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RESEARCH ARTICLE

Exploring the Impact of Cognitive Biases on Stock Investment Choices: A Scale Development Perspective

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ABSTRACT

A cognitive bias arises when an individual's decision-making is affected by inherent human inclinations or tendencies that are difficult to identify. Numerous studies indicate that more than 75% of our choices are shaped by these biases. This implies that nearly everyone is affected by them, although the degree of influence can differ from person to person. In India, the capital market dynamics are being increasingly influenced by retail investors. The quantum of dematerialized (demat) accounts has exceeded 185 million, with retail investors adding around 250,000 million each month. Although various researches show that approximately 80% of Indian investors possess a graduate degree, emphasizing the growing trend of advanced academic qualifications in the investment community. Indian investors, similar to investors around the world, display various cognitive biases that affect their financial choices, frequently resulting in less than ideal investment results. This research focuses on developing a reliable and credible scale for measuring the impact of four cognitive biases (automation bias, status quo bias, hindsight bias and confirmation bias) on the decisions pertaining to stock purchase by the retail investors of northern India. The authors have found that there is a non-availability of a consistent and valid scale to estimate the implication of the four cognitive biases mentioned above on the north Indian investors. An aggregate of 506 valid responses were collected from the investors by the authors and analyzed through an exploratory factor analysis using a principal component analysis and varimax rotation. The results were concluded as the emergence and development of a new scale for measuring the impact of cognitive biases that can be utilized by researchers intending to explore the field in future, targeting respondents from other parts of the world.

Keywords: Automation bias, confirmation bias, hindsight bias, status quo bias.

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1. Introduction

The review of behavioral finance and its examination of how cognitive biases affect investment choices have revealed a complicated relationship between individual psychology and financial decisions. The significant effect of behavioral biases on monetary choices has been noticeable at different phases of the investment process (Gabhane *et al*., 2023). Behavioral finance examines the various notions that lead individuals to make irrational decisions. Many individuals possess various cognitive biases that can become significant obstacles to increasing their financial resources or wealth (Zhang *et al*., 2022). When individuals make perceptions or decisions, they frequently use simplified methods of processing information known as heuristics, which can lead to consistent and predictable mistakes known as cognitive biases (Berthet, 2022). Behavioral finance is a branch of behavioral economics whose aim is to question the conventional finance perspective, which relies on the concepts of market efficacy and the rationality of individuals when making market decisions (Dhungana *et al*., 2022). This logical individual is expected to be able to make the best decision, no matter how much data is required to be analyzed, how complicated the analysis is, or how quickly a decision needs to be made

(Otuteye & Siddiquee, 2015). Recent research in behavioral economics has revealed the existence of market anomalies. Additionally, these studies have emphasized how cognitive biases can influence investment choices (Dhungana *et al*., 2022). Extensive psychological research shows that individuals often make consistent mistakes in their thinking. They tend to be overly confident, view past occurrences as more predictable than they actually were, and place excessive importance on recent experiences, which can lead to distortions in their judgment (Aigbovo & Ilaboya, 2019). As financial markets become more complex, it is essential to comprehend the different elements that affect the decision-making process of individual investors (Tansuchat & Thaicharo, 2025). The significance of this research area has grown lately, encompassing both theoretical and practical contributions (Madaan & Singh, 2019). Earlier research works have utilized a range of methods, including experimental approaches and analysis of real-world data, to clarify the characteristics and effects of a range of cognitive biases (Noch & Rumasukun, 2024). Many biases have been studied in various studies, and their effects are extensive. Nevertheless, further research in different contexts could reveal new insights on the matter (Shukla *et al.*, 2022). Investors exhibit behavioral biases due to insufficient technical knowledge and overconfidence in their decision-making abilities. Individual investors often have fewer chances to assess stocks because of their limited knowledge and interest, as well as high costs and time constraints (Suresh, 2024). Cognitive biases are the underlying causes of systematic errors in reasoning and illogical results in decision-making (Ruhr *et al*., 2019). When faced with investment choices, investors often exhibit inefficiency in behavior that impacts their decision-making. Cognitive and behavioral factors play a significant role in shaping an investor's perception regarding their investment decisions (Novianggie & Asandimitra, 2019). Even when investors possess full knowledge with respect to asset pricing, market security valuations, a company's future prospects, and government investment regulations, they can still go for irrational choices (Zahera & Bansal, 2018). Irrational decision making is affected by inclinations that investors may recognize, and such biases can influence the way investors think (Syarkani & Alghifari, 2022).

The present study takes into consideration four significant cognitive biases that have a considerable impact on the investment decisions of investors. These biases are Automation Bias, Status Quo Bias, Hindsight Bias and Confirmation Bias (Shukla & Shukla, 2023). The automated or machine-driven inclination can be described as an over-reliance on mechanized and non-manual systems for guidance and decision-making (Skitka *et al*., 1999). In the past few years, advancements in artificial intelligence and computerized mechanisms have sparked a technological rising and transformed industries. Additionally, there has been a swift rise in investment in automation (Jiang *et al*., 2022). Artificial Intelligence currently impacts risk evaluations in various sectors, including financial markets, employment and healthcare, the distribution of government incentives and housing (Johnson, 2019). There is significant growth in algorithm driven investment funds and the robotics sector. Systematic algorithms manage funds that represent 35% of the overall US stock exchanges and contribute to 60% of the trading activity within it (Niszczota & Kaszás, 2020). Automation is getting more widespread in our surroundings and is becoming essential for staying competitive and pertinent in today's expanding digital environment (Vorster, 2022). Past studies have indicated that investment management by humans fails to yield better returns than fully mechanized investment management (Skitka *et al*., 1999). The extensive use of automation has transformed investment methods and significantly influenced the growth of capital markets globally (Yang *et al*., 2024). Yet the majority of AI algorithms are created to serve as supportive tools, enhancing rather than substituting the decision-making process of investors. These AI models are not flawless and do not possess the wider investment context that could be important for an investor (Khera *et al*., 2023). This may involve both hardware and software problems, such as algorithms that implement rule sets which overly rigidly define expected values (Strauß, 2021).

People affected by the status quo bias often delay making decisions or prefer to keep things as they are rather than opting for an improbable result (Shukla *et al*., 2020). In investment, this bias is evident among investors who cling to a loss making portfolio out of fear of experiencing even larger losses (Rubaltelli *et al*., 2005). The interest stems from the fact that status quo bias can obstruct innovation and progress. It can be detrimental if a suboptimal situation persists or if beneficial enhancements are overlooked (Shukla *et al*., 2020). Behavioral anomalies, such as the status quo bias, have a greater significance for retail investors in capital markets compared to markets where primarily experienced professionals are trading with one another (Kempf & Ruenzi, 2006). An investor who quickly enters the capital market but takes their time to sell their assets (stocks) tends to experience significant challenges due to status-quo bias, particularly in unfavorable situations simply owing to their tendency to hold losing stocks (Kiky, 2021). Enhancing the mindset of investors in a developed stock market is crucial. One key strategy is to lower the level of status quo bias among investors, which is vital alongside other approaches. Consequently, understanding the measures to reduce this bias and from which angles to address it holds a significant degree of theoretical and practical value in investments (Li *et al*., 2009). Investors in capital markets around the globe show a notable tendency to prefer the current state of affairs (Samuelson & Zeckhauser, 1988).

After gaining new information, agents affected by hindsight bias forget their previous lack of knowledge, believing instead that they always understood the situation. This bias, which prevents individuals from accurately recalling their earlier expectations after receiving new data, obstructs effective information processing by capital market investors (Biais & Weber, 2009). Hindsight bias can hinder investors from effectively comparing new information with their earlier expectations, leading them to mix up their past beliefs with the latest data (Monti & Legrenzi, 2009). Investors may experience overconfidence due to hindsight bias, as they tend to think that they are more

accurate in their predictions than they actually are (Shukla, 2020). Investors with hindsight bias tend to misremember their previous expectations when forming opinions. When selecting portfolios, these individual investors depend on skewed expected returns, thereby inflating the significance of recent available information (Biais & Weber, 2009). Hindsight bias causes investors to downplay volatility, leading to suboptimal portfolio decisions and inadequate risk management. This overestimation of how predictable events are heightens the regret that an individual investor experiences when his choices produce worse results than the alternatives he did not pursue at the initial phase while deciding to invest (Seppälä, 2009). A major consequence of hindsight bias can be viewed in the fact that it can lead investors to feel overly confident in their investment choices. This bias influences various phases of systems, designs, procedures, outlines, contexts, structures and scenarios (Tavor, 2013). There is a positive correlation between outgoingness and hindsight bias. Additionally, there exists a direct connection between forthrightness and hindsight bias among investors (Zahera & Bansal, 2018).

Confirmation bias refers to the tendency of individuals to seek out information that aligns with their existing beliefs with reference to an investment while disregarding or overlooking such information that presents opposing viewpoints to the investors (Verma, 2016). Confirmation bias happens when individuals focus solely on information that supports their initial beliefs, ignoring any evidence that contradicts those (Legoux *et al*., 2014). Confirmation bias arises since social media amplifies the impact of the opinions of others and reinforces users' own beliefs. Additionally, the dynamic social media algorithms possibly exacerbate confirmation bias by presenting users with information that aligns with their interests, limiting their exposure to differing and contradictory perspectives challenging their opinions (Gabhane *et al*., 2023). Confirmation bias affects investors' decision-making, as there is a tendency to seek out information that reinforces their prior investment choices (Armansyah, 2022). Although confirmation bias has been explored through mathematical models and observations in finance and accounting, its impact on market prices has still not been examined because of the constraints of conventional capital markets (Cipriano & Gruca, 2014). Research on mental biases in financial behavior provides compelling evidence for confirmation bias, suggesting that individuals often distort new information to align with their existing beliefs (Duong *et al*., 2014). Confirmation bias greatly influences investment strategies, which can lead to poor decision-making (Gabhane *et al*., 2023). Investors who exhibit a greater confirmation bias tend to have elevated expectations regarding their investment outcomes. However, they also tend to trade excessively, which leads to poorer actual performance (Park *et al*., 2010).

2. Review of Literature

Numerous studies show strong traces of automation bias under controlled environments, but there is also significant anecdotal affirmation from the actual world wherein the outcomes have been fatal (Kempf & Ruenzi, 2006). This bias poses a serious issue in the creation of intelligent systems that assist human decision-making, particularly in high-pressure situations (Sukla *et al.*, 2023). While automation offers numerous advantages in various workplaces, it is crucial to thoroughly assess the impact of implementing automated tools in both complex and simpler decision-making situations (Skitka *et al*., 1999). A study highlights the necessity for a better comprehension of how automation affects the psychology of human operators. It also emphasizes the importance of creating decision-making environments that consider the advantages and disadvantages of both humans and automation to enhance overall performance (Skitka *et al*., 1999). Automation bias plays a crucial role in how pilots engage with automated systems, leading them to overlook some of the information at their disposal when carrying out assignments and making commitments alongside automation (Monti & Legrenzi, 2009). The elements contributing to automation bias are intricate. Nevertheless, even though there is a significant risk of making erroneous decisions, there is limited direct research focused on excessive dependence on technology in the investment arena (Li *et al*., 2009). Automation bias is identified as a significant issue in the realm of decision support systems that are AI-driven as it contravenes ethical guidelines and legal standards irrespective of the operative domain (Kiky, 2021). Recent studies on automation bias indicate that people tend to have excessive confidence in AI, while findings on algorithm disinclination reveal that as the importance of any decision increases, individuals become more hesitant to rely on algorithms (Shukla *et al*., 2020).

Although current theories regarding status quo bias may clarify certain aspects of these results, there is no comprehensive postulate in the writings that encompasses every single finding (Ruhr *et al*., 2019). Although the status quo bias is likely more significant in static situations, it remains unclear whether and how dynamic decision-making processes might lead to static choices that display a state of affairs bias (Li *et al*., 2009). When making choices, people tend to favor maintaining the current situation. This tendency, known as the status quo effect, influences various economic events, including those in capital markets (Samuelson & Zeckhauser, 1988). It is essential to comprehend how the status quo effect can be accurately assessed and, even more significantly, what strategies can be implemented to counter it. Previous studies have primarily concentrated on individual measurement methods rather than on countermeasures (Godefroid *et al*., 2023). Entrepreneurs tend to be less attached to the status quo compared to investors. Analyzing the situations separately shows that the distinction between entrepreneurs and investors arises primarily from their choices of contexts (Niszczota & Kaszás, 2020). An exaggerated emotional and neurological reaction to errors in rejecting the status quo plays a significant role in the development of a state of affairs effect. The differences in neural and emotional reactions observed can forecast a tendency to favor the "as-it-is" in future decision-making (Zahera & Bansal, 2018). Further studies are required to investigate if the chance to show indifference influences how the as-it-is bias shapes

TABLE I: Descriptive Statistical Analysis

Code	Variable/Item	N	Mean	Standard deviation
AB1	I trust that the data available on investment websites regarding a company and its stock is dependable.	506	3.51	0.849
AB2	I trust my own abilities more than the automated data when making stock market investment choices.	506	3.78	0.833
AB3	I believe that Artificial Intelligence (AI) has the potential to significantly impact decisions about stock investment in the future.	506	3.82	0.859
SQB1	I like to purchase a stock multiple times if the same has provided me with strong earnings in the previous month and/or year.	506	4.13	0.809
SQB2	I tend to remain invested in a company, even when there is an option of any other stock with apparently comparable potential.	506	3.17	0.915
SQB3	I think the stock market of India almost always faces ongoing risks, and incorporating new shares into my portfolio appears to be quite hazardous.	506	3.59	0.906
HB1	I maintain a diary of past forecasts that were made by me about my stock market investments.	506	3.78	0.883
HB2	I think that most of the predictions that are made by me about the future of Indian stock markets end up being true.	506	4.05	0.917
HB3	I had this idea when COVID-19 started that Indian stock market will rise sharply to get above 75,000 points by the year 2024.	506	3.85	0.891
CB1	I actively seek out people and news sources with alternative opinions prior to investing in stocks.	506	3.93	0.808
CB2	I favour building an alternative investment plan apart from my existing investment plan.	506	3.89	0.801
CB3	I take complete responsibility and accountability of all my stock investment decisions.	506	4.04	0.816
CB4	I favour using advanced technology like computerized decision making for my stock investment decisions.	506	3.74	0.954

Source: Analysis by authors.

TABLE II: Communalities

	Initial	Extraction
AB1	1.000	0.554
AB2	1.000	0.564
AB3	1.000	0.527
SQB1	1.000	0.532
SQB2	1.000	0.522
SQB3	1.000	0.684
HB1	1.000	0.599
HB2	1.000	0.636
HB3	1.000	0.513
CB1	1.000	0.524
CB2	1.000	0.554
CB3	1.000	0.639
CB4	1.000	0.576

Note: Extraction Method: Principal Component Analysis.

TABLE III: KMO and Bartlett's Test

Kaiser-meyer-olkin measure of sampling adequacy 0.945	
Bartlett's test of sphericity	Approx. Chi-Square 1246.483
	Df 78
	Sig. 0.000

attitudes towards ambiguity in decision making in the capital market (Kempf & Ruenzi, 2006).

Investors with hindsight bias tend to forget their previous lack of knowledge before seeing the results and solutions. This tendency has been shown to impede learning and, specifically, causes investors to miscalculate capital market volatility (Biais & Weber, 2009). Hindsight bias can greatly impact the investment decisions of typical investors, as it can change how they view their asset distribution and, consequently, their level of risk (Monti & Legrenzi, 2009). Findings on hindsight bias indicate that everyone, including portfolio consultants, is affected by it. After knowing the outcome, individuals often view their starting performance more favorably than it truly was (Seppälä, 2009). The hindsight bias effect is observed in all investor categories, but it has a more pronounced impact on older investors compared to younger ones (Tavor, 2013). The investors demonstrated that their choices are affected by behavioral factors rather than being purely rational, and that hindsight bias plays a significant role in the decisions made by individual investors (Aigbovo & Ilaboya, 2019). Investors often mix up their initial forecasts with the data they obtain, which exposes hindsight bias. This bias at times is so prevalent that it hinders participants from acknowledging their estimation mistakes (Singh & Shukla, 2024). Overall, research indicates that more experienced investors tend to achieve better timing outcomes compared to those who are less experienced, signifying that the hindsight bias is more pronounced among less experienced investors (Shukla *et al*., 2016). Cognitive illusions arise from hindsight bias when choosing stocks for investment. The factors that lead to these cognitive illusions influence investors to deviate from rational decision-making

TABLE IV: Total Variance Explained

Component	Initial eigen values			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	3.994	29.875	29.875	3.884	29.875	29.875	2.095	16.119	16.119
2	1.301	10.005	39.881	1.301	10.005	39.881	1.931	14.853	30.973
3	1.100	9.459	49.340	1.100	9.459	49.340	1.643	13.642	44.614
4	1.011	8.777	58.117	1.011	8.777	58.117	1.625	13.502	58.117
5	0.894	6.881	64.997						
6	0.726	5.588	70.585						
7	0.699	5.380	75.965						
8	0.665	5.117	81.082						
9	0.616	4.736	85.819						
10	0.606	4.160	89.979						
11	0.530	3.581	93.560						
12	0.500	3.446	97.006						
13	0.467	2.994	100.000						

Note: Extraction Method: Principal Component Analysis.

TABLE V: Rotated Component Matrix

	Component			
	1	2	3	4
	Automation Bias (AB)			
AB1	0.555			
AB2	0.501			
AB3	0.668			
	Status Quo Bias (SQB)			
SQB1		0.624		
SQB2		0.508		
SQB3		0.805		
	Hindsight Bias (HB)			
HB1			0.731	
HB2			0.754	
HB3			0.639	
	Confirmation Bias (CB)			
CB1				0.552
CB2				0.704
CB3				0.758
CB4				0.699

Note: Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization, a. Rotation converged in seven iterations.

in their investment assessments. These cognitive illusions significantly affect behavioral biases (Suresh, 2024).

Confirmation bias leads investors to develop inflated expectations regarding their capital market investments, yet these investors often see poorer actual results. It reinforces their existing beliefs and increases their overconfidence (Park *et al*., 2010). Confirmation bias is considered a relatively underexplored bias in the areas of behavioral finance and decision-making. The scarcity of research on this bias presents a valuable opportunity for further investigation (Cipriano & Gruca, 2014). Research has shown that the accuracy of predictions regarding market responses to IT investments is negatively affected by confirmation bias. Analysts with strong financial skills are especially prone to these biases, particularly when there is an abundance of information about IT (Legoux *et al*., 2014). Confirmation bias significantly influences the investment choices of Generation Z. The impact of online media, which serves as a key aspect of identity for this generation, can enhance this inclination towards confirmation bias (Runtuwene & Sibilang, 2024). Confirmation bias affects the investment choices of Indonesian investors. They tend to look for information that supports their existing beliefs when purchasing stocks, while disregarding any data that challenges those beliefs (Tripathi & Shukla, 2017). Previous studies indicate that financial analysts may be susceptible to confirmation bias as they forecast earnings and articulate their predictions in written form Cipriano and Gruca (2014). Value investors tend to under react to positive information because of confirmation bias, while they typically respond appropriately or even overreact to negative information. This bias among investors presents intriguing opportunities for research (Duong *et al*., 2014). Research has shown that confirmation bias affects the decision-making of accounting information preparers, indicating that their judgments are heavily swayed by their pre-existing beliefs (Godefroid *et al*., 2023).

3. Research Methodology

The research utilizes a Likert scale questionnaire to collect the opinions of north Indian capital market investors with reference to the subject in question. A total of 520 questionnaires were randomly distributed to 360 male investors and 160 female investors in Bombay Stock Exchange and 506 filled responses were returned from 360 male investors and 146 female investors. The authors have used descriptive research to figure out the orientation of investors with reference to the presence of automation bias, status quo bias, hindsight bias and confirmation bias in their stock investment choices. Table I presents the values of mean and standard deviation of the responses received from the sample survey. The data as already mentioned above has been collected through a five point Likert scale questionnaire on a continuum from strongly disagree (1) to strongly agree (5). The results show that all the four biases have a sizeable impact on the decisions of investors hailing from the north Indian part of India.

3.1. Data Analysis and Interpretation

An Exploratory Factor Analysis (EFA) was performed using a principal component analysis and varimax rotation. The minimum factor loading criteria was set to 0.50. The communality of the scale, which indicates the amount of variance in each dimension, was also assessed to ensure acceptable levels of explanation. The results show that all communalities were over 0.50 (Table II).

An important step involved weighing the overall significance of the correlation matrix through Barlett's Test of Sphericity, which provides a measure of the statistical probability that the correlation matrix has significant correlations among some of its components. The results were significant, $x^2(n = 506) = 1246.483$ ($p < 0.001$), which indicates its fitness for factor analysis. The Kaiser-Meyer-Olkin measure of sampling adequacy (MSA), which indicates the appropriateness of the data for factor analysis, was 0.945 (Table III). In this regard, data with MSA values above 0.800 are considered appropriate for factor analysis. Eventually, the factor solution derived from this analysis yielded four factors for the scale, which accounted for 58.117% of the variation in data (Table IV).

The four factors identified as part of this exploratory factor analysis aligned with the theoretical proposition in this research. Factor 1 includes items AB1 to AB3, referring to Automation Bias (AB). Factor 2 gathers items SQB1 to SQB3, which represents the Status Quo Bias (SQB). Factor 3 assimilates items HB1 to HB3, which indicate the Hindsight Bias (HB). Finally, Factor 4 includes items CB1 to CB4, referring to Confirmation Bias (CB). Factor Loadings are presented in Table V.

4. Conclusion

This study culminates in the creation of a concise and effective cognitive bias scale, building on prior scientific research on cognitive biases. The main insights from this research, particularly the cognitive bias scale, could benefit the research community, including academicians, investment experts, and individual investors, by drawing attention to and enhancing key market results, such as the financial and operational performance of market portfolios. The measurement scale was rigorously evaluated for reliability and validity. The introduction of the cognitive bias scale aims to encourage and facilitate further theoretical advancements and empirical studies in the field of behavioral finance.

5. Limitations and Future Research Directions

This study has met its goals, but there are limitations that need to be tackled in future research. First, upcoming studies should utilize probability sampling methods and increase the respondent size to improve the applicability of the results by investigating the effects of the four cognitive biases on global investors. Second, the theoretical framework used in this research may not encompass all possible biases that could affect investor decisions. Future investigations could look into other biases that may influence investor intentions. Lastly, it is important to closely examine how investor psychology, overconfidence, and AI impact decision-making in capital markets.

Conflict of Interest

The authors state that they carry no recognized financial conflicts of interest or relationships that might have affected the research presented in the paper.

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