0001079	0.06433
	95% Confidence Interval	[0.6141883, ∞]	[0.4946432, ∞]
	<i>Decision Rule</i>	<i>Reject null, bias exists</i>	<i>Fail to reject null, bias doesn't exist</i>
Loss aversion bias	Sample Size	80	146
	Sample Mean	0.66875	0.4315068
	t-stat value	3.9608	-1.6652
	p-value	8.127e-05	0.951
	95% Confidence Interval	[0.5978398, ∞]	[0.3634168, ∞]
	<i>Decision Rule</i>	<i>Reject null, bias exists</i>	<i>Fail to reject null, bias doesn't exist</i>

### Analysis based on investment experience:

Analyses are shown below only for two biases- Conservatism bias (investors having at least 2 years of investment experience) and Over-confidence bias (investors having at least 5 years of investment experience) where the differences have been seen.

**Table 4: t-test analysis data based on investment experience**

Bias Variable	Analysis	Total Respondents	Respondents having at least 2 years on Investment Experience
Conservatism bias	Sample Size	226	61
	Sample Mean	0.5752212	0.5737705
	t-stat value	2.2826	1.1555
	p-value	0.01169	0.1262
	95% Confidence Interval	[0.5207927, ∞]	[0.4671108, ∞]
	<i>Decision Rule</i>	<i>Reject null, bias exists</i>	<i>Fail to reject null, bias doesn't exist</i>
			<b>Respondents having at least 5 years on Investment Experience</b>
Loss aversion bias	Sample Size	226	6
	Sample Mean	0.6084071	0.2407407

	t-stat value	4.0138	-3.5783
	p-value	4.07e-05	0.9993
	95% Confidence Interval	[0.5637978, ∞]	[0.11716238, ∞]
	<i>Decision Rule</i>	<i>Reject null, bias exists</i>	<i>Fail to reject null, bias doesn't exist</i>

## Appendix B

### Association between emotional biases:

Analyses are shown below for three significant emotional biases; impact of all these three biases have been seen in the respondent's investment pattern.

**Contingency table between Loss Aversion and Regret Aversion biases**

	Regret Aversion (Yes)	Regret aversion(No)	Row Totals
Loss Aversion (Yes)	86	18	104
Loss Aversion (No)	97	25	122
Column Totals	183	43	226

X-squared value: 0.19168 (< critical value 3.841)

p-value: 0.6615 (> significance level 0.05)

Decision rule: Fail to reject the null, i.e. there is no association between Loss Aversion and Regret Aversion biases.

**Contingency table Regret Aversion and Gambler's Fallacy biases**

	Gambler's Fallacy (Yes)	Gamblers' Fallacy (No)	Row Totals
Regret Aversion (Yes)	113	70	183
Regret Aversion (No)	28	15	43
Column Totals	141	85	226

X-squared value: 0.055365 (< critical value 3.841)

p-value: 0.814 (> significance level 0.05)

Decision rule: Fail to reject the null, i.e. there is no association between Regret Aversion and Gambler's Fallacy biases.

**Contingency table between Loss Aversion and Gambler's Fallacy biases**

	Gambler's Fallacy (Yes)	Gambler's Fallacy (No)	Row Totals
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Loss Aversion (Yes)	63	41	104
Loss Aversion (No)	78	44	122
Column Totals	141	85	226

X-squared value: 0.1456 (< critical value 3.841)

p-value: 0.7028 (> significance level 0.05)

Decision rule: Fail to reject the null, i.e. there is no association between Loss Aversion and Gambler's Fallacy biases.

**Association between cognitive biases:**

**Contingency table between Over-confidence and Hindsight biases**

	Hindsight (Yes)	Hindsight (No)	Row Totals
Over-confidence (Yes)	83	40	123
Over-confidence (No)	56	47	103
Column Totals	139	87	226

X-squared value: 3.5349 (< critical value 3.841)

p-value: 0.06009 (> significance level 0.05)

Decision rule: Fail to reject the null, i.e. there is no association between Over-confidence and Hindsight biases.

**Contingency table between Conservatism and Confirmation biases**

	Confirmation (Yes)	Confirmation (No)	Row Totals
Conservatism (Yes)	72	58	130
Conservatism (No)	67	29	96
Column Totals	139	87	226

X-squared value: 4.2517 (> critical value 3.841)

p-value: 0.03921 (< significance level 0.05)

Decision rule: Reject the null, i.e. there is an association between Confirmation and Conservatism biases.

**Contingency table between Availability and Representativeness biases**

	Representativeness (Yes)	Representativeness (No)	Row Totals
Availability (Yes)	137	59	196

Availability (No)	16	14	30
Column Totals	153	73	226

X-squared value: 2.5511 (< critical value 3.841)

p-value: 0.1102 (> significance level 0.05)

Decision rule: Fail to reject the null, i.e. there is no association between Availability and Representativeness biases.

**Contingency table between Over-confidence and Illusion of Control biases**

	Representativeness (Yes)	Representativeness (No)	Row Totals
Availability (Yes)	109	14	123
Availability (No)	67	36	103
Column Totals	176	50	226

X-squared value: 16.732 (> critical value 3.841)

p-value: 4.304e-05 (< significance level 0.05)

Decision rule: Reject the null, i.e. there is an association between Availability and Representativeness biases.