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Mind and Money: The Impact of Cognitive Biases on Investor's Decision-Making

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ABSTRACT

Logic and rationality are two terms that often clash in the investor's mind at the time of making decisions and multiple studies including the "Prospect Theory" ("Kahneman and Tversky", 1979, 1982) explain this conflict of the human mind. Through this study, the researchers have attempted to explore the impact of three cognitive biases, namely, availability, hindsight, and anchoring, on the investor's decision-making process.It's a cross-sectional descriptive study conducted among a sample of 137 investors chosen from different demographic profiles including gender, age, and income. The three cognitive biases (availability bias, hindsight bias, and anchoring bias) were chosen as the independent variables, and the investor's decision-making (measured through two sub-constructs namely tenure and risk diversification) is the dependent variable. The questions were generated using Pompian's study (2011) on biases and the data was collected from the respondents using Google Forms. The Structural Equation Modeling using SPSS Version 20 was used for analyzing the data.The findings of our study state that while availability bias and hindsight bias have a significant positive impact on an investor's decision-making, the same doesn't hold true about the anchoring bias. Anchoring bias is measured to have a positive but mostly insignificant impact on an investor's decision-making. Hence, this study too adds to the vast literature of studies on cognitive biases and holds it can mold the investor's decision-making choices and hence, can provide guidance to the policymakers during policy decision-making. The findings can also serve as eye-openers to the various capital market investor about the various invisible factors that can divert their logical.

Keywords: Cognitive Biases, Availability Bias, Hindsight Bias, Anchoring Bias, Investments, Decision-making

JEL Code: G40, G41, G51, G53

1. INTRODUCTION

The intertwining of biases and perspectives in sensible financial decision-making has always been an area of immense interest to the world of finance. Although finance always looks for logic, scientific proofs, and numbers to validate facts, it's an undisputed fact that not all financial decisions made by investors are guided by logic and facts. That is the beauty and depth of behavioral finance as a subject. While traditional finance always assumes that investors are always rational and make decisions based on facts, real-world observations reveal something contrary. Behavioral finance, as a field of study, explores these influences of the psychological factors in the financial markets and investor's investment choices (Kahneman &Tversky, 1979).

Behavioral finance found its roots in the limitations of the "Efficient Market Hypotheses (EMH)", which stresses the rationality of the investors. Studies that evolved after the EMH theory suggests that the investors are not rational and their decisions regarding investment are also the result of their whims and fancies in a majority of the cases (Thaler, 1980 and Shiller, 2003). Behavioral finance classifies these whims and fancies under the heads of

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various behavioral biases. This study is aimed at examining the role of three such Cognitive Biases (Availability Bias, Hindsight Bias, and Anchoring Bias) on the investors' decision-making.

Several factors affect the investor's decision-making process such as economic indicators, risk assessment/tolerance, financial performances of the financial instruments, etc (ChuanMeng and Kaiyrbayeva, 2024). The various multi-criteria analysis methods considermultiple factors simultaneously for better decision-making (Puška, A. et.al., 2017). For instance, factors such as gender, age, and their past investment experiences can also impact investor preferences (Davar& Gill, 2007), whereas, cognitive biases, asymmetric information, and other external factors including regulatory changes can significantly affect investment outcomes (Haidari, 2023). In addition to these general factors, such decisions are also influenced by cognitive biases, which question the rationality of investors while making the financial decisions. The impact of such biases on investment decisionsdisplays the influence of asymmetric information in decision-making processes, thereby challenging traditional models like CAPM (Šević, A., &Marinković, S. (2020). The understanding of these factors hence, is crucial in making informed investment decisions (Shanmugasundaram, V., &Balakrishnan, V., 2010).

Behavioral determinants, such as heuristics, cognitions, emotions, and herding can significantly impact one's investment choices (Ahmed and Noreen, 2021). The impact of cognition on human minds is critically significant. "Cognitive biases are unconscious and systematic errors in thinking that occur when people process and interpret information in their surroundings and influence their decisions and judgments" ("Kahneman et al., 1982"). This often leads to processing of information in a limited way. Cognitive biases can significantly influence the investor's rational and logical decision-making. Availability bias is that category of cognitive biases, where investors tend to rely on recent examples and easily available information while making investment decisions. This bias, which was first time described by Kahneman and Tversky (1973), interprets how perceptions can be skewed by the recency, vividness, and salience of information, thereby leading to judgemental errors.Whereas, confirmation and anchoring bias results from cognitive shortcuts, used to simplify complex information processing (Friedman, 2017; Mohan & Jain, 2008). Hindsight bias, on the other hand, is "the tendency to overestimate the predictability of future events", once their outcomes are known (Roese &Vohs, 2012). This study investigates three such cognitive biases namely availability, hindsight, and anchoring, and explores the direction and extent to which such biases can influence the investor's decisions. The study is carried out with a sample of 137 investors from different demographic domains across Bengaluru.

2. THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

This section investigates and runs through the relevant literature to examine the various constructs (Availability Bias, Hindsight Bias, Anchoring Bias, and Investment Decision-Making), and their relationship that are being explored in this study. The relevant hypotheses are drawn based on the previous literatures.

Availability Bias, Hindsight Bias, and Anchoring Bias on Investment related Decision-Making

The investment decision-making of investors is a complex process that is influenced by multiple factors such as investor biases, risk tolerance, and the time frame of investments. Among these, cognitive biases play a crucial role in deciding the direction of investor's financial decisions. Biases such as overconfidence, anchoring, availability, etc., can lead investors to make sub-optimal choices for investments. Noch (2024), explains how cognitive biases such as Overconfidence Bias can severely distort the investor's trading behavior and decision-making. Other cognitive biases like Anchoring affect the investor's perception of stock values and make them depend heavily on the historical cost aspects while investing in stocks (Elhussein and Abdelgadir, 2020). Further, Rahmawati (2023), explores how availability bias can skew the investor's rationale and motivate them to make the investment choices based onmost recently available information.

Availability Bias is a key cognitive bias, which can influence investors irrespective of their age, gender, or other demographic factors. It highlights how the recent and easily available pieces of information can significantly influence the investor's decision-making process (Kahneman and Tversky, 1973). A very popular instance of availability bias influencing the rationality of investors could be seen during the "2008 Global Financial Crisis", when a vast majority of the investors adopted a conservative strategy towards their investments, fearing the re-occurrence of a similar crisis in the upcoming years (Barberis, 2013). Sudirman (2023), highlights that availability

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bias clubbed with overconfidence bias could indirectly shape the risk tolerance of investors, thereby influencing their investment decisions. The most easily available decisions, hence, have greater implications on the investment choices of individuals (Wang, 2023) and the effect of availability heuristics is such that it not only affects investment decisions but can also influence the collective judgments of individuals in areas such as medical diagnoses as well (Douglas and Miller, 2015). Based on the above discussions, the following hypothesis is formulated:

H1: Availability Bias can have a significant positive impact on the investors' decision-making

Hindsight Bias is yet another cognitive bias, which seems to have significant impact on the investor's process of decision-making. This bias is characterized by the behavior of the investors who believe they can predict outcomes of certain decisions based on past events. This bias often leads to overconfidence in investors and can distort their memory in a way thatcan indulge their decision-making abilities (Roese and Vohs, 2012). Another interesting aspect of this bias is that it displays a significant difference in the manner it emulates in investors of different age groups. Studies prove that hindsight bias manifests quite differently among youngsters and people of old age, hence leading to significant differences in their cognitive processing abilities too. There is also a significant interplay between the emotional state of an individual and the hindsight bias, proving why a negative mood can amplify the hindsight bias of individuals while making decisions (Groß and Bayen, 2016). Based on the above discussions, the following hypothesis can be formulated:

H2: Hindsight Bias can have a significant positive impact on the investment related decisions of investors.

Anchoring is the category of pervasive cognitive bias, in which an individual tends to heavily rely on the "first piece of information encountered," creating an anchor based on which the financial decisions are made (Wang, 2023). This bias can have a significant impact on an individual's financial decision-making capabilities and his/her numerical estimation skills (Lieder et.al, 2018). Like the other categories of cognitive biases, this is also a category of bias which can impact investors of all age, gender, class and category in different levels (Yasseri and Reher, 2019). This bias although can give to positive outcomes by chance, but are largely considered harmful during decision-making and especially when the decisions are related to military intelligence gathering (Wickens et.al, 2010). Anchoring bias also operates with its own set of limits. For instance, the anchors of extreme time-frames have limited influence on the decision-maker and those anchors which have incompatible features have almost zero influence on the decision maker (Chapman and Johnson, 1994). Yet this bias often leads the investor to look for features which are similar to the ones exhibited by biases while making investment decisions and visibly ignoring those features which do not match with the anchor's features (Chapman and Johnson, 1999). The knowledge of the facts and figures and the awareness of existence of such bias in oneself can make an individual aware and help them get over such it (Wang, 2023). Based on the above discussions the third and the last hypothesis for this study is formulated as below:

H3:Anchoring Bias can have a significant positive impact on the investment decisions of investors.

The conceptual framework is shown in the figure 1 below:

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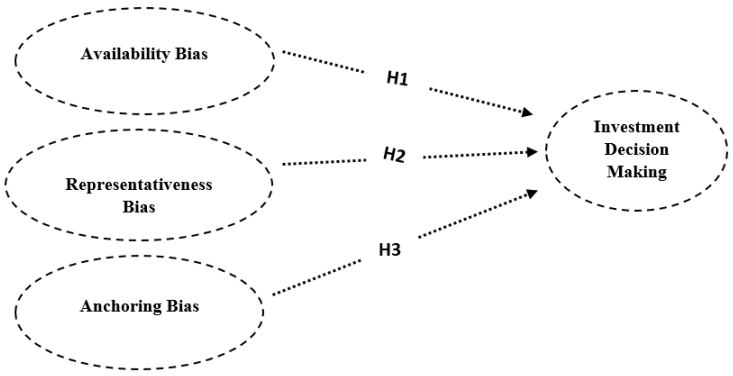

Figure 1: The Conceptual Model

Source: The Authors

3. METHODS

The study was conducted with a sample of 137 capital market investors from across Bengaluru belonging to different gender, age and income groups. It's a cross-sectional study where google forms were used to collect data from the investors. The respondents were contacted via e-mail and subsequent follow ups over calls. The questions for measuring the three cognitive biases used in the study were extracted from the questionnaire for bias developed by Pompian, M. M. (2011).A total of five different items were used to measure each category of bias and their impact on investor's decision-making.

3.1. Design of study

The study used a combination of descriptive and analytical research. The previously done works including research articles, caselets and books on behavioural biases are used to identify the investment patters and and trends (Merchán-Hamann, E., &Tauil, P. L. (2021). Analytical study is used by employing previously validated research questions to understand the influence of biases on the investor's investment patterns (Cardwell, J. M., 2008).

4. ANALYSIS

4.1. Reliability

The reliability analysis by Cronbach's α was measured. The result indicated that the variables were within the normal threshold limit. The availability bias=0.765, which indicates 76.5% consistency in the responses. Likewise, Hindsight Bias=0.794, indicated 79.4% consistency, and Anchoring Bias=0.771, indicates 77.1% consistency. Further, under the dependent variable, investment decision-making indicated 70.1% consistency with the Cronbach's α value of 0.701 (See Table 1)

Table 1
Showing reliability analysis for

Independent variable	**Items**	**Cronbach's Alpha Value**
Availability Bias	5	0.765
Hindsight Bias	4	0.794
Anchoring Bias	5	0.771
Dependent variable		**Cronbach's Alpha Value**

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Investment Decision Making	7	0.701
Source: Primary Data (created by authors)		

5.1. Measurement model

5.1.1. Biases

Biases are the illusions and cognitions of human minds that can affect their decision-making power in any field and they often lead to sub-optimal and illogical decision-making (White, R., 2013). Different types of biases are exhibited by human brains such as action bias, overconfidence, framing effects, and fallacies (Rehak, L. A. et.al., 2010). Based on the pattern in which such biases impact decision-making, such biases can be categorized into various heads, and investment biases are categorized as cognitive, heuristics, and emotional biases. Cognitive biases could lead to errors during financial decision-making (Wright, W. F., 1980) and researchers over and over again have suggested developing heuristics for value investing, which could aid in better decision-making. The awareness of biases and their interplay with the decision-making process during investments is crucial to avoid such biases interrupting the logical decision-making of investors (Hicks, E. P., &Kluemper, G. T., 2011). In this study, the three major cognitive biases, namely, availability, hindsight, and anchoring are chosen and the impacts of these biases on the investor's decision-making process are further investigated.

5.1.1.a. Model fit for the Independent variables and dependent variables

The measurement model is also called "Confirmatory Factor Analysis". In the first step, the goodness of fit model was measured for the Independent Variable (Availability Bias, Hindsight Bias, and Anchoring Bias) and Dependent Variable (Investment Decision-Making). The independent variables indicated good fit, (CMIN/DF = 2.79, GFI= 0.981, NFI= 0.956, CFI= 0.989, RMSEA= 0.030 and p-value<0.001). Further for the dependent variable, the goodness of fit measure indicated a good fit model with the indices as CMIN/DF= 0.737, GFI= 0.996, NFI= 0.992, CFI= 0.979, RMSEA= 0.010, and p-value<0.001. These indicators were undertaken based on Lenkaet.al., 2009. A total of 6 iterations were followed, wherein, 5 items were deleted with one modification indices (Refer Table 2).

Table 2

Showing fit indices of goodness of fit

Indicators of the goodness of fit indices *	**Model Statistics**	
	Independent variables (Availability Bias, Hindsight Bias, and Anchoring Bias)	**Dependent variable (Investment Decision-Making)**
CMIN/DF	2.79	0.737
GFI	0.981	0.996
NFI	0.956	0.992
CFI	0.989	0.979
RMSEA	0.030	0.010
p-value	0.000	0.000
	Decision on model: Good	Decision on model: Good fit

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	fit	

Note:

a) * Indicators of goodness of fit indices were taken according to (Lenka, Suar, D &Mohapatra, 2009)

b) A total of 6 iterations were followed (5 item deletion and 1 modification indices)

Source: Primary data (created by authors)

5.1.1.b. Standardized Estimate

Further, the estimates were analyzed along with convergent and discriminant validity. The standardized estimates were found to be in the range of 0.443 as minimum and 0.850 as maximum and all were found to be significant at 99% confidence level.

5.1.1.c. Convergent and Discriminant Validity

Further, the convergent and discriminant validity were measured. AVE indicated a minimum of 0.35 for Hindsight Bias and a maximum for Anchoring Bias at 0.44. In addition, for Availability Bias, the construct reliability was 0.69, Hindsight Bias= 0.60, and Anchoring Bias= 0.85. It indicates that convergent validity exists ("Hair et.al., 2006").

Further, the discriminant validity was analyzedbased ona comparison provided by "Fornell and Larcker, 1981; Hair et.al, 2006", which indicates that AVE must be greater than squared inter-construct correlation. In this analysis, the AVE was found to be greater than the squared inter-construct correlation in all the cases.

The squared inter-construct correlation was calculated by squaring the values of the correlation achieved from Spearman's Correlation Method (Refer to Table 3)

Table 3
Path Directions of the Latent Variables and its indicators

Path of Latent Variables to Observed Variables			**Standardised Estimates**	***P*-Value**	**Convergent Validity**		**Discriminant Validity**				
					AVE	**CR**	**Constructs**	**AB**	**RB**	**AN**	**Decision on discriminant validity**
AB3	←	F1	.555	---	0.44	0.69	**AB**	**1**	0.135***	0.018***	
AB4	←	F1	.608	***							
AB5	←	F1	.790	***					SICCR	SICCR	
RB1	←	F2	.754	---						0.029*	

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					0.35	0.60	**RB**	0.368**	**1**	*	
RB2	←	F2	.529	***						SICCR	
RB3	←	F2	.443	***							
AN3	←	F3	.759	---	0.65	0.85	**AN**	0.136**	0.172**	**1**	
AN4	←	F3	.807	***							
AN5	←	F3	.850	***							

Source: Primary Data (created by authors)
Notes:
a) SICCR: Squared Inter-Construct Correlation
b) ** Correlation is significant at 0.01 level (2 tailed)

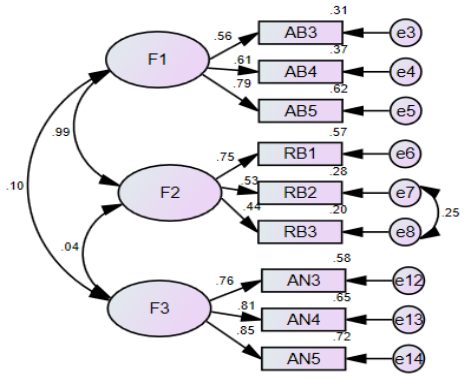

Figure -2: Showing CFA of Investment Biases Variables

Source: Primary data (created by authors)

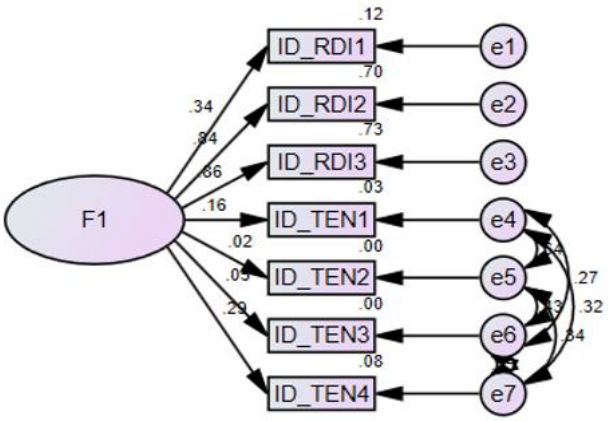

Figure -3: Showing CFA of Investment Decision-making Variables

Source: Primary data (created by authors)

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6. RESULTS OF STRUCTURAL MODEL

In the measurement of causal relationship of investment biases and investment decision-making, the first step followed was the measurement of structural model. The structural model indicated a good fit with two iterations of modification indices with no item deletion. The model statistics indicated good fit as CMIN/DF=2.57, GFI= 0.905, NFI= 0.935, CFI= 0.957, RMSEA= 0.046, and p-value<0.001.

Further, the results of SEM in the measurement of the causal relationship between investment bias and investment decision-making indicated that Availability Bias explained a variance of 26.7% (β= 0.267, p=0.000), hence, H1 is supported. Further, the Hindsight Bias explained a variance of 25.6% (β=0.256, p=0.000), hence H2 is supported. The Anchoring Bias indicated an 18.5% variance in investment decisions (β=0.185, p=0.020), hence H3 is also supported.

Table 4
Fit Indices of Structural model

Fit Indices Indicators	**Goodness of fit Statistics for Structural model**
	Model Statistics
CMIN/DF	2.57
GFI	0.905
NFI	0.935
CFI	0.957
RMSEA	0.046
P-Value	0.000

Source: Primary Data (created by authors)
Note: In structural model 2 iteration followed in terms of modification indices with no item deletion

Table 5
Results of Causal relationship

Hypotheses	**Path analytic model**	**Standardised estimate**	***P*-Value**	**Hypothesis decision**
H1	Availability Bias→ Investment Bias	0.267	0.000	Supported
H2	Representativeness Bias → Investment Bias	0.256	0.000	Supported
H3	Anchoring Bias→ Investment Bias	0.185	0.020	Supported

Source: Primary Data`(created by authors)

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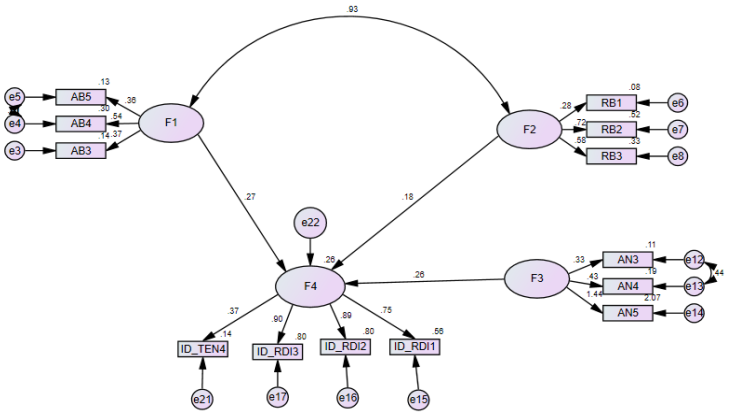

Figure -4: Showing causal relationship of Investment bias with Investment Bias

Source: Primary data (created by authors)

7. DISCUSSION AND IMPLICATIONS

In this study, the researcher examines the relationship between three major cognitive biases on the decision-making of investors. The study which explores the causal relationship of availability bias, hindsight bias, and anchoring bias on the investor's decision making validates the findings by employing SEM using SPSS 20 version. The results of the SEM in the measurement of the model support the first alternative hypothesis (H1), proving that availability bias has a "significant positive impact" on investor's decision-making with β=0.267 and p=0.000. It also indicates the strength or the effect size of the relationship between the variables, which is found to be moderate, yet meaningful. The testing of the second alternate hypothesis (H2) states that hindsight bias also holds a "significant positive impact" on investor's decision-making with β=0.256 and p=0.000. The beta value in the case of H2 also suggests that the relationship is moderately meaningful and not overwhelmingly strong. The testing of the third hypothesis (H3) states that compared to the previous two biases, the impact of the third cognitive bias, named, anchoring is relatively smaller on the investor's decision-making but yet positive and significant with β=0.185 and p=0.000. This study will have an impact on the decision-making of investors with a better understanding of the role biases could have in guiding the investment choices of individuals. The findings of the previous literature largely state that anchoring bias is one of the major biases commonly found among investors and it has a significant positive impact on the decision-making of investors ((Raja Rehan& Imran Umer, 2017; G. Madaan&Sanjeet Singh, 2019; Iva Kurnia Sari Iva et al., 2024; E. Laryea& Sally Peaches Owusu, 2022; K. Kartini&KatiyaNahda, 2021), which is slightly contradicted by the findings of this study. It can open the forum for further discussions and analysis of the key biases impacting an individual's investment choices, guiding the policymakers in framing efficient and impactful investment guidelines.

8. CONCLUSION

This study aims at understanding the impact of human cognitions on the decision-making of investors. Three key cognitive biases namely availability, hindsight, and anchoring were identified for the study, and the causal relationship between these biases and an investor's decision-making was examined. The Structural Equation Modeling was employed using SPSS Version 20 for testing the model which was developed based on the causal relationship between the three biases and the investment decision-making of investors. The results of the testing indicated a significant positive relationship between availability bias and decision-making and between hindsight bias and decision-making. However, the impact of anchoring bias on investors' decision-making was found to be positive but not overwhelmingly strong.

9. LIMITATIONS AND FUTURE RESEARCH

The key assumption of this study is that availability, hindsight, and anchoring bias might have a significant positive relationship with an investor's decision-making. The key limitation of the study is the presence of multiple other biases, whose impact on investment decision-making is not investigated through this. Also, the study is conducted

among a selected group of individuals from Bengaluru. The results might be inconsistent and vary if the sample is replaced or the tests are repeated with different respondents. Further, there are factors other than biases that can also influence the investment decision of individuals and the introduction of such factors as control variables might yield a different result for this kind of study. Hence, there is ample scope for future research on different parameters in this area by accommodating these unidentified or unexplored variables.

Declaration for Conflict of interest

The authors of the article, hereby, certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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