Questioning the Rationality of Individual Stock Market Investors in the 4.0 Era

Tyas Danarti[1*], Ghozali Maskie[1], David Kaluge[1], Kresna Sakti[1]

[1]*Economics Department, Faculty of Economics and Business, Brawijaya University, Malang, Indonesia*
corresponding email:tyas@ub.ac.id; tyasdanar@yahoo.com

ABSTRACT
Online stock trading technology, on the one hand, is growing by present additional features, which provide investors more accurate investment decisions process, all for the purpose of its growth. Aside from that, neoclassical financial theory concept doesn't provide satisfying clarification for the facts anomalies of stock market, one of which is the hypothesis on efficient market. The unsuccessful attempt of the market to reasonably determine assets price which result in overvaluation/undervaluation is one very prominent fact. It is often forgotten that investor behaviour is a key in market price formation for stock assets, drowned by the understanding that macroeconomic variables predominantly influencing prices on the stock market. The rationality of stock investors' behaviour is the focus which this study attempts to fathom, based on investors being the central role of individuals. Based on the central role of individuals as investors, this study tries to explore the rationality of the behaviour of stock investors. Behavioural finance theory—alongside the existing online trading technology background—are the basis where conclusion of the rationality of individual investors in the stock market can be made. First, psychological dimension adheres to individuals, meaning that investors' stable preference on risk-taking behaviour is not present. Second, heuristic behaviour—the tendency to simplify, reduce, or short-cut when processing information—found in individual investors potentially leads to a bias in risk-taking behaviour. Third, loss aversion is more predominantly found in the risk-taking behaviour by investors than the linearity concept of risk-return.
Keywords- *rationality of investors, behavioural finance.*

1. INTRODUCTION

There are several facts and anomalies in the stock market that have not been satisfactorily answered by traditional financial theories, such as the efficiency market hypothesis. Some very prominent facts are high fluctuations in stock prices, market failures to determine asset prices fairly resulting in overvaluation/undervaluation, and rapid development of online trading technology.

The general condition of the stock market, which is reflected in the composite stock price index, is actually an estuary of the reaction of investors in forming their stock portfolios. Investor behaviour determines the formation of market prices for financial assets, in this case stocks. The discussion of investor behaviour within the framework of the efficiency market hypothesis demands the rationality of investors not to be biased in gathering and processing information, as well as meeting the rules of utility maximization.

Failure to meet assumptions is the main cause of all phenomena in the stock market that cannot be explained by the efficiency market hypothesis, starting from the failure to fulfil the assumption that investor is rational, then, within the framework of behavioural finance theory, investor is assumed to be not entirely rational and even irrational.

Therefore, it is very important to develop research on investor behaviour, especially risk-taking behaviour as micro foundations to understand market phenomena.

It is well known that the mechanism and process of trading on the stock market is loaded with technological infrastructure. Investors will interact with technological features, both the technology used to access and process information and the technology for the sale and purchase of stock. The existence of online trading technology will affect the risk-taking behaviour of investors in their stock portfolios, either directly or through a psychological dimension.

2. THE ABSENCE OF STABILITY PREFERENCE ON INVESTORS' RISK-TAKING BEHAVIOUR

Conventional financial theories including neoclassical such as expected utility theory, subjective expected utility, efficiency market hypothesis, portfolio theory, etc. have strict assumptions about the behaviour of individuals as investors. The assumption is that individual investors act rationally when making decisions. Thus, when investors are categorized as risk averse, their decisions must constantly

avoid risks despite being faced with varying relativities of risk and return. Decisions require stability in preferences towards risk.

Rational decision making based on the efficiency market hypothesis is done by comparing a series of alternative choices with the aim of maximizing utility. The alternative investment choices are also influenced by investor's risk preferences. Investor's risk profile is divided into 3 categories: risk averse, when an individual prefers a condition to definitely get $ 50 than a condition to get $ 100 with a probability of 50% or $ 0 with a probability of 50; risk seeking, individuals who choose conditions of getting $ 100 with a probability of 50% or $ 0 with a probability of 50; and risk neutrality, when individuals assume there is no difference between the two conditions [7]. Furthermore, assuming the stability of preferences for risk and the consistency of decisions causes an investor categorized as risk averse, his decision must remain consistent to avoid risk even if faced with different risk and return relativity.

In the development of financial theory, there are many empirical results that do not meet the assumptions of rationality related to the stability of risk preferences by investors. There are many studies aimed at testing whether individual investor behaviour is consistent with the assumptions in the expected utility theory. One of them was conducted by Kahneman and Tversky as a development of the research conducted by M. Allais (1953). With the hypothetical choice experimental method, the findings are corroborating the results of previous studies that individual behaviour is inconsistent in terms of making decisions in risky conditions. It also found a pattern of decisions that indicate the behaviour of investors who tend to certainty conditions, termed as certainty effects, as well as individual behaviour that tends to the most probable conditions, termed as possibility effect [12].

The certainty effect finding is explained through the results of the experimental questions below.

PROBLEM 1:

A : 2,500 probability .33   B : 2,400 certainly
  2,400 probability .66
  0   probability .01
  N=72
      [18%]   [82%]

PROBLEM 2:

C : 2,500 probability .33   D : 2,400 probability .34
  0   probability .67   0   probability .66
  N = 72
      [83%]   [17%]

PROBLEM 3:

A : 4,000 probability .80   B : 3,000 certainly
  N=95
      [20%]   [80%]

PROBLEM 4:

C : 4,000 probability .20   D : 3,000 probability .25
  N=95
      [65%]   [35%]

In problem 1, 82% of respondents chose situation B. This is in accordance with the concept of efficiency market hypothesis, which states that individuals tend to behave risk averse so that they prefer conditions with smaller risks. While risk is interpreted as the probability of a condition, the greater the probability the smaller the risk. Likewise with the results of problem 3 that were asked to respondents who were different from problem 1, it turned out that 80% chose condition B. Answers from 2 different groups of respondents with the same core question turned out to lead to the same conclusion, namely individuals tend to be risk averse.

Then, for respondents who are the same as problem 1, problem 2 is proposed for answer, and the majority of respondents, 83%, chose condition C, which is relatively more risky (smaller probability). When tested again with questions that are essentially the same in problem 4 with different respondents, the results remained consistent that the majority of individuals chose condition C, which was more at risk.

This fact is certainly not consistent with the concept that individuals are risk averse as has been proven in problem 1 and problem 3. If individuals have consistent and stable behaviour in different situations such as rationality efficiency market hypothesis, then the answer should be condition D, which has a smaller risk (greater probability). Therefore, the concept of efficiency market hypothesis, which states that the behaviour of risk-averse individual will be consistent and stable in different situations, becomes unproven. In other words, the efficiency market hypothesis assumption that individuals are rational (based on stability preferences) is not fulfilled.

From experiments on 2 groups with different questions but with the same goal, it was found that individuals tend to focus on certain results, which are called certainty effects [13]. An individual's choice of definite conditions cannot be a reference for his choice in a risky situation. This means that individuals choosing definite conditions do not mean that they will behave risk averse when dealing with a choice of uncertain conditions.

Furthermore, the findings about the possibility effect are explained through experiments using 2 sets of selected questions posed to 66 different respondents. The questions are as follows:

PROBLEM 5:

A: 6,000 probability .45   B : 3,000 probability   .90
  N=66
      [14%]   [86%]

PROBLEM 6:

C: 6,000 probability .001   D : 3,000 probability   .002
N=66
      [73%]   [27%]

From the majority of respondents' answers on these 2 problems, it is implied that the decision choice motivation is not about whether the individual is risk averse or vice versa. At first glance, if only based on the majority of respondents' choices for problem 1 is B, the momentary conclusions obtained are evidence that individuals behave in risk averse. But when problem 6 is added to be decided by the same

individual, it will be seen that the findings of the results in problem 5 are not about the existence of risk averse behaviour because in problem 6 the majority of individuals choose conditions that give greater results even though the probability is smaller (more risky).

Problem 6 is made with a very small probability, and the difference in probability between conditions is very small (0.001 and 0.002), while the results to be received there are large differences. With this choice condition, it turns out that the main consideration of individuals is to choose prospects (6,000; 0,001) compared to (3,000; 0,002) because of the small possibility to get results (winning) in the two conditions, so that the one that gives the largest prospect value is chosen. Whereas in problem 5, with very large differences in probability (0.45; 0.90), the majority of individuals choose the condition that has the greatest possibility even though it has a smaller prospect value. Individual behaviour that considers the size of the possibility of a prospect when making risky decisions is called the possibility effect [13].

The certainty effect and the possibility effect on investor behaviour when making decisions in risky situations is the answer to behavioural finance theory to explain why individual behaviour is inconsistent as risk averse. Researches conducted by [4] and [2] also concluded that risk averse behaviour is inconsistent, but changes when the relativity of the risks faced is also changing.

3. A BIAS IN RISK-TAKING BEHAVIOUR AS A POTENTIAL RESULT OF THE TENDENCY OF SIMPLIFYING, REDUCING, OR SHORT-CUTTING INFORMATION PROCESSING BY INDIVIDUAL INVESTORS

With the understanding that individuals as economic agents cannot be sterile from the psychological dimension when making decisions, decisions are often based on beliefs about the possibility of an event that contains uncertainty. Behavioural economics provides a conceptual framework from the perspective of psychology through the presence of heuristic variables. Heuristics are defined as simple rules that only require a short time for searching and processing information [11]. In parallel thinking, heuristics also means shortcuts used by individuals to reduce the complexity of the problems encountered [5]. Whereas, [2] stated that heuristics are a rule of thumb to facilitate decision-making processes in complex and uncertain situations. The finding that individuals tend to simplify, reduce, or short cut in processing information is formulated as the law of small number. The concept of the law of small number explains how individual behaviour exaggerates the probability distribution of an event in a small group as a resemblance of the probability distribution of an event for the population. The concept of the law of small number is the foundation of an argument for individual heuristic behaviour.

According to [7], although heuristics are useful in some cases, in certain cases heuristics will cause a systematic error called bias. Kahneman and Tversky first reviewed the potential for heuristic bias, dividing heuristic bias based on the trigger into representativeness bias, availability bias, and overconfidence bias [17]. In the development of behavioural finance studies, especially on heuristics, there are many more specific behavioural biases, but the 3 biases mentioned above are behavioural biases that generally occur.

Representativeness bias can potentially occur when the process of subjective evaluation of the likelihood of an event is determined by the level of similarity [7]. Representativeness refers to the level of similarity of an event or subject to the population [9], or the degree of resemblance between an event and the population. In quantitative domain representativeness can be interpreted as the law of small number, where the sample or small group is considered capable of representing the condition of the population of origin of the sample. The term the law of small number was first coined by Tversky and Kahneman (1971), who assumed that individuals often overestimate the similarity of probability distributions in small groups to the distribution of probabilities in large groups. Therefore, the conditions in the sample are considered to have represented the overall condition of the population from which the sample was taken, or, in other words, the condition of the population will be reflected intact in the condition of the sample. The phrases 'represents the overall condition' and 'reflected intact' are able to describe what is meant by overestimating the law of small number mechanism.

Heuristics are often done by equating the process of assessing similarity with probability assessment. This action is a serious mistake because similarity or representativeness is not influenced by factors that affect the probability. One factor that does not have any influence on representativeness but has a major impact on the probability is the probability that happened before or the average frequency of such events. Therefore, when assessing probabilities using representativeness, prior probabilities are not considered, thus violating the concept of probability itself. Conversely, assessing representativeness using average frequency will obscure the level of similarity to stereotypes. The tradeoff condition between the use of probability and the average frequency is an indication that heuristic representativeness will cause bias.

There is a statement that representativeness sometimes results in bias when individuals put more emphasis on recent events or experiences and deny long-term average conditions [19]. At first glance, the statement seems to contradict the statement of [11] that representativeness is not influenced by the average frequency. However, what is actually meant by long-term average conditions [19] is a depiction of the stability of behaviour patterns or stability of stereotypes. Furthermore, representativeness can also encourage "negative sample size" when the sample size is too small to be used as a reference [3]. When investors are only fixated on a rising stock and ignore the stock performance history, the situation is referred to as bias caused by representativeness. The representativeness behaviour

explains the excessive behaviour of investors in reacting to buying and selling shares [9].

Availability bias occurs when investors exaggerate the possibility of the latest observations or experiences because they are still deeply imprinted in memory [6]. In line with this definition, [16] stated that availability heuristic is a rule of thumb used by decision makers to assess the class frequency or likelihood of an event based on the events that are easiest to remember or most quickly occur in thought. Such behaviour is reasonable because a frequent event is more memorable than a rare event.

When availability heuristic is applied to stock selection, the question that arises is how investors choose certain stocks from hundreds of shares listed on the stock market. Various media provide reviews about stocks that have good/bad prospects or about issuer's decreasing/increasing financial performance, or company's strategy that is being carried out. The intensity of the news and how provocative the news about these stocks will affect individual memory, and, when it came to making a decision, the choice will fall in the most memorable stocks [16]. In fact, there is a research by Gadarowski in [16] regarding the relationship between stock performance and the intensity of the news, the results turned out to be stocks that are often reported to have underperformed performance.

Furthermore, regarding the broader definition of availability bias, [20] stated that availability bias is a situation when decision makers (investors) prefer to base their knowledge and available procedures rather than to look for alternatives. Based on this definition, there is an expansion of "availability", not only to information but also to procedures to find and process information which is then used to analyze stocks and leads to stock selection decisions.

Regarding the stock analysis method, it is theoretically distinguished between fundamental and technical analysis. Availability bias is vulnerable to occur in the technical analysis phase; this is because investors tend to use the same method because skills in use increase as the intensity of usage increases. The use of a limited analysis method increases the chance of receiving a false signal because it is not confirmed with alternative technical analysis methods.

Overconfidence bias is intended when an investor overestimates the reliability of his knowledge and skills (Thaler 1999). There are two types of overconfidence. The first is called miscalibration, i.e. when people feel that they know more than actually known, or when the individual is redundant in assessing the accuracy of knowledge, thus ignoring the possibility of a risk. Nevertheless, there are findings that education has the effect of reducing miscalibration [15]. The second is called better than average effect, i.e. when someone has confidence that he is better than average [7]. When investors overestimate their ability to produce information or to identify the significance of the existing data, and the data is not captured by other investors, there is a tendency to ignore the possibility of investors estimation error which can result in losses.

In general, the overconfidence model predicts that investors who have overconfidence behaviour can over-sell shares that cause losses [1]. The loss is the implication of overconfidence bias that causes people underestimate the

risks involved [6]. In line with this thinking, [5] stated that one of the manifestations of overconfidence is an undiversified portfolio. It was also stated by [17] that excessive stock trading is the effect of overconfidence behaviour of investors. The statement is also in line with the findings of [8] that overconfident investors tend to buy and sell stock with high frequency.

4. LOSS AVERSION IS MORE PREDOMINANTLY FOUND IN THE RISK-TAKING BEHAVIOUR BY INVESTORS THAN THE LINEARITY CONCEPT OF RISK-RETURN

The concept of loss aversion explains that individuals interpret differently between losses and profits. Losses have more impact than profits, so the psychological rejection of a loss is much stronger than the desire to achieve profit. The loss aversion phenomenon implies that individuals prefer a probability of above 50: 50 for an alternative event with the same absolute value [14]. This statement is in accordance with the experiment results of [10], where 80% of respondents chose the definitive results of $ 3,000 rather than 80% probability of getting $ 4000 or 20% of not getting any. Meanwhile, when faced with the choice at a loss, 92% of respondents prefer an 80% probability of losing $ 4000 and 20% of not losing anything in comparison with the condition of certainly losing $ 3000. In 2 cases of all respondents choosing the condition with a lower expected value, this would not be consistent with the expected utility theory that individual will maximize utility.

The concept of loss aversion states that individual behaviour is more sensitive to losses than to gains condition although the magnitude of the losses and gains have the same value and very small [2]. It can be said that individuals interpret differently between losses and gains. Losses have more impact than profits, so the psychological resistance to loss conditions is much stronger than the desire to achieve gain [18].

The manifestations of loss aversion in stock investor are disposition effect, in that investors tend to sell stocks that have risen in value since it was purchased rather than to sell stocks that are declining. Disposition effect as a manifestation of resistance to loss conditions which is much stronger than the desire to achieve a gain certainly have an impact on investor's risk-taking behaviour. Risk-taking behaviour that arises is that the more reluctant to bear the risk of loss is when the greater the gain obtained, but the more willingness to bear the risk is when faced with a greater loss.

5. CONCLUSION

Conclusion in regard to the rationality of individual investors in the stock market can be made. First, psychological dimension adheres to individuals, meaning that investors' stable preference on risk-taking behaviour is not present.

Second, heuristic behaviour—the tendency to simplify, reduce, or short-cut when processing information—found in individual investors potentially leads to a bias in risk-taking behaviour. Third, loss aversion is more predominantly found in the risk-taking behaviour by investors than the linearity concept of risk-return.

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