

# IRRATIONAL BEHAVIOR OF INDIVIDUAL HOUSEHOLD INVESTORS: DOES THE COGNITIVE BIASES INFLUENCE THE INVESTMENT DECISION?

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**Abstract:** *All investors thrive to make their investments safe and vies to make their investments productive so the process making these investments decision needs to be future oriented. The fear of uncertainty and the risk factors influence the investment decisions of the investors and sometimes cognitive bias of the investors which is in turn reflected in the return, market value and risks. The cognitive biases namely overconfidence, ambiguity aversion, mental accounting, confirmation bias, regency and framing bias are the most dominating factors in the process of decision-making. This paper attempts to examine the influence of cognitive biases in making their investments. The authors analyzed 392 individual investors from the households of Tamil Nadu from various cities. The collected data is analyzed by applying proper statistical tools and AMOS available in the SPSS package. It is evident from the study that the sampled households exhibit irrational behavior considering the investment and even while making investment decision. The cluster analysis proved that high numbers of investors are negatively influenced by cognitive bias while taking investment decisions.*

**Keywords:** *Irrational Behavior, Household Investment, Cognitive Bias, Investment Decision*

## INTRODUCTION

In an ever-changing market environment, decision-making does not come with a manual for the investors who wants to make efficient investments. For making productive investments, the investors spend more time searching the information but decision making in terms of the investment is not very effective and has many reasons associated to them to be so.

Irrational behavior is one among the factors which induce the investors to take decisions in an irrational way because investors are not ready to spend much time on collecting the market information otherwise they interpret the collected information on one aspect but failed to analyze the alternative aspect of the same information. The human behavior is purely bound by their cognitive ability . Many authors consider the biases namely overconfidence, self-attribution, illusion control, conservatism, ambiguity aversion, mental accounting, conformation, hindsight, recency, cognitive dissonance and framing. According to Osachoff (2016), cognitive bias is a systematic deviation from the

rationality in judgment, whereby the human-drawn assumption in an illogical manner. It is a basic statistical information processing or remembrance errors, which is common to all humans. The researcher presented the major selected cognitive biases, which are used to the present study for the analysis purpose. Overconfidence is an overestimation of the confidence level in the accuracy of judgments. When the investors are overconfident on their personal ability or skills to predict the uncertainty, they make mistakes by taking decision or judgments without knowing the real situation. According to Grinblatt & Keloharju (2009) when the investors put too much confidence in their abilities and beliefs based on irrationality it evolved two different interpretations such as "better than average effect" and "miscalibration". It arises when the confidence interval around the investor's personal signals is stronger than the reality. It leads the people to give too much weight for private signals. Self-attribution bias is a process, which helps to determine the behavior's antecedents and consequences. When the investors have the self-attribution bias, they attribute the internal causes (skills) to their success or positive outcomes but they blame the external causes (bad) to their negative outcome. According to Pompian (2006), the self-enhancing bias is a cognitive bias, which explains the human inclination to claim an irrational degree of credit for their success, but the self-protecting bias is an emotional bias, which symbolizes the corollary effects, and they irrationally reject their responsibility for their failures. Ambiguity aversion bias is a preference given to the known factor than the unknown factor to avoid the future uncertainties. When the investors have ambiguity aversion bias, they prefer or make investment only on well-known market investment than the unknown risk associated investments to avoid the losses in their investments. According to Pompian (2006) when the investor feels that they have skill or knowledge, they believe that they will prefer to stake claims on ambiguous events and those outcomes can be predicted based on their own judgment rather than the known odds. Otherwise, if they feel that they do not have skills or knowledge then they will prefer to gamble on chance events this is called as competence effect. The mental accounting bias is a psychological allocation of options or objects based on the subject criteria. When the investors have mental accounting

bias, they tend to separate their money into various accounts based on the logical future requirements without considering their current requirements. According to Thaler, Tversky, Kahneman, & Schwartz (May 1997) it is a mind based activity in which people are engaged in the same and regular activities. The mental accounting determines the decision of framing and outcomes. People, who frame narrow decisions, tend to make the choices on a short-term basis and not adopt long-term policies. A person, who frames narrowly the past outcomes, will examine the gains and losses frequently. The confirmation bias is a way to search, interpret and recall the information and confirm their beliefs or assumptions, which already exists in their mind. When the investor has confirmation bias, they search or recall the information and confirm it with the market information to make investment decision. According to Jones and Sugden (2001) the confirmation bias is a predisposition in which individuals weigh the disconfirming evidence while interpreting vague information. Usually, individuals search the evidence, which supports their existing belief than the disconfirming evidence. Cognitive dissonance bias is a situation in which people have conflicts with their attitude and such attitudes produce mental discomfort or dissonance so they alter their attitude or behavior to reduce their discomfort. In the market, when the investor suffers losses on investment due to ups and downs in the market the investor feels fear. In order to avoid the fear of loss of investment, they may be selling the investment to avoid the losses. According to Pompian (2006), it is a mental conflict, which happens only when people experience with newly acquired information conflicting with the existing understandings. In psychology, the cognition represents the attitude, emotions, beliefs or values. The term cognitive dissonance represents a state of imbalance, which is occurring when the conflicting cognitions cross. Framing bias is a situation in which the brain makes decisions according to the information presented to them. When the positive frame is presented, people become risk takers but in the negative frame, people become risk averter. When the market information is positive to the investors, they take investment decisions even it has more risks but when the information is not in favor of them they do not take the risk even though the asset produced better return. According to Tversky and Kahneman (January 1981) people react differently to particular choices based on the way of the choice existing to them. People avoid taking risk at the time of the positive frame and seek risk at the time of the negative frame is presented. The framing bias cannot be avoided in the real life.

According to Osachoff (2016), cognitive bias is a systematic deviation from the rationality in judgment, whereby the human-drawn assumption in an illogical

manner. It is a basic statistical information processing or remembrance errors, which is common to all humans. Many studies have proved that the investors behave irrationally towards the investment decision and the markets showed inefficiently. The study of Ozcan and Overby (2008) assessed the impact of US Mlti-frim Alliance announcement and stock market reaction. The study showed that the size of the firm and coverage of analyst have moderate relationship between the firm's diversity and its abnormal return. The study proved that attention, selection and subsequent changes in the announcement have produced the cognitive biases. Hence, the managers should take care of the information processing and disclose the information to the investors in the market. In the year 2012, Subash examined the influence of behavioral biases such as overconfidence, representativeness, anchoring, cognitive dissonance, regret aversion, gamblers' fallacy, mental accounting and hindsight on the decision. The study found that out of the total 93 respondents, 53 investors had suffered with the loss of 30% on investment due to behavioral biases. The young and experienced investors heavily suffered with these biases and the younger investors form the behavioral pattern of investments in the market. The gamblers' fallacy, anchoring and hindsight biases significantly affected the investment decision of the young investors than the experienced investors in the Indian stock market. Purohit, Satija and Saxena (2014) made an attempt to understand the behavior of individual investors in the Indian stock market. The study found that the investors who have educational background are ready to invest their money in the stock market. Hence, the literacy levels of the investors play a vital in the stock market investment. Based on the market movements, investors make subsequent changes in the investment even though they make investment decision in a rational manner. Therefore, investor combines their behavioral and cognitive biases while making investment decisions. Kulkarni (2015) examined emotions, cognitive errors and heuristics factors affecting the investment decisions. The study found that investor makes judgments based on approximation thumb rule, feelings and emotions which are major factors affecting the investment decision of the Indian investors regard to capital market. If the investors are in a good mood they will be more optimistic in evaluating investment. The study concluded that behavioral finance is an alternative solution to the difficulties faced by the investors in the market. Kungu (2016) assessed the effect of cognitive biases on investment decision. It found that the investment decision of the investor is not rational and it influenced by the behavioral factors. The anchoring bias affect the investment decision of investors, investors trade in NSE market because they took investment decisions based on the past performance of the respective stocks,

further they are affected by excessive optimism bias because they use their own predicative skills to pick up the outperforming stocks in the market. Finally, the investors decision is also affected by the mental accounting bias because before investing in the NSE market, investor treats their investment portfolio separately and acquires market information based on the portfolio. Seppala (2009) examined the impact of hindsight, overconfidence and self-attribution bias on investment advisors and how these biases affect the investment advisors. Further, the author studied the thinking style and cognitive abilities of individuals on the disclosure to behavior biases. For that purpose, primary data were collected from financial professionals, university students and engineering company employees. The study found that financial professionals had low level overconfidence but were exposed to self-attribution bias, investment consultant had less exposed but they had hindsight bias and the individual thinking styles are explained by the behavioral biases of the investment advisors. Glaser and Weber (2007) analyzed the overconfidence of online broker investors in various dimensions and analyzed whether these overconfidence measures are significantly related with trading volume of individual investors. The paper found that investors trade more when they believe that they are above average in terms of past performances and investment skills but they did not have an average performance. The study proved that the investor's investment behavior is influenced by the irrational behavior in the form of cognitive, emotional and heuristics. The cognitive behavior is the most dominating factor for investors' investment decision so the paper focuses on the cognitive behavior of the investors on investment decision.

### METHODOLOGY

The households are the target samples of this study. The researcher used the 'District Census Handbook' published by the Directorate of Census Operation Tamil Nadu for the year 2011 to find out the available area wise households in Tamil Nadu. For covering the entire Tamil Nadu, the areas were classified into Southern, Northern, Eastern and Central region. Out of the total number of households in Tamil Nadu, Chennai, Coimbatore, Tirunelveli and Tiruchirappalli stood first place in respective regions of Tamil Nadu by adopting Purposive Sampling. The present study is empirical and qualitative in nature. The researcher used both primary and secondary data. A close ended and well structured questionnaire is used as a tool to collect the data from the individual investors in the selected study areas. The researcher conducted pilot survey taking 80 respondents 20 from four selected places and the questionnaire is pre-tested with appropriate tools in order to assure the presence of all the variables necessary to conduct research and check whether any

unwanted questions were included or not. The main survey is carried by the researchers in the selected districts of Tamil Nadu. The total population of households for the top most places in four regions totally rose to 2,928,545. As per a Table developed by W.G.Cochran (1963) for determining sample size, 400 sample units were selected with 5 per cent precision at 95 per cent confidence level when the population is more than 1,00,000. Questionnaires were distributed among the households living in four selected areas 100 each by adopting Convenience Sampling method because researcher approached the stock broking houses, property agencies, family members, friends and relatives located at different locations of the study areas. Finally, while coding the questionnaire with the help of SPSS version 21, the researcher found that five questionnaires were found partly filled and seven questionnaires were found to be outliers hence, the researcher excluded 12 questionnaires and took 392 questionnaires for analysis.

### RELIABILITY TEST

The internal reliability test has been used to measure the items holding together to measure the measurement model of the respective construct. Hence, the Cronbach's Alpha is to be conducted in SPSS in order to measure the internal reliability of the each and every items and constructs used in the measurement model. The higher alpha value (0.7) indicates that the reliability of the items is achieved.

**Table-1: Reliability Test**

Construct and Factors	Number of Item	Cronbach's Alpha
<b>Cognitive Behaviour</b>	<b>73</b>	<b>0.984</b>
Overconfidence	9	0.990
Self-attribution	7	0.986
Illusion of Control	5	0.983
Conservatism	8	0.986
Ambiguity Aversion	5	0.980
Mental Accounting	6	0.981
Confirmation	8	0.985
Hindsight	7	0.985
Recency	7	0.982
Cognitive Dissonance	5	0.976
Framing	6	0.985

Source: Computed from primary data

### HYPOTHESES FRAMED

To test the influence of irrationality among the household investors, the researcher framed the following hypotheses and tested them with the help of statistical tools.

**H01:** Covariance matrices of Investment pattern are equal across the cluster groups under Cognitive bias.

**H02:** Covariance matrices of Investment objectives are equal across the cluster groups under Cognitive bias.

**H03:** Levels of Cognitive bias do not have any influence on the investment pattern of the respondents.

**H04:** Levels of Cognitive bias do not have any influence on the investment objectives of the respondents.

### TOOLS FOR DATA ANALYSIS

The Cronbach's Alpha is used to check the Reliability of items under factors and it is appraised using Cronbach's coefficient. Content validity of the questionnaire is checked by giving the questionnaire to the experts of the subjects. This test ensures that the measurements are reliable for further use. Exploratory

Factor Analysis was used to group the variables coming under different factors. Confirmatory Factor Analysis was used to examine the grouped items under and between each constructs. Cluster analysis is used to classify the investors according to the level of bias selected for the study. Analysis of Variance (one way MANOVA) was applied to test the impact of behavioral biases on investment pattern and objectives. Chi-Square test is applied to assess the association between the socio-economic variables and investment pattern and objectives.

### RESULT ANALYSIS AND DISCUSSION

The levels of cognitive biases of the respondent investors are presented in the table 1.

**Table-2: Investors Opinion towards Cognitive Behavioral Biases**

Investor Opinion	Cognitive Biases										
	Overconfidence Bias	Self-Attribution Bias	Illusion of Control Bias	Conservatism Bias	Ambiguity Aversion Bias	Mental Accounting Bias	Confirmation Bias	Hindsight Bias	Recency Bias	Cognitive Dissonance Bias	Framing Bias
Strongly Disagree	3	-	11	-	-	-	-	3	-	1	-
Disagree	30	24	20	28	17	18	23	27	11	12	24
Moderately Disagree	20	13	33	30	21	7	14	29	16	17	20
Mildly Disagree	30	29	29	25	25	19	29	33	38	31	31
Undecided	33	38	33	64	26	31	24	46	43	56	27
Mildly Agree	43	46	44	22	46	49	36	77	39	59	41
Moderately Agree	57	74	70	63	61	75	67	93	62	66	69
Agree	75	72	97	61	81	81	93	84	76	77	74
Strongly Agree	101	96	55	99	115	112	106	-	107	73	106
<b>Total Investors</b>	<b>392</b>	<b>392</b>	<b>392</b>	<b>392</b>	<b>392</b>	<b>392</b>	<b>392</b>	<b>392</b>	<b>392</b>	<b>392</b>	<b>392</b>

Source: Computed from primary data.

It is enlightened from the table 2 that regarding the opinion of investors towards overconfidence bias statements, 83 investors are given their opinion as "from strongly disagree to mildly disagree" towards the overconfidence of investors on investment decision, 33 investors chose "neither agree nor disagree" about their opinion towards the statements but 276 investors gave the opinion "from mildly agree to moderately agree" to the overconfidence bias statements out of which 43 investors chose "mildly agree", 57 investors chose "moderately agree", 75 investors chose "agree" and 101 investors chose "strongly agree" to the statements.

Out of total 392 sampled investors, 66 investors chose the option "from mildly disagree to disagree", 38 investors are not sure about the statements of self-attribution bias but 288 investors opt "from mildly

agree to strongly agree", out of which 46 investors chose "mildly agree", 74 investors chose "moderately agree", 72 investors expressed "agree" and 96 investors have chosen "strongly agree" to the self-attribution bias statements. However, none of the investor conveyed their opinion as strongly disagree to any statements which reflect the self-attribution bias.

In the measurement of illusion control bias of investment decision, 93 investors chose the option "strongly disagree to mildly disagree" the statements, 33 investors are uncertain on the statements which reflect the illusion control bias but 266 investors have assigned positive opinion to these statements which is categorized from "mildly agree to strongly agree". Out of positive opinion investors, 44 investors "mildly agree", 70 investors "moderately agree", 97 investors

"agree" and 55 investors has opinion that those are all "strongly agree" to the illusion control bias statements.

In the investors opinion towards conservatism bias statements, 83 investors conveyed their opinion from "disagree to mildly disagree", 64 investors chose "neither agree nor disagree" to these statements so they are neutral towards the conservatism bias statements but 245 investors opinion categorized from "mildly agreed to strongly agree" to the conservatism bias out of which 22 investors mildly agree, 63 investors moderately agree, 61 investors agree and 99 investors chose "strongly agree" to the statements which reflect the conservative bias on the investment decision. None of the investors chose "strongly disagree" opinion to any statements which reflects the conservatism bias on investment decision of the investors.

In the ambiguity aversion bias statements, 63 investors chose "mildly disagreed to disagree" of the statements which represented the ambiguity aversion bias but 26 investors chose "neither agree nor disagree" to the statements because these investors are neutral towards ambiguity aversion bias and 303 investors chose the opinion "strongly agree to mildly agree". Among the agreed investors, 75 investors chose "mildly agree", 70 investors chose "moderately agree", 97 investors chose "agree" and 62 investors have chosen "strongly agree" to the statements which reflect the ambiguity aversion bias on investment decision but none of the investors chose "strongly disagree" opinion to any statements which reflects the ambiguity aversion bias on investment decision of the investors.

44 investors chose "disagree" to the mental accounting bias statement and 31 investors are uncertain but 317 investors on mental accounting bias statement chose "mildly agree to strongly agree" to the statements out of which 49 investors chose "mildly agree", 75 investors "moderately agree", 81 investors chose "agree" and 112 investors chose "strongly agree" to mental accounting bias statements. It is interesting to note down that among the total investors, none of the investors chose "strongly disagree", which represents the mental accounting bias on investment decision, and majority of the investors are chose "agree" to the statements, which reflect the mental accounting bias.

In confirmation bias, 302 investors assigned positive sign to the confirmation bias statements out of which 36 investors chose "mildly agree", 67 investors chose "moderately agree", 93 investors chose "agree" and 106 investors chose "strongly agree" to the confirmation bias statements but 24 investors chose "neither agree nor disagree", which represent the conformation bias. Out of total 392 investors, 66 investors conveyed negative opinion on the confirmation bias statements which categorized from "disagree to mildly disagree"

but none of the investors chose "strongly disagree" opinion.

Out of sample investors categorized in the scale in hindsight bias, 92 investors chose "strongly disagree to mildly disagree" and 46 investors "neither agree nor disagree". Out of 392 investors, 254 investors chose "agree" to the hindsight bias, which categorized from "mildly agree to agree" but none of the investors chose "strongly agree" to any statements of hindsight bias. Out of agreed investors 77 investors chose "mildly agree", 93 investors chose "moderately agreed", 84 investors chose "agree" among the statements.

Out of total sampled investors, 65 investors chose "disagree to mildly disagree" among the statements, 43 investors are uncertain about the statements on the Recency bias but 284 investors chose "agree" among the statements out of which 39 investors conveyed their opinion as "mildly agree", 62 investors chose "moderately agree", 76 investors expressed "agree" option and 107 investors chose "strongly agree" as their opinion on Recency bias statements but none of the investors have chosen "strongly disagree" to any statements which reflect the Recency bias.

In the cognitive dissonance bias on investment decision, 61 investors chose "disagree" which categorized from "mildly disagree to strongly disagree" among the statements, 56 investors chose "neither disagree nor agree" and 275 investors conveyed positive opinion to these statements out of which 59 investors chose "mildly agree", 66 investors chose "moderately agree", 77 investors chose "agree" to the cognitive dissonance bias statements and 73 investors chose "strongly agree" to the statements which reflect the cognitive dissonance bias of the investors on investment decision.

In framing bias, 290 investors have given positive opinion towards the statements, which describe the framing bias out of which 41 investors "mildly agree", 69 investors chose "moderately agree", 74 investors chose "agree" and 106 investors chose the "strongly agree" option to the framing bias statements, but 27 investors chose "neither agree nor disagree" to these statements, which represent the framing bias. Out of 392 investors, 75 investors chose "disagree" option to the statements but none of the investors have conveyed "strongly disagree" option to any statement which represented the framing bias on investment decision.

### FACTORING OF COGNITIVE BEHAVIOUR

The Factor analysis is performed to get number of items into reasonable factors. Before conducting the factor analysis, it is obligatory to conduct the two types of tests namely Kaiser-Meyer-Olkin (KMO) and Bartlett's

Test of Sphericity. The KMO is used to measure the sampling adequacy of each variable in the cognitive measurement model and the statistics is measured. The proportion of variance among the observed variables that might be caused by some common factors. The higher value of KMO indicates that the sampling is adequate to conduct factor analysis of cognitive behavior. The Bartlett's Test of Sphericity test is the hypothesis that the correlation matrix is identity matrix,

which means the variables are unrelated and it is unsuitable for structure detection. The Kaiser-Meyer-Olkin and Bartlett test results were presented in the table 3.

**Table-3: Results of KMO and Bartlett's Test**

Particulars	Test Values	
<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy.</b>	.976	
<b>Bartlett's Test of Sphericity</b>	Approx. Chi-Square	51254.348
	Df	2628
	Sig.	0.000

Source: Computed from primary data.

The Kaiser-Meyer-Olkin test value 0.976 is sufficiently high and the sample data is appropriate to use factor analysis to reach a meaningful conclusion that the selected items explain the 90.711 per cent of common variance of the underlying factors. The Bartlett's test of Sphericity shows the chi-square value of 51254.348 at 99 percent significant level because the significant value (p-value) is less than 0.001. Therefore, the items are fit for factor analysis and the selected items form the constructs/factors.

cognitive behavior on investment decision of individual investors and the Promax rotation were adopted to allow the factors to correlate in the pattern matrix because the Promax rotation can be calculated more faster than the other methods namely Direct Oblimin rotation and also it is useful for very large data set. The Eigen value is one or more than one is considered as the new factor and it should be used for further analysis. Eleven factors are extracted from the original 73 items of cognitive behavior of the investors and the detail results are presented in the table 4.

The Maximum-Likelihood method is adopted to extract the factors from the selected variables under the

**Table-4: Total Variance Explained for Cognitive Behaviour**

Factor	Initial Eigen Values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	34.425	47.157	47.157	34.332	47.030	47.030
2	7.737	10.598	57.755	7.645	10.472	57.502
3	4.204	5.759	63.513	4.111	5.631	63.133
4	3.672	5.030	68.543	3.579	4.903	68.036
5	3.134	4.294	72.837	3.038	4.162	72.198
6	2.951	4.043	76.880	2.861	3.919	76.117
7	2.669	3.656	80.536	2.577	3.530	79.646
8	2.453	3.361	83.897	2.361	3.234	82.881
9	2.230	3.055	86.952	2.142	2.934	85.815
10	1.977	2.708	89.661	1.881	2.577	88.392
11	1.788	2.449	92.110	1.692	2.318	90.711

Source: Computed from primary data.

Table 4 explained that the factor one has the value of 34.425 as Eigen value and explains the 47.030 per cent of variance among the total variance. The second factor carries the Eigen value of 7.737 and it explains 10.472 per cent of total variance, the third factor has 4.672 as an Eigen value and it explains 5.631 per cent of variance, the fourth factor has the Eigen value of 3.367 and explains the 4.903 per cent of variance, The fifth factor carried the Eigen value of 3.134 and explains

4.903 per cent variance, the sixth patterned factor has the Eigen value of 2.951 and it explains 3.919 per cent of variance. The seventh patterned factor has the Eigen value of 2.669 which explains 3.530 per cent of variance, the eighth factor has carried the Eigen value of 2.453 and explains 3.234 per cent of variance, the ninth factor has Eigen value of 2.230 and explains 2.934 per cent of variance, the tenth factor explain the variance of 2.577 and has the Eigen value of 1.977 and

the eleventh factor has the Eigen value of 1.788 and explains 2.318 per cent variance. Altogether, the eleven factors explained variance of 90.711 percent of variance and the remaining 9.289 per cent of variance is

explained by the other factors. The extracted items under each factor along with the factor loading values are shown in the table 5.

**Table-5: Pattern Matrix of Cognitive Behaviour**

Cognitive Behavioral Items	Factor											
	1	2	3	4	5	6	7	8	9	10	11	
My investment decision is based on private information rather than publicly available information in the market.	0.963											
My investment option is always better than others are while choosing investments from financial & physical assets.	0.958											
I have more confidence in my analytical skills so I can select better investment avenues in the market.	0.953											
Even though the market has an unfavorable condition, my investment will never give losses to me because of my confidence in my investment skills.	0.951											
If the previous investments gave the extraordinary return, I will invest in the same investment avenue without considering any negative financial matters relating to previous investment.	0.941											
Suppose, if I received more profit in a particular investment in the market, I will involve frequent trading without considering the risk factors associated with the investment.	0.949											
My judgment about the investment is always correct so I have confidence that I will pickup outperforming assets in the market.	0.955											
My investment awareness level is always better than others are, hence I can involve in the more trading to get some extra return on the investments.	0.951											
I have much confidence in my experience in the field of investment, so I can predict	0.938											

the market events and my investments' outcome.			
If I heard any news about a particular asset, which gives more return in the short-term basis, I will search information in the market, which is supporting my heard news to make investment in the particular assets.	0.954		
Before making investment decision, I will search the market information, which is supporting my guess/thought about a particular investment in the market.	0.903		
If I heard any negative information about my investments in the market, I will search the positive information, which is support, my ideas in the market to make subsequent changes in my investment.	0.952		
Sometimes my investment decision will be based on the investment information, which supports my ideas in the market.	0.966		
When I think an asset will not able to produce good return in the near future, I will confirm the assets performance in the market before making the decision.	0.949		
When I think that a particular investment will grow and give extraordinary return in the market, I will evaluate asset's returns in the past years before making investment decision.	0.931		
I never consider the contradicting information in the market while making investment decision.	0.956		
If any information is not support my thoughts/ideas, I will search yet information, which support my thoughts.	0.905		
After determining a particular investment is good among the other investments in the market, I will never change my investment option even though I heard any bad news about it.	0.925		
I would like to follow the traditional style (without changing the investment pattern) of investment pattern rather than the new pattern in my investment decision.	0.947		
I never considered the new information, which contradicts my traditional thoughts or beliefs in my investment decision.	0.920		
I will keep previous information rather than acting on the updated information in the investment decision.	0.971		

I followed the same style and pattern of investment in the market since my investment habit started in my life.	0.9 18		
I never change my regular investment pattern even though I heard any negative information about the investment.	0.9 41		
The new information comes from the market may be false so I will not update that information in my investment decision.	0.9 21		
I am a conservative in nature so I would not like to follow the new ethics of my investment decision.	0.9 50		
My investment success depends on my skills because I have great talent to evaluate the features of investments.	0.96 0		
My return on portfolio increased because I used my skills while constructing the portfolio in the market.	0.94 5		
If I got investment success from the market, I will share my investment experience with my friends and relatives.	0.95 7		
I will not share the failures of my investments with anyone in the market because of my prestige.	0.93 4		
I can construct the better portfolio and earn more profit on the investment because I am the best investor among other investors in the market.	0.92 2		
Due to my bad luck, sometimes I suffered from bad return on investments in the market.	0.93 0		
I never take investment decision based on the ideas of others in the market because I have better analytical skills.	0.93 5		
My investment decision is based on the most recent events rather than the oldest events in the market.	0.95 3		
I will invest in a particular asset based on recent recallable events in the market.	0.97 0		
I make the investment decision based on the recent records and news published by the investors' track managers.	0.94 3		
Sometimes my investment decision is based on the monthly/weekly reports and assets trend in the market.	0.93 8		
I will invest the hot investment avenues recently available in the market.	0.91 7		
When the price of a particular asset goes up in the market, I will invest in such assets because I believe that the price of such an asset will go up further.	0.89 6		
When the price of a particular asset shows a continuously decreasing trend in the market I never invest in such assets because I believe that the price of such an asset further will decrease.	0.91 8		
After getting some success in the investment decision, I think that I can predict better investment in the market.	0.91 5		
After getting higher return on my investment, I hope that I can predict the accurate outcome of my investment in the market.	0.90 3		
If I won the investment market occasionally, I will believe that I can foresee everything better than others can and I know everything about the market.	0.97 9		
I hope that I had the ability to predict the market events because the market events are repeatable.	0.92 5		

I will invest in some assets in the market because I know the particular assets will grow faster than among other assets in the market.	0.98 0	
I never invest in some investment areas because I hope that these investment areas will not grow.	0.94 4	
I know very well about the market. Therefore, I can estimate the outcome of my assets in the market.	0.93 2	
When I think that a particular asset will give the loss in the market then I will not make the investment.	0.94 3	
When a particular investment produces the good return in the past years, I will invest because I believe that it will produce a good return in future also.	0.92 8	
When I realized losses in the investment in the past, I will never invest gain because of I not ready to suffer from losses again.	0.95 1	
My investment decision is based on the market situation. When I think the market environment is a favor to me, I will invest in the risky asset.	0.94 9	
When the market situation is not favoring my investment decision, I will not make the investment even though the asset is safe in the market.	0.97 3	
When the asset fulfils one or two aspects of my needs, I will invest without considering the other aspects of my needs.	0.96 8	
I will invest money in the assets as per my schedule and I will not divert my planned money to yet another investment purpose at any occasions.	0.94 4	
My investment decision always has some logical reasons otherwise; I will not go for investment in the market.	0.91 6	
Usually, I segregate my entire savings into different investments to meet my future planned requirements.	0.96 3	
Normally in the market, I will invest huge amount of money in safe assets and less amount of money in risky assets.	0.92 1	
If I wish to earn more and highest return on my investment, I will go for investment in emerging market instruments.	0.91 6	
If I which to safeguard my investment amount in the market, I will go for investment in the safest investment instruments like insurance, post office, bank deposit, etc.,	0.92 6	
I would not like to invest unknown or unfamiliar assets to me in the market.	0.98 1	
I will not invest my money in any assets, which are beyond my investment knowledge.	0.93 9	
If I have good proficiency in a particular investment arena, I will make 100% investment on such assets.	0.93 0	
I always prefer to make an investment on known risky assets rather than unknown risky assets in the market.	0.95 0	
“Known Devil is better than Unknown Angel” is the best proverb in my investment life so I follow this proverb in my investment decision.	0.91 3	
I hope that my investment can earn the extra return even though market faced higher fluctuations.	0.97 5	
I can predict the future outcome of my investments through my investment skills.	0.90 6	
My investment’s return will be more than the actual market return because I have proofed myself in constructing efficient portfolio at many times.	0.95 4	
I believe that I can influence my investment performance in the market to some extent.	0.93 5	
I can predict the future of new assets launched in the market recently.	0.96 3	
Sometime I will involve in the investment activity to avoid my mental pain associated with the investment.	0.93 3	
To avoid my mental discomfort, I will not evaluate my investment performance at the time of huge fluctuation in the market.	0.93 7	

I will not make the investment decision, when the market information inconsistent with my belief.	0.93 3
To avoid tension on investment decision, I never consider new information, which is not supporting my beliefs.	0.91 2
I feel mental distress, when I obtained new information, which makes inconsistent with my existing understandings.	0.94 8

Source: Extracted from factory analysis by using primary data.

It is interpreted from the table 5 that the first factor which contain nine items/statements to measure the overconfidence bias on investment decision. Among the nine statements loaded in the particular factor, the statement 'My investment decision is based on private information rather than publicly available information in the market' is the highest loading value which is 0.963 and the lowest factor loading statement in this factor is 'I have much confidence in my experience in the field of investment, so I can predict the market events and my investments' outcome' which carries the factor value of 0.938. In between these two values the statement 'My investment option is always better than others while choosing investments from financial & physical assets' carries the factor value of 0.958, the statement 'I have more confidence in my analytical skills so I can select better investment avenues in the market' has the factor value of 0.953, the statement 'Even though the market has an unfavorable condition, my investment will never give losses to me because of my confidence in my investment skills' holds the factor value of 0.951, the statement 'If the previous investments gave the extraordinary return, I will invest in the same investment avenue without considering any negative financial matters relating to previous investment' has the loading value of 0.941, the statement 'Suppose if I received more profit in a particular investment in the market, I will involve frequent trading without considering the risk factors associated with the investment' has the factor loading value of 0.949, the statement 'My judgment about the investment is always correct so I have confidence that I will pickup outperforming assets in the market' has the factor loading value of 0.955 and the statement 'My investment awareness level is always better than others, hence I can involve in the more trading to get some extra return on the investments' loaded in the first factor with the loading value of 0.951.

The second factor consists of eight items, which shows the confirmation bias of the investors on investment decisions. The item loading value ranges from 0.966 to 0.903. the statement 'If I heard any news about a particular asset which gives more return in the short-term basis, I will search information in the market which is supporting my heard news to make investments in particular assets' has the item loaded value of 0.954, the statement 'Before making investment decisions, I will search the market information which is supporting my guess/thought

about a particular investment in the market' has the loaded value of 0.903, the statement 'If I heard any negative information about my investments in the market, I will search the positive information, which is support, my ideas in the market to make subsequent changes in my investment.' has loaded value of 0.952, the statement 'Sometimes my investment decision will be based on the investment information which supports my ideas in the market' has the loaded value of 0.966, the statement 'When I think an asset will not able to produce good return in the near future, I will confirm the assets performance in the market before making the decision.' Has the item loaded value of 0.949, the statement 'When I think that a particular investment will grow and give extraordinary return in the market, I will evaluate asset's returns in the past years before making investment decision' has the loaded value of 0.931, the statement 'I never consider the contradicting information in the market while making investment decision' has the loaded value of 0.956 and the statement 'If any information is not support my thoughts/ideas, I will search yet information which support my thoughts' loaded in the second factor with the loading value of 0.905.

The eight statements loaded in the third factor to convey the conservatism bias of the investors on the investment decision. Among the loaded statements, the statement 'After determining a particular investment is good among the other investments in the market, I will never change my investment option even though I heard any bad news about it' has loaded value of 0.925, the statement 'I would like to follow the traditional style (without changing the investment pattern) of investment pattern rather than the new pattern in my investment decision' has the loaded value of 0.947, the statement 'I never considered the new information which contradicts my traditional thoughts or beliefs in my investment decision' is loaded with the value of 0.920, the statement 'I will keep previous information rather than acting on the updated information in the investment decision' is loaded with the value of 0.971, the statement 'I followed the same style and pattern of investment in the market since my investment habit started in my life' is loaded with value of 0.918, the statement 'I never change my regular investment pattern even though I heard any negative information about the investment is loaded with the value of 0.941, the statement 'The new information comes from the market may be false so I will not update that

information in my investment decision' is loaded with the value of 0.921 and the statement 'I am conservative in nature so I would not like to follow the new ethics of my investment decision' loaded in the third factor with loaded value of 0.950.

The fourth factor called the self-attribution bias on the investment decision, which consists of seven statements. The statement is loaded with values ranging from 0.960 to 0.922. Among the seven statements, the statement 'My investment success depends on my skills because I have great talent to evaluate the features of investments' loaded with the loading value of 0.960, the statement 'My return on portfolio increased because I used my skills while constructing the portfolio in the market' is loaded with the loading value of 0.945, the statement 'If I got investment success from the market I will share my investment experience with my friends and relatives' is loaded with the loading value of 0.957, the statement 'I will not share the failures of my investments with anyone in the market because of my prestige' is loaded with the loading value of 0.934, the statement 'I can construct the better portfolio and earn more profit on the investment because I am the best investor among other investors in the market' is loaded in the fourth factor with the loading value of 0.922, the statement 'Due to my bad luck, sometimes I suffered from bad return on investments in the market' is loaded with the loading value of 0.930 and the statement 'I never take investment decision based on the ideas of others in the market because I have better analytical skills' is loaded with the value of 0.935 in the fourth factor.

The fifth factor consists of seven items, which reflects the Recency bias on the investment decision of the investors. The statement 'My investment decision is based on the most recent events rather than the oldest events in the market' is loaded with the factor value of 0.953, the statement 'I will invest in a particular asset based on recent recallable events in the market' is loaded with the factor value of 0.970, the statement 'I make the investment decision based on the recent records and news published by the investors' track managers' is loaded with the factor value of 0.943, the statement 'Sometimes my investment decision is based on the monthly/weekly reports and assets trend in the market' loaded with the factor value of 0.938, the statement 'I will invest the hot investment avenues recently available in the market' is loaded with the factor value of 0.917, the statement 'When the price of a particular asset goes up in the market I will invest in such assets because I believe that the price of such an asset will go up further' is loaded with the loading value of 0.896 and the statement 'When the price of a particular asset shows a continuously decreasing trend in the market I never invest in such assets because I believe that the price of such an asset further will

decrease' is loaded with the loading value of 0.918 in the fifth factor

There are seven statements loaded in the sixth factor, which shows the hindsight bias of the investors on investment decision. The factor loading value ranges from 0.980 to 0.903. The statement 'After getting some success in the investment decision, I think that I can predict better investment in the market' loaded with the factor loading value of 0.915, the statement 'After getting higher return on my investment, I hope that I can predict the accurate outcome of my investment in the market' loading with the factor loading value of 0.903, the statement 'If I won the investment market occasionally, I will believe that I can foresee everything better than others and I know everything about the market' loaded with the factor value of 0.979, the statement 'I hope that I had the ability to predict the market events because the market events are repeatable' loaded with the factor loading value of 0.925, the statement 'I will invest in some assets in the market because I know the particular assets will grow faster than among other assets in the market' loaded with the loading value of 0.980, the statement 'I never invest in some investment areas because I hope that these investment areas will not grow' loaded with the factor loading value of 0.944 and the statement 'I know very well about the market. So I can estimate the outcome of my assets in the market' loaded with the loading value of 0.932 in the sixth factor.

There are six statements loaded in the seventh factor, which is used to assess the framing behavior of investors on investment decision. The statement 'When I think that a particular asset will give the loss in the market then I will not make the investment' loaded with the loading value of 0.943, the statement 'When a particular investment produces the good return in the past years, I will invest because I believe that it will produce a good return in future also' is loaded with the loading value of 0.928, the statement 'When I realized losses in the investment in the past, I will never invest gain because of I not ready to suffer from losses again' is loaded with the loading value of 0.951, the statement 'My investment decision is based on the market situation. When I think the market environment is a favor to me, I will invest in the risky asset' loaded with the loading value of 0.949, the statement 'When the market situation is not favoring my investment decision, I will not make the investment even though the asset is safe in the market' loaded with the loading value of 0.973 and the statement 'When the asset fulfils one or two aspects of my needs I will invest without considering the other aspects of my needs' loaded in the seventh factor with the loading value of 0.968.

The eighth factor is loaded with the six statements, which are used to assess the mental accounting

behavior of the investors. Among the six statements, the statement 'I will invest money in the assets as per my schedule and I will not divert my planned money to yet another investment purpose at any occasions' loaded with the loading value of 0.944, the statement 'My investment decision always has some logical reasons otherwise I will not go for investment in the market' is loaded with the loading value of 0.916, the statement 'Usually, I segregate my entire savings into different investments to meet my future planned requirements' is loaded with the loading value of 0.963, the statement 'Normally in the market, I will invest huge amount of money in safe assets and less amount of money in risky assets' is loaded with the loading value of 0.921, the statement 'If I wish to earn more and highest return on my investment, I will go for investment in emerging market instruments' is loaded in the eighth factor with the loading value of 0.916 and the statement 'If I wish to safeguard my investment amount in the market, I will go for investment in the safest investment instruments like insurance, post office, bank deposit, etc.,' is loaded with the loading value of 0.926 in the same factor.

There are five statements used to find the ambiguity aversion bias of the investors on investment decision and these statements are loaded in the ninth factor among the other factors. The statement 'I wouldn't like to invest unknown or unfamiliar assets to me in the market' is loaded in the factor with the loading value of 0.981, the statement 'I will not invest my money in any assets, which are beyond my investment knowledge' is loaded with the loading value of 0.939, the statement 'If I have good proficiency in a particular investment arena, I will make 100% investment on such assets' is loaded in this factor with the loading value of 0.930, the statement 'I always prefer to make an investment on known risky assets rather than unknown risky assets in the market' is loaded with the loading value of 0.950 and the "Known Devil is better than Unknown Angel" is the best proverb in my investment life so I follow this proverb in my investment decision' statement is loaded in the ninth factor with the loading value of 0.913.

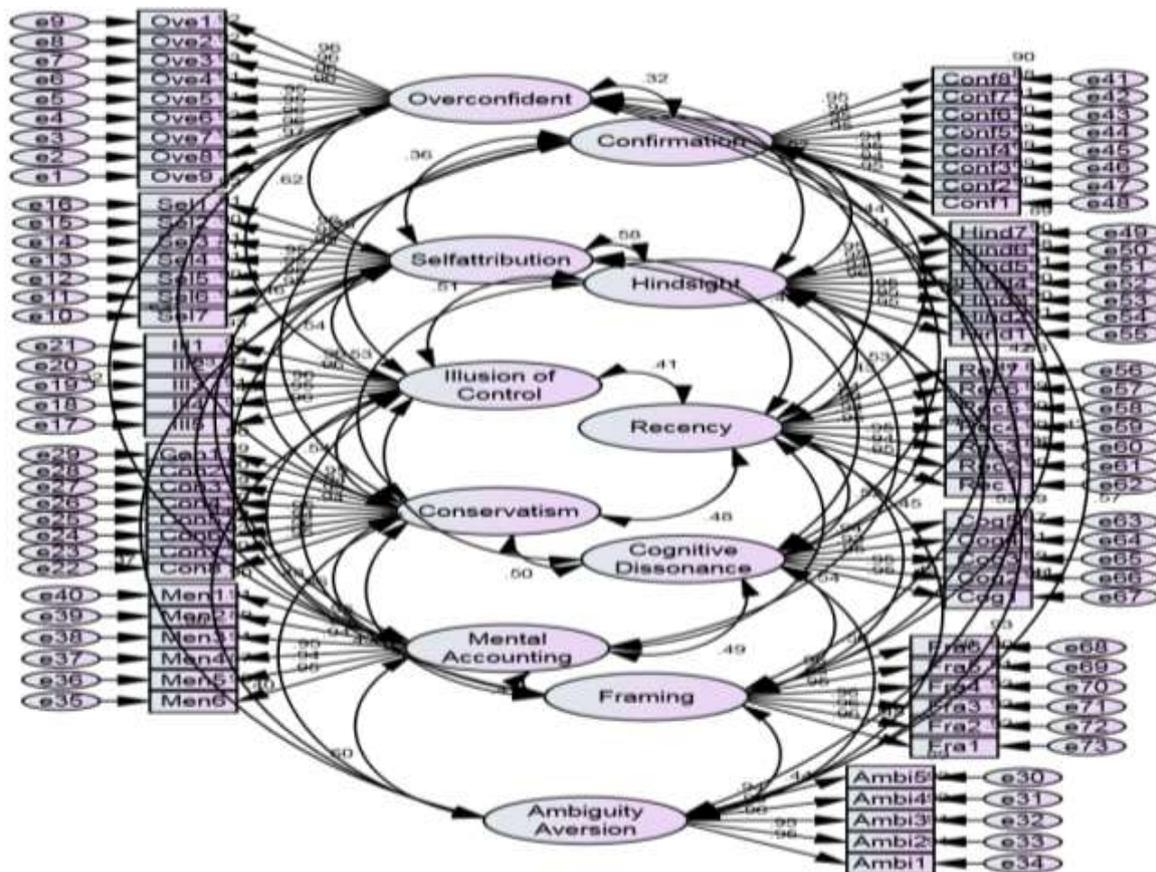
The illusion control bias on investment decision is assessed by the five statements, which are loaded in the tenth factor. The statement 'I hope that my investment can earn the extra return even though market faced higher fluctuations' is loaded in the tenth factor with the loading value of 0.975, the statement 'I can predict the future outcome of my investments through my investment skills' is loaded in this factor with the loading value of 0.906, the statement 'My investment's return will be more than the actual market return because I have proofed myself in constructing efficient portfolio at many times' is loaded with the loading value of 0.954, I believe that I can influence my investment performance in the market to some extent'

is loaded with the loading value of 0.935 and the statement 'I can predict the future of new assets launched in the market recently' loaded in the tenth factor with the loading value of 0.963.

The last eleventh factor consists of five statements used to assess the cognitive dissonance behavior of investors on investment decision. The factor loading value ranges from 0.912 to 0.948. the statement 'Sometime I will involve in the investment activity to avoid my mental pain associated with the investment' is loaded with the loading value 0.933, the statement 'To avoid my mental discomfort, I will not evaluate my investment performance at the time of huge fluctuation in the market' is loaded with the loading value of 0.937, the statement 'When the market information inconsistent with my belief, I will not make the investment decision' is loaded with the loading value of 0.933, the statement 'To avoid tension on investment decision, I never consider new information, which is not supporting my beliefs' is loaded with the loading value of 0.912, the statement 'I feel mental distress, when I obtained new information which makes inconsistent with my existing understandings' is loaded in the eleventh factor with the loading value of 0.948.

#### **Analysis of Movement Structure of Measurement Model of Cognitive Behavioral Biases**

Factor analysis is used to find out the possible basic factor structure from the set of observed items so the factors are derived from the factor analysis and the basic underlying factor structure among the items are recognized. After run the factor analysis seventy-three items are reduced into eleven different factors namely overconfidence, confirmation, conservatism, self-attribution, Recency, hindsight, framing, mental accounting, ambiguity aversion, illusion of control and cognitive dissonance. The confirmatory factor analysis is used to verify the factor structure with the set of observed variables with the latent variable (unobserved variable). The researcher can test the hypothesis in the confirmatory factor analysis by allowing the relationship between the observed variables and its causal latent constructs. All the selected variables in the cognitive behavioral biases are independently tested and checked. The tested data is fit for the factor structure with the observed data. The output file of the Analysis of Movement Structure (AMOS) is examined to notice the under-identification and over-identification of acceptability and non-acceptability of the structured factor model. The main purpose of the confirmatory factor analysis is to check whether the latent variables are explained by, the observed variables are not. The factor loading for the extracted items in the cognitive behavior of investors on investment decision is showed in the figure 1.



Source: Drafted based on primary data with the help AMOS package

**Figure-1: Factor Loadings of Cognitive Behavioral Biases**

In the measurement model of cognitive behavior bias of the investors, the rectangle boxes represents individual observed variable for each factored behavioral biases under cognitive behavior. The Nine statements regarding Overconfident bias is coded from Ove1 to Ove9, Seven statements of Self-attribution bias coded from Sel1 to Sel7, Five statements of Illusion of Control bias is coded as Ill1 to Ill5, Eight statements are coded from Con1 to Con8 for the Conservatism bias, Five statements are coded from Ambi1 to Ambi5 for the Ambiguity aversion bias, Six statements were coded from Men1 to Men6 for Mental Accounting bias, Eight statements are coded from Conf1 to Conf8 for the Confirmation bias, Seven statements were coded form Hind1 to Hind7 for the Hindsight bias and yet another Seven statement coded from Rec1 to Rec7 to Recency

bias, Five statements are coded from Cog1 to Cog5 for the Cognitive Dissonance bias and Six statements were coded from Fra1 to Fra6 for the Framing bias. The small circle of each rectangle is represented the error terms of each observed variable from e1 to e73. The circle which represented by the all observed variables in the model is called constructs namely Overconfidence, Self-attribution, Illusion control, Conservatism, Ambiguity Aversion, Mental Accounting, Confirmation, Hindsight, Recency, Cognitive dissonance and Framing. The double-headed line is used to measure the correlation between the constructs in the measurement model. The squared multiple correlations of each and every observed item is presented on the top of the rectangle.

**Table-6: Estimated Squared Multiple Correlations of Observed Variables**

Cognitive Behavioral Biases	Statement Code	Estimate
Framing Bias	Fra1	.921
	Fra2	.916
	Fra3	.922
	Fra4	.907
	Fra5	.905
	Fra6	.929
Cognitive Dissonance Bias	Cog1	.896
	Cog2	.893
	Cog3	.905

	Cog4	.868
	Cog5	.893
Recency Bias	Rec1	.901
	Rec2	.882
	Rec3	.896
	Rec4	.899
	Rec5	.890
	Rec6	.871
	Rec7	.883
Hindsight Bias	Hind1	.911
	Hind2	.905
	Hind3	.899
	Hind4	.914
	Hind5	.880
	Hind6	.903
	Hind7	.895
Confirmation Bias	Conf1	.905
	Conf2	.889
	Conf3	.894
	Conf4	.892
	Conf5	.895
	Conf6	.906
	Conf7	.879
	Conf8	.898
Mental Accounting Bias	Men1	.901
	Men2	.906
	Men3	.889
	Men4	.908
	Men5	.875
	Men6	.903
Ambiguity Aversion Bias	Ambi1	.910
	Ambi2	.909
	Ambi3	.921
	Ambi4	.916
	Ambi5	.892
Conservatism Bias	Con1	.903
	Con2	.893
	Con3	.903
	Con4	.890
	Con5	.902
	Con6	.890
	Con7	.915
	Con8	.897
Illusion of Control Bias	Ill1	.928
	Ill2	.920
	Ill3	.915
	Ill4	.911
	Ill5	.920
Self-attribution Bias	Sel1	.921
	Sel2	.906
	Sel3	.903
	Sel4	.911
	Sel5	.908
	Sel6	.904
	Sel7	.908

Overconfidence Bias	Ove1	.926
	Ove2	.917
	Ove3	.915
	Ove4	.927
	Ove5	.909
	Ove6	.911
	Ove7	.921
	Ove8	.920
	Ove9	.935

Source: Values extracted from AMOS output.

It is understood from the table 6 that the estimated squared multiple correlation of framing bias's statements is 0.905 to 0.929, the cognitive dissonance bias's statements squared correlation ranges from 0.868 to 0.929, the statements of Recency bias's squared multiple correlation estimated value ranges from 0.871 to 0.901, the estimated value of hindsight bias's statements ranges from 0.880 to 0.914, the squared multiple correlation value of the confirmation bias's statements ranges from 0.879 to 0.906, the squared multiple correlation of the mental accounting bias's

statements ranges from 0.875 to 0.908, the statements of ambiguity aversion bias estimated value ranges from 0.892 to 0.921, the statement of conservatism bias estimated value ranges from 0.897 to 0.915, the statements of illusion of control bias's squared multiple correlation value ranges from 0.911 to 0.928, the statements of self-attribution bias's statements squared multiple correlation value ranges from 0.903 to 0.921 and the statements of overconfidence bias ranges from 0.909 to 0.935.

**Table-7: Correlation Estimation between the Cognitive Behavioral Biases Constructs**

Cognitive Biases	Correlation	Cognitive Biases	Estimate
Overconfident	↔	Self-attribution	0.620
Overconfident	↔	Illusion of Control	0.513
Overconfident	↔	Conservatism	0.626
Overconfident	↔	Ambiguity Aversion	0.317
Overconfident	↔	Mental Accounting	0.315
Overconfident	↔	Confirmation	0.324
Overconfident	↔	Hindsight	0.522
Overconfident	↔	Recency	0.410
Overconfident	↔	Cognitive Dissonance	0.423
Overconfident	↔	Framing	0.442
Self-attribution	↔	Illusion of Control	0.535
Self-attribution	↔	Conservatism	0.476
Self-attribution	↔	Ambiguity Aversion	0.367
Self-attribution	↔	Mental Accounting	0.366
Self-attribution	↔	Confirmation	0.365
Self-attribution	↔	Hindsight	0.584
Self-attribution	↔	Recency	0.445
Self-attribution	↔	Cognitive Dissonance	0.435
Self-attribution	↔	Framing	0.437
Illusion of Control	↔	Conservatism	0.540
Illusion of Control	↔	Ambiguity Aversion	0.384
Illusion of Control	↔	Mental Accounting	0.406
Illusion of Control	↔	Confirmation	0.379
Illusion of Control	↔	Hindsight	0.512
Illusion of Control	↔	Recency	0.412
Illusion of Control	↔	Cognitive Dissonance	0.519
Illusion of Control	↔	Framing	0.476
Conservatism	↔	Ambiguity Aversion	0.399
Conservatism	↔	Mental Accounting	0.360
Conservatism	↔	Confirmation	0.463
Conservatism	↔	Hindsight	0.533

Conservatism	↔	Recency	0.478
Conservatism	↔	Cognitive Dissonance	0.501
Conservatism	↔	Framing	0.432
Ambiguity Aversion	↔	Mental Accounting	0.597
Ambiguity Aversion	↔	Confirmation	0.568
Ambiguity Aversion	↔	Hindsight	0.408
Ambiguity Aversion	↔	Recency	0.502
Ambiguity Aversion	↔	Cognitive Dissonance	0.454
Ambiguity Aversion	↔	Framing	0.441
Mental Accounting	↔	Confirmation	0.627
Mental Accounting	↔	Hindsight	0.453
Mental Accounting	↔	Recency	0.540
Mental Accounting	↔	Cognitive Dissonance	0.486
Mental Accounting	↔	Framing	0.413
Confirmation	↔	Hindsight	0.442
Confirmation	↔	Recency	0.541
Confirmation	↔	Cognitive Dissonance	0.420
Confirmation	↔	Framing	0.415
Hindsight	↔	Recency	0.533
Hindsight	↔	Cognitive Dissonance	0.542
Hindsight	↔	Framing	0.517
Recency	↔	Cognitive Dissonance	0.523
Recency	↔	Framing	0.488
Cognitive Dissonance	↔	Framing	0.561

Source: Values extracted from AMOS output.

It is observed from the table 7 that the correction between the cognitive behavioral biases constructs ranges from 0.315 to 0.627. The mental accounting bias is highly correlated with confirmation bias and the overconfidence bias and mental accounting bias is correlated very low.

From the AMOS output file, the required following items were extracted for validating the factor structure

is which for drafted model. The absolute model fit is reported by the Root Mean Square Error Approximation (RMSEA) and Goodness of Fit Index (GFI). The Incremental Fit is reported by various measures namely Adjusted Goodness Fit Index (AGFI), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Normal Fit Index (NFI). The Parsimonious Fit is tested by the Chi-Square/df (CMIN/DF).

**Table-8: Confirmatory Factor Analysis Model Fit Indices for Cognitive Behavioral Biases of Investors**

Category of Model Fit	Measures	Threshold Values*	Model Values**
<b>Absolute Fit</b>	Root Mean Square Error Approximation (RMSEA)	Less than 0.08	0.029
	Goodness Fit Index (GFI)	Greater than 0.90	0.814
<b>Incremental Fit</b>	Adjusted Goodness Fit Index (AGFI)	Greater than 0.90	0.799
	Comparative Fit Index (CFI)	Greater than 0.95 – Great Greater than 0.90 - Traditional Greater than 0.80 – Permissible	0.984
	Tucker-Lewis Index (TLI)	Greater than 0.90	0.983
	Normal Fit Index (NFI)	Greater than 0.90	0.939
<b>Parsimonious Fit</b>	Chi-Square/df (CMIN/DF)	Less than 3 – Good Less than 5 - Permissible	1.338

Note: \*Values from [http://statwiki.kolobkreations.com/index.php?title=Confirmatory\\_Factor\\_Analysis](http://statwiki.kolobkreations.com/index.php?title=Confirmatory_Factor_Analysis);

\*\* Values extracted from AMOS output file. Source: Computed from primary data.

It is interpreted from table 8 that the absolute fit indices, Root Mean Square Error Approximation of the measurement model is 0.029 which is less than the threshold value of less than 0.08 but the Goodness Fit Index is 0.814 for the measurement model and this value is less than the threshold value of greater than 0.90. The threshold value of incremental fit indices

namely Adjusted Goodness Fit Index (AGFI), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Normal Fit Index (NFI). In the measurement model the value of AGFI is 0.799, CFI is 0.984 so, the model is great as per threshold value but it does not fulfill the AGFI, the TLI is 0.984 and NFI is 0.939. The Parsimonious Fit value is 1.338, which is less than the threshold value of three so the model is good as per the threshold value commentary. Therefore, the factor structure of the cognitive behavior of investors on investment decision is valid and accepted. The overall measurement model is fit. Further, the Discriminant validity and convergent validity are the subsets of construct validity. The Discriminant validity is conducted to test whether the measurement model of the latent variable or construct is free from the redundant items and the convergent validity is used to

validate all items in the measurement model as statistically significant. The composite reliability is used to indicate the reliability of internal consistency of latent construct and the average variance extracted is the indicator of average percentage of variance explained by the measuring items for a latent construct.

The Composite Reliability value should be 0.6 or more which indicates the reliability between the measuring items and latent construct and the Average Variance Extracted is 0.5 and above which indicates that the average percentage of variation in the latent variable is measured by the observed items and the Discriminant Validity is the correlation between the construct (unobserved variable) should not exceed 0.85 besides if the correlation value between the two constructs (unobserved variable) are redundant which means multicollinearity exist between the latent variables.

**Table-9: Reliability and Discriminant Validity Index for the Measurement Model**

Particulars	Cognitive Dissonance Bias	Overconfidence Bias	Self-attribution Bias	Illusion of Control Bias	Conservatism Bias	Ambiguity Aversion Bias	Mental Accounting Bias	Confirmation Bias	Recency Bias	Hindsight Bias	Framing Bias
<b>Composite Reliability</b>	0.976	0.99	0.986	0.983	0.986	0.98	0.981	0.985	0.982	0.984	0.985
<b>Average Variance Extracted</b>	0.891	0.92	0.909	0.919	0.899	0.909	0.897	0.894	0.888	0.901	0.917
Cognitive Dissonance Bias	<b>0.944</b>	0.423	0.435	0.519	0.501	0.454	0.486	0.42	0.523	0.542	0.561
Overconfidence Bias		<b>0.959</b>	0.62	0.513	0.626	0.317	0.315	0.324	0.41	0.522	0.442
Self-attribution Bias			<b>0.953</b>	0.535	0.476	0.367	0.366	0.365	0.445	0.584	0.437
Illusion of Control Bias				<b>0.959</b>	0.540	0.384	0.406	0.379	0.412	0.512	0.476
Conservatism Bias					<b>0.948</b>	0.399	0.36	0.463	0.478	0.533	0.432
Ambiguity Aversion Bias						<b>0.954</b>	0.597	0.568	0.502	0.408	0.441
Mental Accounting Bias							<b>0.947</b>	0.627	0.54	0.453	0.413
Confirmation Bias								<b>0.946</b>	0.541	0.442	0.415
Recency Bias									<b>0.943</b>	0.533	0.488
Hindsight Bias										<b>0.949</b>	0.517
Framing Bias											<b>0.958</b>

Source: Computed with the help of James Gaskin's Stats Tools Package.

It is observed from the table 9 that the latent variable namely overconfidence, confirmation, conservatism, self-attribution, Recency, hindsight, framing, mental accounting, ambiguity aversion, illusion of control and cognitive dissonance have the composite reliability value which ranges from 0.976 to 0.990 and the average variance extracted ranges from 0.888 to 0.920. The measurement model value of CR and AVE exceeds the threshold value the Discriminant Validity between the constructs is less than 0.85 and between the construct correlation value of overconfidence, confirmation, conservatism, self-attribution, Recency, hindsight, framing, mental accounting, ambiguity aversion,

illusion of control and cognitive dissonance is presented in the table 10.

#### **CLUSTER ANALYSIS OF COGNITIVE BEHAVIORAL BIASES**

Generally, highly biased investors may take investment decisions in an irrational way. Levels of bias of the respondents are studied with the help of Likert Scale with 9 points. However, for classifying the respondents biased level is very important hence the researcher used K=Mean Custer Analysis. Hierarchical Cluster Analysis has been applied to find the number of groups existing in the data. The Hierarchical cluster Analysis indicates that the three clusters is ideal and classified

accordingly and presented in Table 4.25 with the ANOVA Results.

**Table-10: ANOVA Test for Assessing the Influence of factors of Cognitive Behavioral Bias in classifying Cluster**

Factor	F Value	P Value
Overconfidence Bias	216.552	0.001
Self-attribution Bias	109.280	0.001
Illusion of Control Bias	107.684	0.001
Conservatism Bias	238.271	0.001
Ambiguity Aversion Bias	109.333	0.001
Mental Accounting Bias	155.150	0.001
Confirmation Bias	248.888	0.001
Hindsight Bias	115.904	0.001
Recency Bias	146.306	0.001
Cognitive Dissonance Bias	92.770	0.001
Framing Bias	102.352	0.001

Source: Computed from primary data.

The table 10 states the F and P values of value factors relating to cognitive in classifying group cluster under cognitive cluster. In all the factors of cognitive, the P values are lesser than 0.05 at 5% levels of significance. It is clear from the results that all the factors are significantly influencing in classifying groups under cognitive cluster.

The investors belong to the first cluster is named positive, second cluster is classified moderate and third cluster is named negative. For knowing their ranking of each and every factor mean square value is found and presented in Table 11.

**Table-11: Cluster Classification for Cognitive Behavioral Bias**

Cognitive Behavioral Factors	Final Cluster		
	Positive	Moderate	Negative
Overconfidence Bias	Moderate (40)	Low (39)	High (69)
Self-attribution Bias	Low (31)	Moderate (36)	High (52)
Illusion of Control Bias	Low (19)	Moderate (25)	High (36)
Conservatism Bias	Low (28)	Moderate (37)	High (60)
Ambiguity Aversion Bias	Low (20)	Moderate (33)	High (37)
Mental Accounting Bias	Low (23)	Moderate (41)	High (44)
Confirmation Bias	Low (26)	Moderate (53)	High (59)
Hindsight Bias	Low (24)	Moderate (34)	High (44)
Recency Bias	Low (27)	Moderate (42)	High (51)
Cognitive Dissonance Bias	Low (21)	Moderate (28)	High (36)
Framing Bias	Low (24)	Moderate (33)	High (44)
Number of Investors under Cluster	76 (19.39)	118 (30.10)	198 (50.51)

Source: Based on computed values from primary data.

Table 11 exhibits that the mean values of all the factors relating to negative group are higher than other groups

infers that the sample investors are having high levels of cognitive bias ranging from mean values of 36 to 69.

Positive group has lesser mean values ranging from 19 to 31 for all the cognitive factors except overconfidence bias in that positive group has moderate level of mean value. The mean square of Moderate group is moderate for all factors except for overconfidence bias ranges from 25 to 53.

### IMPACT OF COGNITIVE BIASES ON INVESTMENT PATTERN

The cognitive behavioral biases namely overconfidence, confirmation, conservatism, self-attribution, Recency, hindsight, framing, mental accounting, ambiguity aversion, illusion of control and cognitive dissonance are taken as independent variable and the investment avenues Equity share, Debenture/Bond, Provident fund, Bank deposits, Mutual fund, Chit fund, Post office savings, Insurance policies, Government Securities, Gold/Silver, Residential Flats/Apartments, and Agricultural lands are taken as dependent variable because the individual investor

behavior induced them to make investment in particular assets. Cognitive bias of investors may have an influence over Investment pattern of the respondents. Literatures showed that nearly 90 per cent of the investment decision is based on irrationality of the investors. The researcher too has an intention to test the influence of cognitive biases on investment pattern of investors so one-way MANOVA was used by taking the investment pattern as dependent variables and cognitive behavioral bias cluster as independent variable and the results are produced as under.

*H<sub>07</sub>: Covariance matrices of investment pattern are equal across cluster groups under cognitive behavioral biases.*

The Box's test of equality of covariance matrices is used to tests the null hypothesis that the observed covariance matrices of the investment pattern are equal across cluster groups under cognitive behavioral biases.

**Table-12: Box's Test of Equality of Covariance Matrices**

Box's M	209.159
F	1.272
Degree of Freedom (df) 1	156
Degree of Freedom (df) 2	172584.368
<b>Significant value</b>	<b>.012</b>

Source: Computed from primary data.

It can be inferred from Table 12 that that the covariance matrices of investment pattern across the groups classified under cognitive biases are not equal since the significant level is less than 0.05 at 5% levels of significance. Hence, it is proved that the covariance of investment pattern across the group classified under

cognitive bias. Multivariate test is useful to know whether there are significant group differences on a linear combination of the dependent variables. Table 13 shows the significant group differences on a linear combination of investment pattern of the respondents.

**Table-13: Multivariate Tests**

Effect	Value	F	Hypothesis df	Error df	Sig.	
<b>Cognitive Behavioral Bias and Investment Pattern</b>	Pillai's Trace	.075	1.229	24.000	758.000	.207
	<b>Wilks' Lambda</b>	<b>.926</b>	<b>1.238</b>	<b>24.000</b>	<b>756.000</b>	<b>.200</b>
	Hotelling's Trace	.079	1.246	24.000	754.000	.193
	Roy's Largest Root	.067	2.127	12.000	379.000	.015

Source: Computed from primary data.

Table 13 reveals that there are not significant group differences on the investment pattern of the respondents since the P value is more than 0.05 at 5% levels of significance. For knowing the influence of cognitive bias based on groups on the investment

pattern hypothesis is framed and tested with the help of one-way MANOVA.

*H<sub>08</sub>: Levels of cognitive behavior of investors do not influence investment pattern.*

**Table-14: Level of Cognitive Behavioral Biases with Respect to Investment Pattern**

Investment Pattern	Low Level (1)		Moderate Level (2)		High Level (3)		F Value	P Value	Scheffe's Multiple Comparison
	Mean	S.D.	Mean	S.D.	Mean	S.D.			
Equity Share	3.09	1.425	3.16	1.426	2.93	1.455	1.042	0.354	

Debenture/Bond	2.66	1.138	2.75	1.221	2.40	1.250	3.227	0.041*	
Provident Fund	2.84	1.155	2.97	1.247	2.98	1.327	.357	0.700	
Bank Deposits	3.37	1.187	3.42	1.297	3.49	1.293	.304	0.738	
Mutual Fund	2.92	1.334	2.94	1.410	2.59	1.382	3.099	0.046*	
Chit Fund	3.12	1.296	3.10	1.392	2.59	1.421	6.799	0.001**	<b>1 Vs. 3 and 2 Vs. 3</b>
Insurance Policies	3.42	1.349	3.53	1.231	3.23	1.423	1.907	0.150	
Post Office Savings Schemes	3.12	1.433	3.30	1.498	3.03	1.531	1.163	0.314	
Government Securities	2.57	1.408	2.68	1.358	2.46	1.369	.945	0.390	
Gold/Silver	3.38	1.095	3.60	1.241	3.53	1.324	.715	0.490	
Residential Flats/Apartments	3.09	1.298	3.31	1.223	2.90	1.331	3.582	0.029*	<b>2 Vs. 3</b>
Agricultural Lands	3.05	1.285	3.00	1.320	2.85	1.461	.744	0.476	

Note: S.D. – Standard Deviation; \*P values Significant at 5% level; Source: Computed from primary data.

The table 14 shows the mean, standard deviation, F and P values between the cognitive behavior and investment avenues. It is interpreted that the cognitive behavior of the investors has an influence over the investment avenues of debenture/bond, mutual fund, chit fund and residential flats/apartments since the P value of debenture/bond is 0.041, mutual fund 0.046, chit fund is 0.001 and residential flats/apartments is 0.029 at 5% and 1% levels of significance. In order to know the influence of cognitive behavior on investment avenues, the Scheffe's Multiple Comparison is used and found that the investors having high level cognitive bias are differ from investors are having low and moderate level of cognitive bias as far as the chit fund investment is concerned. Investors having moderate level of cognitive bias are differ from investors having

high level of cognitive behavior with respect to residential flats/apartments.

### IMPACT OF COGNITIVE BEHAVIORAL BIASES ON INVESTMENT OBJECTIVES

Cognitive bias of investors may have an influence over investment objectives of respondents. The researcher too has intentions to test the influence of cognitive bias on investment objectives of investors so one-way MANOVA was used by taking investment objectives as dependent variables and cognitive behavioral bias cluster as independent variable and the results are produced below.

*H<sub>09</sub>: Covariance matrices of investment objectives are equal across cluster groups under cognitive biases.*

The Box's test of equality of covariance matrices is used to test the null hypothesis that the observed covariance matrices of the investment objectives are equal across cluster groups under cognitive biases.

**Table-15: Box's Test of Equality of Covariance Matrices**

Box's M	110.874
F	1.184
Degree of Freedom (df) 1	90
Degree of Freedom (df) 2	176809.291
<b>Significant value</b>	<b>.112</b>

Source: Computed from primary data.

It can be inferred from Table 15 that that the covariance matrices of investment objectives across the groups are classified under cognitive biases are equal since the significant level is more than 0.05 at 5% level of significance. Hence, it is proved that the covariance of investment objectives across the group could not be

classified under cognitive bias. Multivariate test is useful to know whether there are significant group differences on a linear combination of the dependent variables. Table 16 shows significant group differences on a linear combination of investment pattern of the respondents.

**Table-16: Multivariate Tests**

Effect	Test Value	F Value	Hypothesis df	Error df	Sig.	
<b>Cognitive Behaviour and Investment Objectives</b>	Pillai's Trace	.060	1.303	18.000	764.000	0.178
	<b>Wilks' Lambda</b>	<b>.941</b>	<b>1.302</b>	<b>18.000</b>	<b>762.000</b>	<b>0.178</b>
	Hotelling's Trace	.062	1.301	18.000	760.000	0.179
	Roy's Largest Root	.042	1.798	9.000	382.000	0.067

Source: Computed from primary data.

Table 16 reveals that there is not significant group differences on the investment pattern of the respondents since the P value is more than 0.05 at 5% level of significance. For knowing the influence of

cognitive bias based on groups on the investment objectives hypothesis is framed and tested with the help of one-way MANOVA.

$H_{010}$ : Levels of cognitive behavior of investors do not influence investment objectives.

**Table-17: Level of Cognitive Behavioral Biases with Respect to Investment Objectives**

Investment Objectives	Low Level (1)		Moderate Level (2)		High Level (3)		F Value	P Value
	Mean	S.D.	Mean	S.D.	Mean	S.D.		
Safety	2.75	2.493	3.25	2.837	3.56	3.096	2.139	0.119
Liquidity	4.32	2.186	5.01	2.423	4.70	2.663	1.776	0.171
Profit	4.26	2.169	4.08	2.246	3.75	2.265	1.698	0.184
Capital Appreciation	5.12	2.215	5.01	2.232	4.69	2.058	1.480	0.229
Retirement Benefits	5.63	2.388	5.31	2.312	5.01	2.143	2.290	0.103
Tax Benefits	5.80	2.215	5.54	2.348	5.62	2.213	.316	0.730
Regular Return	5.13	2.537	5.28	2.241	5.16	2.182	.138	0.871
Children's Future	5.50	2.585	5.48	2.707	5.99	2.452	1.877	0.154
Family Function	6.62	2.535	6.12	2.737	6.63	2.468	1.602	0.203

Note: S.D. – Standard Deviation; \*P values Significant at 5% level; Source: Computed from primary data.

The table 17 shows the mean, standard deviation, F, and P values between the Cognitive behavioral bias and investment objectives of the investors. It is interpreted that the Cognitive behavioral bias of the investors has no influence on any investment objectives which means that the cognitive behavior have the similar effect with respect to the selection of investment objectives.

### CONCLUSION AND POLICY IMPLICATION

Investors' attitude and behaviours are interchangeably interacting in investment decision. Hence understanding the behaviour of individual investors are very essential to the financial institutions, policy makers, corporate and other intermediaries involving in financial markets to raise money. Understanding the irrationality among the investors based on different biases helpful to policy makers to create awareness about the market condition by passing information and observing activities of the investors will be helpful to spot the reason for their irrationality and take every steps to reduce irrationality hence the cash flow into capital as well as money market will consistently flow with less volatility that leads to economic development of the industries and countries. Therefore, the study suggested that the household investors preferred investing in gold/silver and bank deposits to equity and other financial securities. Proper awareness may be created through regulatory bodies thereby informing the investors and make them capable of taking decisions in their own by taking industrial and company analysis that increases rationality among the investors. Investors should check the authenticity of any information before taking decision based off of the information in order to avoid herd behaviour. Policy makers and intermediaries involved in trading of assets

may conduct workshops periodically in which they may invite experts from psychology who may be of help to develop the cognitive thinking of the investors, resulting in reduced cognitive biases. Periodical Review meeting may be conducted by regulatory bodies and in that, investors in different securities and intermediaries may be invited to express their views about different investments and reasons for non-attainment of investment objectives if any, and the sources selected by them while selecting securities. This meet will help the investors to spot their weakness in their portfolio decision and leading the investors towards optimum portfolio selection.

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