

# PROSPECT DRIVEN BIASES AFFECTING INVESTMENT DECISION MAKING: MEDIATING BY RISK PERCEPTION AND MODERATING BY ROBO-ADVISORY

*Kiran Yadav<sup>1</sup> and Shikha Daga<sup>2</sup>*

DOI: 10.58426/cgi.v5.i2.2023.37-51

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## Abstract

There is a debate in the investing world that revolves around whether investors adhere to classical theory or accord with the prospect theory. This study aims to examine the impact of prospect theory on the process of making investment decisions. The study has employed a hypothesis deductive technique, in which the suggested research model was tested using structural equation modelling in AMOSS Data that was obtained from 278 individual investors who participated in the Indian stock market for this study. The empirical findings indicate that biases driven by prospect theory have an impact on the irrational decision-making process among individual investors. The study also introduced a second-order measurement invariance related to prospect theory which has not been widely explored before. Investors tend to avoid losses and experience fear about potential losses; consequently, they may make irrational decisions. Surprisingly, even knowledgeable investors are susceptible to biases associated with prospect theory demonstrating significant and a positive relationship between prospect bias and irrational investment decision-making amongst individual investors. Risk perception of individual investors partially mediates and robo-advisory moderates the relationship between irrational investment decision-making and individual investors biases. The study's conclusions exhort individual investors to recognise and assess their prejudices and emotions. This research will assist in raising investor understanding so they can determine their financial capability after weighing all of their options.

**Keywords:** Prospect Theory, Mental Accounting, Higher Order, Robo Advisory, Loss Aversion.

**JEL Classification:** D91, G40,G41, D81

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<sup>1</sup> Assistant Professor, PGDAV College, University of Delhi

<sup>2</sup> Assistant Professor, PGDAV College, University of Delhi

## **1. Introduction**

Do the investors make decisions rationally? Recent development in finance highlights that human beings (Tversky et al., n.d.) are never rational in fact individual psychology plays an important role in decision-making. Behavioural finance a new paradigm in finance demonstrates how actually investors behave. Behavioural finance is an area of research that integrates concepts from finance and psychology to comprehend how people make financial decisions . It seeks to explain why people often deviate from traditional economic assumptions of rationality when it comes to their financial choices. Behavioral finance explores the psychological biases and cognitive errors that influence investors and consumers, leading to suboptimal decision-making in the financial realm. Behavioral finance challenges the assumption of traditional finance about the efficient market hypothesis, which suggests that financial markets are perfectly efficient and that prices always reflect all available information. Instead, behavioral finance proposes that markets are influenced by the irrational behavior of investors, resulting in market inefficiencies. Because behavioural finance has such a strong effect on investors' success, it has become an essential component of the decision-making process (Jahanzeb et al., 2012). Additionally, behavioural finance demonstrates that emotional factors can play a role in affecting decision-making. Financial and investing decisions are addressed from a human perspective by behavioural finance. (Ricciardi & Simon, 2000). Prospect theory is a branch of behavioural economics that explains how people choose between probabilistic options when there is risk and it is uncertain how likely certain outcomes will be. Compared to the anticipated utility theory, this theory—which was created in 1992 by Amos Tversky and Daniel Kahneman—is seen to be more psychologically accurate in explaining how people make decisions. According to prospect theory, the value function is convex in the loss region as it depicts that the investors are risk seekers when they face loss, and concave in the gain region which depicts investors are risk-averse when they face gains (Kuo and Chen, 2012). Shefrin and Statman (1985) extended the prospect theory (Kahneman and Tversky, 1979) giving the name—the disposition effect to this phenomenon by applying it to investment behavior and concluding that the investor sells the winning stock early and holds the loser one. Waweru et al. (2008) study depicts how prospect theory influences investors' decision-making through mental accounting, regret aversion, and loss aversion. This study aims to examine the impact of prospect theory on the process of making investment decisions. The introduction of robo-advisory services to provide a digital platform for investment is a technical innovation in the field of finance. In this study, we also try to examine whether these robo-advisory services help to mitigate the biases of investors.

The remaining study is organised as: Section 2 provides the literature review, theoretical background and development of the hypothesis along with the conceptual model. In section 3 research methodology is described. Section 4 is about the data analysis and in section 5, the findings are discussed. Section 6 deals with the conclusion of the study.

## **2. Literature review and theoretical background**

Prospect theory posits that the psychological characteristics of investors impact their decision-making, leading to illogical judgments. This theory captured the most important features of investor decision-making. (Bodnaruk & Simonov, 2015) , an alternative to the expected utility theory (Haubert et. al. 2012). Some of the common prospect theory-driven biases are - loss aversion, mental accounting, regret aversion (Waweru et al., 2008), and self-control.

**Loss Aversion**-People are more sensitive to losses than they are to similar profits (Kliger & Kudryavtsev, 2010). They make investment decisions while considering the loss aspect (Sahi, 2013). Gains and losses are not handled by investors in the same manner. Fearful of losing out, they seek to make quick money by selling the security for even less than the market value. Even the gender of investors also has a high impact on the occurrence of these biases (Kumar et al 2018).

**Mental accounting**: - According to Thaler (1985), investors have a distinct goal for investing, and because of this mental accounting, they split their investment into multiple portfolios in such a manner that the specified purpose is met while maximizing return and minimizing risk (Ritter, 2003). (Barberis et al., 2001) provided that mental accounting is “the process by which investors think about and evaluate their financial investments and transactions”.

**Regret aversion**: Savage (1951) initially proposed this hypothesis, which argues that investors have regrets about their decisions. It is a feeling that an investor has after making a mistake. (Fogel and Berry, 2010). Because of this bias, investors attempt to postpone decision-making. They purchase the incorrect asset out of fear of loss. Due to susceptible by this bias investors invest in stocks that pay regular dividends (Shefrin and Statman, 1985).

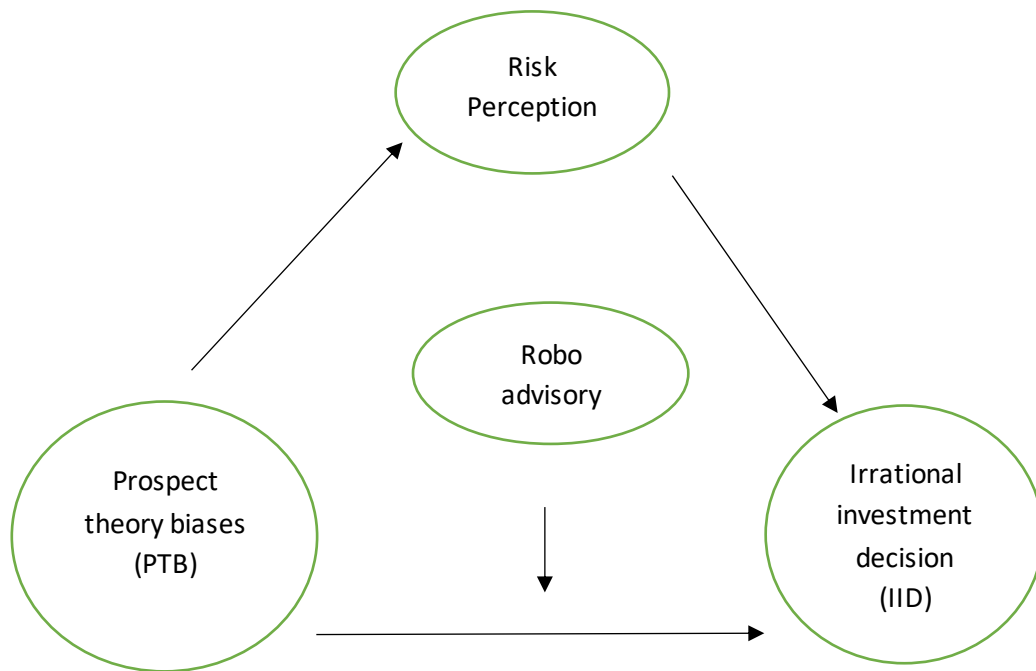
**Self-control**-Individuals' self-regulation and risk assessment abilities are impacted by a lack of additional self-control. Because of their vulnerability to this bias, investors prioritize short-term aims above long-term ambitions. As a result, the investor spends more money to earn a short-term return. Mental accounting has an impact on self-control (Rha et al., 2006).

### 3. Methodology

#### 3.1. Model Building and Hypothesis Formulation

Contrary to what conventional finance indicates, investors do not act rationally. Instead, they base their decisions on the perception of gains rather than losses because they believe that gains and losses have distinct values. The purpose of this study is to determine how prospect theory-driven biases affect the financial market investing decisions of individuals. Additionally, the study has made an effort to determine whether robo-advising and risk perception modify this relationship. Based on gap analysis from the existing literature review following conceptual model (Figure 1) is derived. Therefore, the objective of this study is to empirically examine PT and IID's role with risk perception as a mediator and robo advisory as a moderator.

**Figure 1- Conceptual Model**



**Source:** Author's Compilation

To achieve the objective of this research, the following hypotheses were developed:

H1: Prospect theory biases (PTB) have a significant positive influence on the irrational investment decision (IID) of individual investors in the financial market.

H2: Prospect theory biases (PTB) are positively associated with the risk perception (RP) of individual investors in the financial market.

H3: Risk perception (RP) of individual investors has a significant positive influence on irrational investment decisions (IID).

H4: Risk perceptions (RP) mediate the relationship between prospect theory biases (PTB) and irrational investment decisions (IID)

H5: Robo advisory moderates the relationship between prospect-driven biases (PTB) and irrational investment decisions (IID).

### **3.2 Sampling Framework and Data Collection**

The study targeted the population of individual investors who are investing in the stock market, but due to the limitation of the study, the individual investors who live in Delhi and NCR were taken as samples in this research. Quota and snowball sampling were used for sampling. Snowball sampling is applied when the population of the research is unknown and difficult to determine (Sadira et al,1999; Lim 2012). Primary Data was collected by the 278 individual investors through an adapted questionnaire from existing literature who invested in the Indian stock market and live in Delhi and NCR.

### **3.3 Research Instrument Design**

This research employed a deductive technique, which was guided by the theoretical framework of prospect theory. The study employed a quantitative cross-sectional research design, utilizing a questionnaire as the primary data collection tool, in accordance with the research model. The questionnaire was designed following a thorough research of the existing literature. Section 1 evaluated the socio-demographic characteristics of the participants. Section 2 included inquiries about robo advisory, prospect theory biases, and risk perception. Section 3 had questions on investment decision-making. A 5-point Likert scale is employed, with a rating of 5 indicating "Strongly agree" and a rating of 1 indicating "Strongly disagree". Before collecting data, the content validity of the instrument was confirmed by conducting a thorough evaluation by academics and industry specialists.

### 3.4 Descriptive Statistics of Demography

The individual investors or retail investors who invested in the Indian stock market were the main focus of the study. A total of 350 questionnaires were sent, but only 295 were returned. Out of 295, only 278 were complete and used for this research as shown in Table 1. Out of 278, 158 (57%) of the responders were men, and 119 (43%) were women. Of the 278 individuals, 167 (67%) belonged to the 20–35 age group, which represents a sizable component of the sample. 64 (23%) were in the 36–50 age group, 17 (6%) were in the 51–60 age group, and 11 (4%) were over 60 years old.

**Table no -1. Background information of respondents**

Category		Frequency	Percentage
Age	20-35	167	67%
	36-50	64	23%
	51-60	17	6%
Gender	Male	158	57%
	Female	119	43%
Marital status	Single	160	57.4%
	Married	118	42.6%

**Source:** Author's Compilation

### 3.5 Statistical Methodology

The gathered data were organized and examined using the "Statistical Package for the Social Sciences" (SPSS) 22 and AMOS 22 software packages. Initially, the study instrument, a closed questionnaire, was submitted for evaluation to two behavioral finance specialists, four expert investors, and a broker to assess the questionnaire's statements and establish its content validity. Following a comprehensive evaluation, specialists have suggested implementing a few small modifications. After making such improvements, preliminary research was carried out to assess the internal consistency and reliability of the scale. Subsequently, the model's measurement was verified, and the association between prospect biases and IID was analyzed using SEM. The bootstrapping approach is employed to assess the presence of a mediating influence. The Bootstrapping approach is chosen because it yields the most precise intervals for indirect impact, as demonstrated by MacKinnon et al. (2004). "The bootstrapping approach is that the standard error estimates and confidence intervals of indirect effect will usually be imprecise because the indirect effect estimates generally do not follow a normal distribution" (Duan et al., 2020).

## 4. Data Analysis

### 4.1. Pilot testing

Initially, a pilot test of the questionnaire was conducted. A total of 150 replies were collected from individual investors who have participated in the financial market. The main objective of the pilot study was to assess the internal consistency and reliability of the instruments, given the reflective scale (Nunnally and Bernstein, 1967).

### 4.2. Reliability and Validity Assessment

Before performing the validity and reliability tests, the Kaiser-Meyer-Olkin (KMO) value of 0.85 was calculated, indicating satisfactory sample adequacy (Hair, 2009). The reliability of a scale is a measure of its accuracy, consistency, and freedom from errors. Cronbach's alpha was employed to assess the reliability of the instrument, given that the scale is reflecting. Therefore, it is necessary to assess the internal consistency of the items within each construct, which should exceed 0.7 (as shown in Table 2) for all constructs. This criterion is considered acceptable according to the guidelines set by Nunnally and Bernstein (1967) and Fornell and Larcker (1981). After reliability, convergent validity and discriminate validity were checked through confirmatory factor analysis (CFA). “The convergent validity was checked through the critical ratio (CR) and average variance extracted (AVE). The value of  $CR > 0.7$ ,  $AVE > 0.5$  and  $CR > AVE$  of all constructs (Bagozzi et al., 1988)”. Hence, convergent validity was achieved. The discriminant validity was verified using the instrument provided by Professor Gakingston. “The value of AVE (average variance explained) was higher than ASV (average shared variance) as well as MSV (maximum shared variance) ( $AVE > ASV > MSV$ ) for all seven constructs”. Several reliability and validity indices provided good findings.

**Table. 2. Internal Consistency and Convergent Validity Test**

	CR	AVE	MSV	MaxR(H)	MA	R	RISK	SC	LA	IID
<b>MA</b>	0.813	0.592	0.176	0.818	<b>0.770</b>					
<b>R</b>	0.834	0.557	0.232	0.837	0.419	<b>0.746</b>				
<b>RISK</b>	0.837	0.565	0.228	0.854	0.348	0.225	<b>0.752</b>			
<b>SC</b>	0.837	0.565	0.142	0.856	0.357	0.377	0.171	<b>0.752</b>		
<b>LA</b>	0.853	0.592	0.232	0.858	0.370	0.482	0.175	0.182	<b>0.769</b>	
<b>IID</b>	0.894	0.627	0.228	0.894	0.214	0.240	0.478	0.363	0.269	<b>0.792</b>

Source: Author's Compilation

### **4.3 Common Method Bias**

The Common Method Bias (CMB) issue mostly arises when research utilizing cross-sectional data exerts an impact on the conclusions (Podsakoff and Organ, 1986). Therefore, this study employed a cross-sectional approach to examine the CMB. To do this, the statistical software SPSS was utilized to perform Harman's one-factor test with the "Principal Component Analysis" extraction method. Based on the data, it is seen that seven variables possess multiple eigenvalues. Among these variables, the first component accounts for 27.466% of the total explained variance, which is less than 50%. As a result, additional analysis may be performed on the data without any Common Method Bias.

## **5. Finding and discussion**

### **5.1. Measurement Model**

SEM was utilized in this investigation. SEM consists of two models: a structural model is employed to examine the hypotheses, while a measurement model is utilized to evaluate the adequacy of observable elements on its underlying variable. Firstly, we evaluate the model's fitness. The measurement model is assessed using many indicators, such as the goodness of fit and badness of fit. In this research, model fitness measures through  $CMIN/df = 1.61$ , that lies in between 1-3 prescribed limit (Schumacker & Lomax, 2004) shown in Table -3, which confines model fitness. Other indicators are goodness-of-fit (GFI) = 0.898, "Comparative fit index (CFI)=0.953", "NFI=0.887", "Tucker- Lewis's index (TLI) =0.946" all values are under prescribed limit by (Tabachnick et al., 2007), whereas "Root means square error of approximation (RMSEA)= 0.047" comes within the range prescribed by (Steiger, 2000).

The second-order prospect biases are employed in this research. The second-order measurement model utilizes two levels of underlying factors and can only be used after the theory has been confirmed (Hair Jr. et al., 2014). A "second-order measurement" model is a statistical strategy to validate first-order model whether they load onto the principal construct and convergent validity was analysis by same criteria. Results shows five first order factor scoring are from 0.532-0.796, , the composite reliability (CR)=0.81, and the second-order construct "Average Variance extracted (AVE)=0.56 calculated by the formula given (MacKenzie et al., 2011), which exceeding the threshold value of 0.5 (Fornell & Larcker, 1981)".



**Table 3: CFA Model of Fit**

“Goodness of fitness indices”	“CMIN/D F”	“GFI”	“CFI”	“NFI”	“TLI”	“RMSEA”
Measurement model of first-order	<b>1.61</b>	<b>.898</b>	<b>.953</b>	<b>.887</b>	<b>.946</b>	<b>.047</b>
Measurement model of second-order	<b>2.245</b>	<b>.937</b>	<b>.956</b>	<b>.923</b>	<b>.948</b>	<b>.051</b>
Measurement model of path	<b>1.679</b>	<b>.893</b>	<b>.947</b>	<b>.879</b>	<b>.940</b>	<b>.049</b>
Acceptable range	<b>1-3</b>	<b>&gt;.80</b>	<b>&gt;.90</b>	<b>&gt;.80</b>	<b>&gt;.80</b>	<b>&lt;.08</b>
	<b>Acceptable</b>	<b>Acceptable</b>	<b>Acceptable</b>	<b>Acceptable</b>	<b>Acceptable</b>	<b>Acceptable</b>

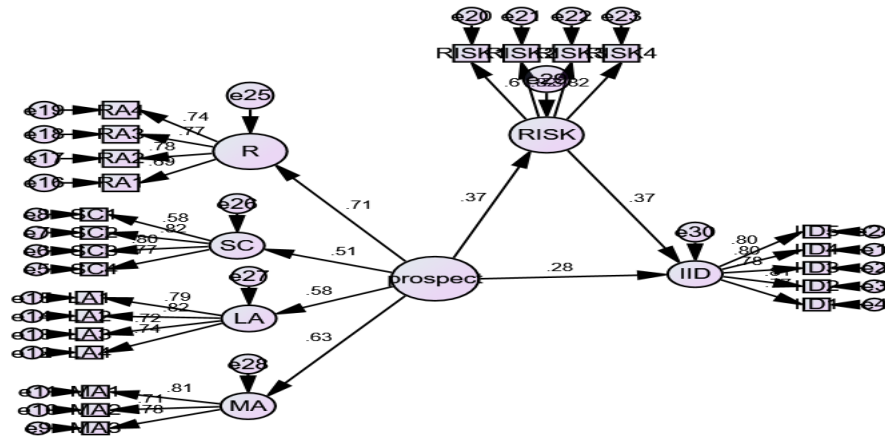
**Source:** Author’s Compilation

## 5.2. Testing of Hypothesis

The covariance-based structural equation model (SEM) of this research is presented in Figure-1 and also indicates the direct and indirect relationship between the variables undertaken for this study. The results indicate that the IIR of individual investors is significantly positively associated with second-order prospect biases with  $\beta=0.28$ , ( $p<0.05$ ); and risk perception with  $\beta =0.37$ , ( $p<0.05$ ). Risk perception also significantly positively affected by IID with  $\beta =0.37$ , ( $p <0.05$ ). This means that investors are risk seekers when they face loss, and are risk-averse when they face gains in result affect their portfolios. Therefore, it’s necessary to analyse all available information before making decisions. Therefore, hypotheses H01, H02, and H03 are supported by analysis shown in Table- 4.

The indirect effect of prospect theory-driven biases on investment decisions also remains significantly positively associated. Table 5 shows the indirect relationship between the prospect-driven biases and investment decisions in the presence of mediation risk perception and fulfilled all three conditions of mediation. The bootstrap method at 95% confidence interval with 10000 bootstraps was used to check the mediation effect suggested by (Preacher et al., 2008). The direct path of prospect-driven biases  $\beta= 0.345$ , ( $p<0.05$ ) was significantly positively associated with investment decision. The indirect effect of mediator risk perception on the relationship between prospect biases and investment decision is significantly positively associated with  $\beta= 0.146$ , ( $p<0.05$ ). The total effect is (0.491) divided into indirect (0.146) and direct (0.345). Results show that risk perception partially mediates the relationship of prospect biases and investment decision with Variance accounted for (VAF) 29.73%. Hence, hypothesis H4 is supported by analysis.

Figure 2: “Standardized Direct, Indirect, and Total Effects”



Source: Author’s Compilation

Table 4: Hypothesis Testing

H0	“Endogenous Constructs”	“Exogenous Constructs”	Estimation	SE	CR	Results
	Risk aversion	prospect	.712	.251	5.168**	
	Self Control		.514			
	Loss aversion		.585	.214	4.980**	
	Mental accounting		.629	.241	5.109**	
H1	Irrational Investment decisions		.281			Supported
H2	Risk perception		.373	.159	3.769**	Supported
H3	Irrational Investment decisions	risk	.374	.104	4.850**	Supported

“Notes: \*\* Significant at 1%”

Source: Author’s Compilation

**Table 5: Effect of Mediator**

“Type of effect”	“Standardised Path Coefficient”	“P Value “	“Conclusion”
Total Effect	0.491	0.011	Significantly positive affect
Indirect Effect	0.146	0.011	Significantly positive affect
Direct effect	0.345	0.001	Significantly positive affect
VAF by risk perception	0.146/0.491 = 29.73%		Weak partial mediation affect

Source: Author’s Compilation

### 5.3 Moderation effect

An investigation was carried out using AMOSS 22 to examine how robo-advising moderates prospect biases and irrational investing decisions. The presence of interaction effects might cause distortions in the results as a result of problems with model convergence (Zainudin, 2014). Consequently, the data was split into two groups for the researchers to conduct a multi-group CFA. Category 1 consists of those who utilize "robo advisory services," whereas category 2 comprises individuals who do not utilize such services. The data was divided into according to these groups and processed individually, with further moderation checks. A total of 91 investors utilized robo advice services, while 187 investors did not use robo advisory services. The reason for doing bootstrapping with 10,000 samples is due to the disparity in numbers. Firstly, the data was assessed for multicollinearity by examining the Variance Inflation Factor (VIF) values, which should be greater than 1, and the tolerance value, which should be less than 0.1, in order to mitigate the presence of multicollinearity among the constructs. Therefore, hypothesis H5 suggests that robo advice has a moderating effect on the connection.

## 6. Results and Discussion

The present study analyses how individual investors take their investment decision as suggested by traditional finance or as suggested by behavioural economics. For that prospect theory biases, the model of behavioural economics given by Daniel Kahneman and Amos Tversky (Brooks et al., n.d.) was studied through this research to identify how the decision of individual investors is influenced by these biases and ends up with irrational investment decision-making. The study also tried to find out risk perception of investors and how it helps to escape from these biases and whether the users of robo advisory services and non-user robo advisory services investors' decision

making are different. Survey method was used through a structured questionnaire to achieve the objectives of this research. The empirical results supported that prospect theory biases influence individual investment decision. We are more emotionally affected by loss than by equal gains. Therefore, we'll probably want to prevent a loss rather than pursue a gain. This is accurate even if the outcomes of our alternatives are the same. To avoid making bad decisions, the investor must have a deeper understanding of these biases and determine if they affect them or not. Investors who establish and adhere to advanced investing choice guidelines can reduce the likelihood of being susceptible to prospect biases. The results are supportive of the earlier studies ((Waweru et al., 2008); (Goo et al., 2010); (Chen et al., 2007); (Khan, 2020) (Zahera & Bansal, 2019); (Sashikala & Chitramani, 2018) that also provide evidence for prospect Theory providing how seemingly odd or nonsensical decisions humans might make. As a result, we also agree with this point of view since market conditions are unpredictable and people make decisions based in large part on their need to avoid losing money. But, individuals might steer clear of making bad financial choices if they had a better understanding of these biases. Investors must realize that just because something has worked in the past, it won't always work in the future.

## **7. Conclusion**

The study proves that investors decide based on their emotions, when given two equal options, an investor will select the option with the higher prospective reward. According to the prospect hypothesis, investors consider perceived profits more highly than perceived losses when determining how much to gain or lose that end up in irrational decisions. The study's conclusions exhort individual investors to recognize and comprehend their prejudices and emotions. It will assist in raising investor knowledge to determine their financial capability after weighing all of their options. Furthermore, it assists other financial professionals, such as financial and investment advisers, in recognizing and analyzing the psychology of their own investments and in evaluating the actions of their clients. Policymakers and regulators that oversee the stock market can benefit from this study's understanding of the process and significance of behavioural factors in investors' decision-making. Furthermore, it offers fresh insights to the current conversation about the behaviour of investors when making investments, giving both academic and non-academic scholars excellent new directions for future research. While prospect theory-driven biases were the focus of our study, future research may look at biases related to herding, confirmation, familiarity, and other factors that influence investing decision-making. Furthermore, this model may also be examined with other moderator or mediator variables such as locus of control and financial literacy. As a result, additional study in this field is possible, and the results of these investigations

will shed further light on the psychology of investor decision-making. Only individual investors were included in this investigation. Therefore, in order to determine if institutional investors and other market participants are likewise impacted by similar biases, the same study may be conducted.

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