Weighting the Behavioral Biases of Investors in Shiraz Stock Exchange by Using the Fuzzy Analytical Hierarchy Process

¹Hamed Bakhtar and ²Ph.D Maziar Saberi

¹Department of Management, Yasouj Branch, Islamic azad University, Yasouj, Iran.
²Department of Economic, Yasouj Branch, Islamic azad University, Yasouj, Iran.

ARTICLE INFO	ABSTRACT
	The purpose of this study is examining and weighting the investment biases of Shiraz Stock Exchange. METHODS: Shiraz Stock Exchange. The main goal of this research is to weight the behavioral biases affecting investors' decisions in Shiraz Stock Exchange. To achieve this goal the 36-fold bias were weighted and prioritized by using fuzzy Analytical Hierarchy Process. In ranking the five-fold groups, groups of "cognitive", "emotional", "non-economic phenomena", "Heuristic behavior" and finally the "preferential" are respectively acquired the order of first to fifth. In ranking of the 36-fold bias, "loss aversion" bias from "emotional" group placed in the first position. The bias of "illusion (fallacy) of Gambler" from "Heuristic behavior", "ambiguity in the value changes process" from "preferential", "herd instinct (collectivism behavior)" from "abnormal phenomena (economic behavior)" and the "representative" from "cognitive" group, respectively, placed in the second, seventh, tenth and fifteenth positions.

INTRODUCTION

After the introduction of Efficient Markets Hypothesis in the 60s, a large part of the researches tested this hypothesis to confirm or deny it in different markets of the world. The Efficient markets hypothesis is built based on the principle of economic wise man; it is noteworthy that not only the efficient market hypothesis, but also all modern financial theories are built on this basis. According to this hypothesis, the stock market set act reasonably in receiving and processing input data and the data promptly after reaching the market and without willingness and special-purpose (bias) reflect on the stock prices. The Standard financial assumptions are left no place for human and cognitive errors in financial decisions [1]

Having a systematic approach to capital markets and its actions and reactions is necessary to achieve a true understanding of it. In today's complex markets, we must know all the influencing factors on the capital market to provide a correct analysis of it. One of the major factors affecting the financial markets is the investors' behavioral actions. This issue is so important and influential that in recent years financial scientists theorized investors' behavioral interactions and placed in a relatively extended context called behavioral finance. Such topics considered in this field are: to what extent individuals' wish to escape from risk in financial markets and when they do, or their behavioral interactions are independent from each other to what extent and how much are related to each other. Many believe that the behavioral finance is application of psychology in finance affairs [1]

Behavioral finance history returns almost to the early 70s. This combined branch of financial science that uses the psychology science in general and sometimes sociology for better analysis of financial markets problems, generally examines the investors' decision-making process and their responses to the different conditions of financial markets and more emphasis on the influence of personality, culture, and investors' judgments on investment decisions. Specific structures of Iranian culture and its influence on the behaviors of individuals and groups of people, makes the necessity of cognition theories and analytical models and cognition behavioral finance inevitable for market participants and stakeholders. Sometimes it can be seen that there is one-way demand and only purchasing or selling in the market instead of two-sided demand and buying and selling at the same time, which is undoubtedly an example of specific behavior patterns of the market. The

Corresponding Author: Hamed Bakhtar, Department of Management, Yasouj Branch, Islamic azad University, Yasouj, Iran.

behavioral finance by formulating behavioral models helps us to recognize our capital markets better and behave better in removing the bottlenecks caused by behavioral models.

The bias is deviation from the correct and optimal decisions. Since time and cognition resources are limited, we cannot optimally analyze the data obtained from the environment; So the human mind naturally uses rules of thumb. If such innovative methods are appropriately used they can be effective, otherwise the inevitable bias will occur. Generally, individuals may make mistakes in the process of thinking and decision-making.

In the decision making science the selection of a strategy among available strategies or prioritizing strategies is raised and it is few years that methods of decision making by multiple indexes of «MADM» have placed in it. The Analytic Hierarchy Process (AHP) has been used more than other methods in management science. The AHP is one of the most popular versatile techniques of decision making that first time was invented by Thomas L. Saati Iraqi-born in the 1970s. AHP reflects normal behavior and human thought. This technique, examines the complex issues, and converts them into a simple form and solves them based on their Interaction effects.

AHP can be used when decision making faced with several competing options and decision criteria. The criteria can be quantitative and qualitative. This decision making method is based on pairwise comparisons lies. The Decision-maker begins by providing Hierarchical decision tree. The Hierarchical decision tree shows the compared factors and evaluated competing alternatives in decision. Then a series of pairwise comparisons performed. These comparisons show the weight of each factor in line with evaluated competing alternatives in decision. The logic of AHP finally combines matrices resulted from pairwise comparisons in a way that an optimal decision reached.

2. Literature:

Studies in the field of behavioral finance is raised in the financial literature from the 80s and since then many studies have been done in this area that the most important researches by the Iranian researchers are as follows:

"Raei" and "Fallahpour", in an article introduced behavioral finance as a different approach in the field of financial, and stated: behavioral finance is a paradigm due to which the financial markets are studied by using models that leave aside the two main and limiting traditional paradigm assumptions -maximization of expected utility and perfect rationality-. Behavioral finance has two main bases, first the limitation of arbitrage, based on which rational investors cannot easily use of arbitrage opportunities because they face with situations of accepting some risks. The second basic of behavioral finance is psychology, by using which the behavior and judgment of investors and their errors when judging are studied. Raei and Fallahpour in this paper, after examining two main bases of behavioral finance, refer to some of their applications. in his article examined the contrast of the modern financial theories with behavioral finance. His theory entitled market anomalies is challenged against another theory named behavioral finance aim to integrate psychology with economics. The purpose of this paper is to review concepts, studies conducted in both fields of the history of their formation, evaluate strengths and weaknesses of both theory and the challenges before them. The final conclusion suggests that in fact the role of behavioral finance to explain the behavior of economic agents is undeniable.

"Eslami Bidgoli" in a book entitled Advanced Financial Management Issues theoretically explained the Behavioral Finance. In addition to express the definitions and opinions of scholars of financial field, like Thaler, Merton and so on about the behavioral finance, he has been trying to provide a paradigm about behavioral finance.

"Fallah and others" in a research examined the factors influencing the investment intention of real investors in Tehran Stock Exchange and to identify factors influencing the investment intention of real investors, a 28-item questionnaire was designed and distributed among the sample consisted of 450 persons. Their findings suggest that financial information of firms and general information published on the market directly and through influencing the investors' expectations, effect on their buying decisions. Also individual needs directly effect on the intention of buying stock. The results showed that the maximum effect on the investment plan respectively belongs to variables: general information (0/5461), accounting and financial information (0/4702), expectations of investors (0/31) and needs of investors (0/24). in a paper examined the factors influencing the decision of shareholders at Tehran Stock Exchange on the basis of the structural equation modeling. Since the behavioral finance of investors and the manner of decision making at Stock Exchange is due to various factors, the mentioned research conducted to identify these factors. First data was collected by using a questionnaire and then factors were identified by using factor analysis method. Then, mentioned factors in the areas of political, economic, psychological factors of market and financial variables in the company with path analysis were analyzed by using LISREL software. Their results show that the political factors, psychological factors of market, economic factors and financial factors in the company respectively have the highest influence on the decision of shareholders in Tehran Stock Exchange.

"Shahr Abadi and other" in an article tried to explain behavioral finance and in addition to express the basis of standard financial theories, showed the behavioral and psychological aspects in areas of financial and

investment and tried to pose the behavioral biases or behavioral characteristics of investors in the financial sphere, academically.

3. Research Method:

In this study, after the determination and classification of behavioral biases affecting investors' decisions in Shiraz Stock Exchange the pairwise comparisons questionnaire was designed and distributed among the financial experts of Stock Exchange to complete. Then the data from the questionnaires were analyzed by AHP with fuzzy approach and ultimately desired behavioral biases are weighted and ratings to the degree of importance of each mentioned biases in the decision making process of investors in Shiraz Stock Exchange be specified.

For data analysis, the questions, the level of assessment and the causal effects of variables should be considered, because each statistical method measure data in a certain level. In the present study the analysis and the observation level of both individuals (the micro level) is considered. The statistical population of study consists of all the financial professionals and experts in Shiraz Stock Exchange.

4. Data analysis:

4.1 Determination of components of the hierarchical structure and drawing the decision tree:

After studying literature and interviewing with financial and Stock Exchange experts, the components of decision tree extracted and its hierarchical structure in the form of three-level, objectives, criteria and sub criteria were designed following the table. The decision tree is shown in Figure.

Hierarchical structure model

| First level: Target	
Prioritization of Investors' behavioral biases in Shiraz Stock Exchange	
Second Level: Criteria (groups of five)	
Cognitive	**Emotional**
➢ Ensure excessive bias ➢ availability bias ➢ conservative bias ➢ mental accounting bias ➢ bias in the estimate (perception after the fact) ➢ cognitive dissonance bias ➢ confirmation bias ➢ self-attribution bias ➢ ambiguity aversion bias ➢ new orientation bias ➢ shape or framework orientation bias ➢ representation bias ➢ leaning and compromise bias (immobilization) ➢ illusion of control bias	➢ Self-control bias ➢ optimism and pessimism bias ➢ regret aversion bias ➢ loss aversion bias ➢ forgiveness bias ➢ bias of maintain the current situation ➢ overreaction to accidental bias
Unusual phenomena (economic behavior)	**Preferential bias (preference or priority)**
➢ abuse effect of placing ➢ fixation bias ➢ preferences with the error limits time ➢ the moment Investment ➢ herd instinct (collectivism behavior) ➢ cost fallacy located	➢ nonlinear probability weighting bias ➢ ambiguity in the value changes bias ➢ bias of using the purchase price as a reference point ➢ bias tends to be short-term rather than long-term perspective ➢ bias of tends to repeat risk ➢ closed framework orientation bias
	Heuristic behaviors ➢ expectations theory bias ➢ Gamblers' illusion (fallacy) bias ➢ money illusion bias

4.2 Doing pairwise comparisons:

Making comparisons made between different decision options, based on each indicator and judge about importance of the decision indicator by pairwise comparisons, after designing the decision hierarchy, the decision maker must create set of matrices that numerically measure relative importance or superiority of the indicators to each other and every decision option with respect to the indicators relative to other options. This is done by making comparisons between the two elements (pairwise comparison) and by assigning a numerical score indicating the superiority or importance of either of the two decision elements.

Valuation indicators relative to each other

Explanation	Comparison of i relative to j	Preferred value
Option or index i to j is of equal importance or have no priority to each other.	equal importance	1
Option or index i to j is a bit more important.	relatively more important	3
Option or index i is more important than j.	more important	5
Option or index i is very important than j.	very important	7

Option or index i to j is absolutely important and not comparable to j.	absolutely Important	9
Intermediate values indicate between the preferred values for example 8, indicating the importance of greater than 7 and less than 9 for i.		2,4,6,8
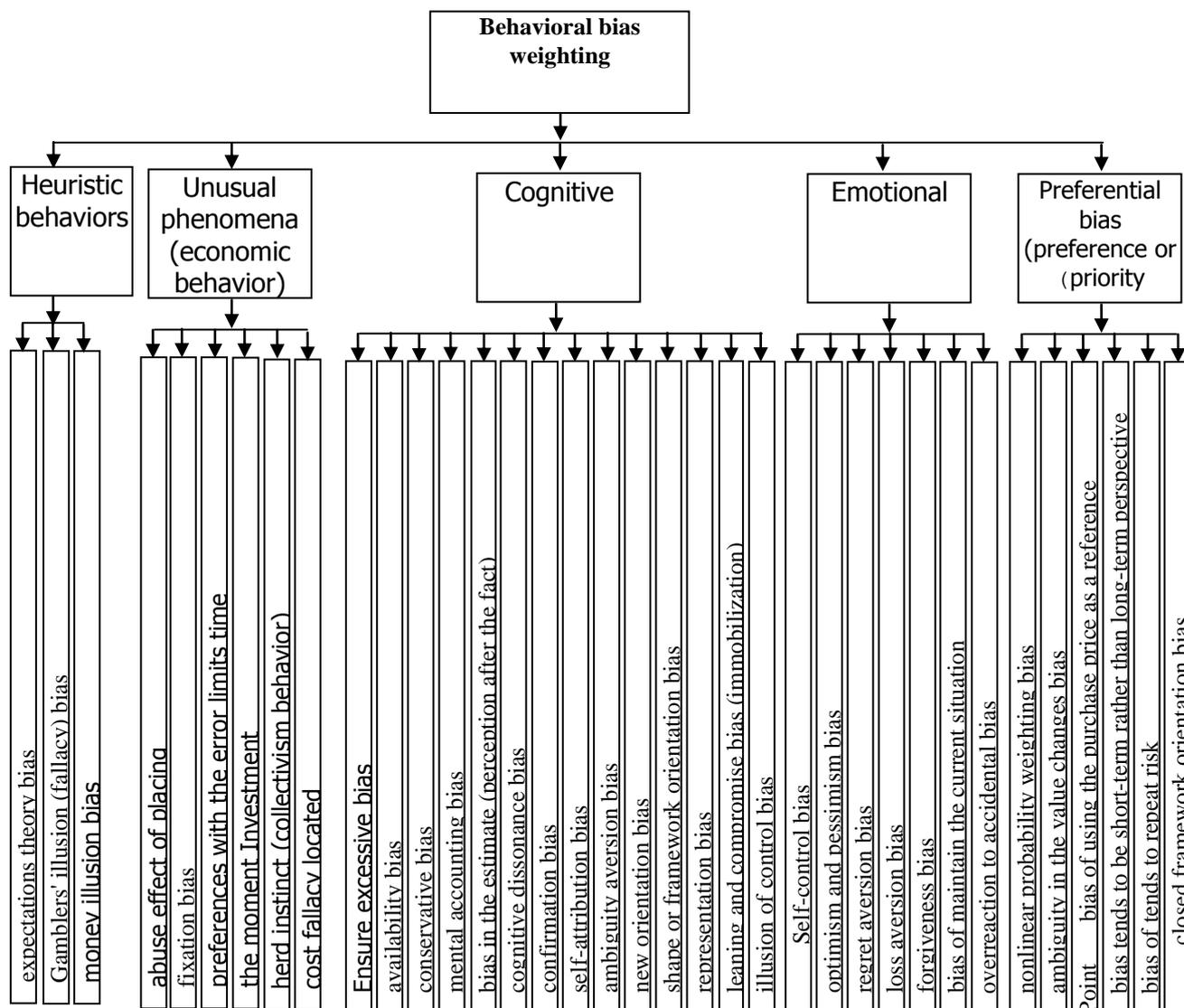
Decision tree

In this step to obtain the relative importance of each criterion and sub criterion respondents were asked. For this purpose, first, 30 questionnaires were distributed between the members of the Statistical population - Financial Experts of Shiraz Stock Exchange- that finally 20 completed questionnaires were collected and analyzed.

4.3 determine the relative importance of 5-fold groups:

The results of the questionnaire after the integration and application of developmental analysis method of Chang by using MATLAB software and also the triangular fuzzy numbers is provided for criteria as specific vector W_1 in following table.

The matrix to determine the relative importance of criteria (groupings of bias)

W_1	Cognitive	Emotional	Unusual phenomena (economic behavior)	Heuristic behaviors	Preferential	weighting Behavioral bias
0/12	(1/08, 1/34, 1/64)	(0/91, 1/26, 1/71)	(0/63, 1/14, 1/65)	(0/94, 1/22, 1/54)	(1,1,1)	Preferential
0/17	(1/46, 2/08, 2/64)	(1/46, 1/82, 2/31)	(1/26, 1/55, 1/91)	(1,1,1)	(0/66, 0/82, 1/06)	Heuristic behaviors

W₁	Cognitive	Emotional	Unusual phenomena (economic behavior)	Heuristic behaviors	Preferential	weighting Behavioral bias
0/19	(1/14, 1/71, 2/24)	(0/91, 1/44, 1/96)	(1,1,1)	(0/52, 0/64, 0/79)	(0/61, 0/87, 1/59)	Unusual phenomena (economic behavior)
0/26	(1/26, 1/78, 2/29)	(1,1,1)	(0/59, 0/69, 1/1)	(0/43, 0/55, 0/68)	(0/58, 0/79, 1/1)	Emotional
0/32	(1,1,1)	(0/44, 0/56, 0/79)	(0/45, 0/55, 0/87)	(0/38, 0/48, 0/68)	(0/61, 0/75, 0/93)	Cognitive

4.4 Adjusting the weights of the sub criteria using the weights of the criteria:

In this step, the elements of the specific vector of weights of the 5-fold groups (criteria) -which is shown in the table - are multiplied by the vector of initial weights of behavioral biases of subgroups to obtain the final weights of behavioral biases. By obtaining the final weights of behavioral biases, the 36-fold behavioral biases can be ranked.

Weights of the 5-fold groups (criteria)

importance weights	Criteria (groupings of bias)
0/32	Cognitive
0/26	Emotional
0/19	Unusual phenomena (economic behavior)
0/17	Heuristic behaviors
0/12	Preferential

Since the weight of Heuristic behavior is 0/15, it is multiplied by the weight Vector of its sub criteria i.e. its behavioral biases of its subset to obtain the final weights which is shown in the table.
Prioritization of 36-fold biases.

final weight	group name	bias name	priority
70%	Emotional	loss aversion	1
60%	Heuristic behaviors	Gamblers' illusion (fallacy)	2
60%	Heuristic behaviors	expectations theory	3
51%	Heuristic behaviors	money illusion	4
41%	Emotional	regret aversion	5
36%	Emotional	maintain the current situation	6
50%	Preferential	ambiguity in the value changes	7
34%	Emotional	overreaction to accidental	8
34%	Emotional	Self-control	9
36%	Unusual phenomena (economic behavior)	herd instinct (collectivism behavior)	10
34%	Preferential	using the purchase price as a reference point	11
34%	Unusual phenomena (economic behavior)	cost fallacy located	12
34%	Unusual phenomena (economic behavior)	abuse effect of placing (By intention)	13
32%	Preferential	tends to be short-term rather than long-term perspective	14
29%	Cognitive	representation	15
29%	Cognitive	new orientation	16
29%	Cognitive	self-attribution	17
30%	Unusual phenomena (economic behavior)	fixation	18
28%	Unusual phenomena (economic behavior)	the moment Investment	19
26%	Cognitive	estimate	20
26%	Cognitive	Ensure excessive	21
26%	Cognitive	ambiguity aversion	22
26%	Cognitive	mental accounting	23
26%	Unusual phenomena (economic behavior)	preferences with the error limits time	24
23%	Emotional	optimism and pessimism	25
21%	Emotional	forgiveness	26
22%	Cognitive	availability	27
22%	Cognitive	conservative	28
19%	Cognitive	illusion of control	29
19%	Cognitive	confirmation	30
19%	Cognitive	cognitive dissonance	31
16%	Cognitive	framework orientation	32
13%	Cognitive	leaning and compromise	33
006%	Preferential	tends to repeat risk	34

final weight	group name	bias name	priority
005%	Preferential	closed framework orientation	35
003%	Preferential	nonlinear probability weighting	36

As shown in Table bias of "loss aversion" of the "emotional" group has the highest degree of importance and the bias of "nonlinear probability weighting" of the "Preferential" group has the lowest degree.

Conclusion:

In ranking the five-fold groups, groups of "cognitive", "emotional", "non-economic phenomena", "Heuristic behavior" and finally the "preferential" are respectively acquired the order of first to fifth. In ranking of the 36-fold bias, "loss aversion" bias from "emotional" group placed in the first position. The bias of "illusion (fallacy) of Gambler" from "Heuristic behavior", "ambiguity in the value changes process" from "preferential", "herd instinct (collectivism behavior)" from "abnormal phenomena (economic behavior)" and the "representative" from "cognitive" group, respectively, placed in the second, seventh, tenth and fifteenth positions. The behavioral biases are not typical only for investors, but professionals also have the same situation. Behavioral biases create decision making errors and a format in which decisions form, impact the manner of looking at risk. The outcome of these cases causes a behavior from the investor that is not accommodating with rational expectations and market efficiency. Given the high priority of cognitive and emotional groups' biases, it can be concluded that there is a strong interrelationship between personality and investors' behavioral biases in Shiraz Stock Exchange They rely more on feelings rather than logical decision makings and scientific calculations, this could be due to the low financial knowledge of investors and due to inappropriate and excessive government interventions. These interventions have caused the market not be in its natural process and so financial and logical techniques not be able to respond the needs of shareholders and they take emotional perceptions excessively to meet their decide needs.

Bias of "loss aversion" will be more in the turbulent and unstable economies Therefore, the top priority of this bias may indicate an unstable climate in Shiraz Stock Exchange is originated from the country's macroeconomic environment and impact on it. It is recommended to investors who suffered this bias, to keep losses shares if ensure that the stock price will go up in future and if the consultant suggested, sell these stocks quickly to avoid further losses. It is also suggested that to sale its profitable shares have enough contemplate to sell it at the best possible time. The status of the first, third and fifth respectively for the biases of "loss aversion", "Theory of expectations" and "regret aversion" could be a sign of bubbles in the stock price and false valuing of stock [2]

The status of the second, sixth and ninth respectively for the behavioral biases such as "gamblers' illusion (fallacy)", "maintain the current situation" and "self-control" represent shareholders lack timely access to accurate information links with companies active in Shiraz Stock Exchange, which led to the wrong decisions. Because the lack of accurate information can lead to errors in the decision making In this field researchers advise to people who do not vote for independence and those who suffer from this bias to do not accept idea with no reason. For example, investors are recommended to avoid this bias when several people advise them to purchase or sell shares, request reason and evidence for proposals and consult with expert consultants.Bias of "self-attribution" and "ultra-reliable" respectively were ranked seventeenth and twenty-first. in their study stated investors with more knowledge are more susceptible than others to expose with ultra-reliable and self-attribution biases. The ultra-confidence leads to exaggerate the accuracy of their personal information, and Self-attribution also leads to pay less attention to the published public information, especially when the mentioned information is in conflict with their personal information.

5. Suggestions:
5.1 Research proposals:

Preparing and approving needed laws and regulations for Shiraz Stock Exchange.
Calculating Shiraz Stock Exchange efficiency by calculating the behavioral biases of the total stock.
The use of other techniques of decision making for ranking behavioral biases of investors.
Examining the effect of Culture of the society on the type and level of behavioral biases of investors.
Identifying and prioritizing the behavioral biases causes of investors of Shiraz Stock Exchange.

5.2 applied suggestions:
1. It is recommended that a study with this subject be done in the country as a whole.
2. The effect of each class of biases in Shiraz Stock Exchange be studied separately.

REFERENCES

[1] Eslami Bidgoli, Gholam Reza, 2009. Topics in the theory and financial management, Termeh Publications, Tehran.

[2] Raei, Reza. And Talangi, Ahmad, 2004. "Advanced Investment Management" Samt Publications.