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Research Paper

A Study on Statistical "Z Test" to Analyse Behavioural Finance Using Psychological Theories.

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ABSTRACT:- A remarkable feature of modern financial markets is the huge amount of trade that is carried out not only by institutions who have informational advantage in trading but also by individual investors who are likely to be less knowledgeable about financial markets. The efficient market hypothesis that has been the building block of traditional finance theory would suggest that there should be very little trade in financial markets as information gets quickly incorporated into prices leaving less opportunity for gainful trade among investors. Of course, a certain amount of trade is bound to happen for new information to get incorporated in stock prices. Behavioural finance offers insights and plausible explanations of why we can expect to see such behaviour on the part of investors. Investors often update their beliefs in a way which is influenced by various biases inherent.Approaches based on perfect prediction, completely flexible prices, and complete knowledge of investment decisions of other players in the market' are increasingly unrealistic in today's global financial markets. Behavioural finance is a new perspective of financial theory, which seeks to understand and predict systematic financial market implications of psychological decision-making. By understanding the human behaviour and psychological mechanisms involved in financial decision-making, standard finance models may be improved to better reflect and explain the reality in today's evolving markets.

I. INTRODUCTION

A ***Z*-test** is any statistical test for which the distribution of the test statistic under the null hypothesis can be approximated by a normal distribution. Because of the central limit theorem, many test statistics are approximately normally distributed for large samples. For each significance level, the *Z*-test has a single critical value (for example, 1.96 for 5% two tailed) which makes it more convenient than the Student's *t*-test which has separate critical values for each sample size. Therefore, many statistical tests can be conveniently performed as approximate *Z*-tests if the sample size is large or the population variance known. If the population variance is unknown (and therefore has to be estimated from the sample itself) and the sample size is not large ($n < 30$), the Student's *t*-test may be more appropriate.

The traditional finance theory and research believe that investors always try to maximize their utilities by compromising their feelings and emotions. The traditional finance theory has always ignored the investors' psychology (Kadir Can YALCIN) and believed that humans are emotionless. In contrast to traditional finance theory, the behavioural finance theorist believes that individuals suffer from irrationality at a time of decision making. According to behavioural finance theory, investors' psychology can be classified as overconfidence, optimism, hindsight, overreaction to chance, errors of preferences, regret of omission & commission, regret & risk taking (Daniel and Mark, 1998). According to Kahneman D and Amos (1979) individuals' investment decisions are not rational. Their decisions are affected by inevitable cognitive and emotional biases which make their decisions irrational. This phenomenon is more relevant in case of stock market investors' behaviour. The different studies have opposite conclusions, e.g. Jegadeesh and Titman (2001) found the momentum effect as a cause of irrational behaviour in the stock market while in against of that Daniel and Titman (2000) found strong momentum in growth stocks compare to value stocks which shows rational behaviour of investors. Majority of the research were done with the help of stock market data but there was no direct interaction with investors. Some factors for irrational behaviour in the stock market were witnessed but it could be inappropriate and injustice to generalize and extrapolate those factors. With an objective to study natural effect of psychological biases on investors' decisions, this study examines the investors' behaviour with the help of different

behavioural finance theories viz. overconfidence, disposition effect, conservatism, cognitive dissonance, rationality and regret theory.

1.1 Behavioural Theories

Behavioural finance attempts to explain and increase the understanding of reasoning patterns of investors, including the emotional processes involved and the degree to which they influence the decision-making process. Essentially, the behavioural finance attempts to explain "what", "why", and "how" of finance and investment, from a human perspective. Ricciardi and Simon (2000) discussed some general principles of behavioural finance including the overconfidence, financial cognitive dissonance, the theory of regret, and prospect theory, and compare it with modern portfolio theory and the efficient market hypothesis. Raiffa (1968) introduced 3 approaches for analyzing decision making of investors. First, the Normative Analysis which is the rational solution to the decision problem. Second, the Descriptive Analysis is the way in which real people actually make decisions and third, prescriptive Analysis is which is concerned with practical advice and help that people could use to make more rational decisions. Kahneman (1998) explained the concept of beliefs, preferences, and biases of investment advisors should know about.

1.1.1 Regret Theory

According to Investopedia "simply regret theory deals with the emotional reaction people experience after realizing they've made an error in judgment. Faced with the prospect of selling a stock, investors become emotionally affected by the price at which they purchased the stock. So, they avoid selling it as a way to avoid the regret of having made a bad investment, as well as the embarrassment of reporting a loss."

1.1.2 Conservatism

Conservative is simply means traditional. Conservatism as psychological attitude means human being has some excess attachment to the things which they have already with them. And if something new is offered to them then they are not ready to accept that new thing or slowly and gradually they accept that new thing. Edward (1962) explains conservatism bias. It means "Investors are too slow (too conservative) in updating their beliefs in response to recent evidence. This means that they might initially under react to news about a firm, so that prices will fully reflect new information only gradually. Such a bias would give rise to momentum in stock market returns."

1.1.3 Rationality

A rational decision is one that is not just reasoned, but is also optimal for achieving a goal or solving a problem. Rabin (1998) discussed and compared the view of economist and psychologist and concluded that in short duration investors were irrational but in long duration the human nature became rational. Sevil, Sen and Yalama (2007) surveyed and analysed the attitude of investors of Istanbul Stock Exchange. Through the questionnaire they examined the prospect theory, regret aversion, cognitive dissonance and heuristics. They found that investors were not totally rational.

1.1.4 Disposition Effect

The common behaviour of investors to hold looser stocks too long and sell the winner stock too early is called disposition effect (Grinblatt and Han, 2002). Investors may rationally, or irrationally, believe that their current losers in future will outperform their current winners. They may sell winners to rebalance their portfolios or they may refrain from selling losers due to the higher transactions costs of trading at lower prices. The disposition effect was studies by Odean (1998). He analysed 10,000 trading accounts and their trading pattern. He found that the investors demonstrate a disposition effect; it means hold losing investment too long and sells winning investment soon.

1.1.5 Overconfidence

Overconfidence defines as "an overestimation of the probabilities for a set of events by Mahajan, J. (1992). Operationally, it is reflected by comparing whether the specific probability assigned is greater than the portion that is correct for all assessments assigned that given probability." J. Michailova (2010) tests the overconfidence bias among the gender with the help of questionnaire of 50 questions. She concludes that there is no significant difference among expressed overconfidence by both the genders and they did not appear to be associated with overconfidence.

1.1.6 Financial Cognitive Dissonance

As individuals, we attempt to reduce our inner conflict (decrease our dissonance) in one of two ways: 1) we change our past values, feelings, or opinions, or, 2 we attempt to justify or rationalize our choice. This theory may apply to investors or traders in the stock market who attempt to rationalize contradictory behaviours, so that they seem to follow naturally from personal values or viewpoints. Goetzmann and Peles (1993) explain the cognitive dissonance. According to them, an individual try to reduce his/her inner conflict by changing their past values, feelings or opinion or he/she attempt to justify his/her choices.

1.1.7 Prospect Theory

Prospect theory deals with the idea that people do not always behave rationally. This theory holds that there are constant biases motivated by psychological factors that influence people's choices under conditions of uncertainty. Prospect theory considers preferences as a function of "decision weights," and it assumes that these weights do not always match with probabilities. Specifically, prospect theory suggests that decision weights tend to overweigh small probabilities and under-weigh moderate and high probabilities. Kahneman and Smit (2002) had used insights from cognitive psychology regarding the mental processes of answering questions, forming judgments, and making choices, to help us better understand how people make economic decisions. The explained heuristics and biases, prospect theory, decision making differences according to economy and psychology. Schwarz (1998) conclude that if investors faced with the possibility of losing money they often take a riskier decisions aimed at loss aversion. So, investors' prospects changed according to the probabilities of being in profit or loss.

1.1.8 Herd Behaviour

Herding occurs when individual's private information is overwhelmed by the influence of public information about the decisions of a herd or group. Evidence of group influence in many economic and financial decisions is consistent with bounded rationality: in an uncertain world, if we realise that our own judgment is fallible then it may be rational to assume that others are better informed and follow them (Keynes 1930, 1936, 1937). Herding occurs when individuals mimic others, ignoring their own substantive private information (Scharfstein and Stein 1990). Be it the Dotcom Boom or MMTC going up to 5600 in 2007 it is due to the herd mentality of the investors. The circuit filters of stocks are also evidences of presence of herd behaviour in investors.There are a couple of reasons why herd behaviour happens.

The first is the social pressure of conformity. You probably know from experience that this can be a powerful force.This is because most people are very sociable and have a natural desire to be accepted by a group, rather than be branded as an outcast. Therefore, following the group is an ideal way of becoming a member

The second reason is the common rationale that it's unlikely that such a large group could be wrong. After all, even if you are convinced that a particular idea or course or action is irrational or incorrect, you might still follow the herd, believing they know something that you don't. This is especially prevalent in situations in which an individual has very little experience.

II. FORMATION OF RESEARCH PROBLEM

The purpose of this study is to find out if buying behaviour or investment behaviour is affected by psychological aspects of the mind with the help of psychological theories. The research will also determine the extent to which these behaviour affects an investment decision made by an investor

2.1 Objective of Study

The primary objective of the study was to understand the behaviour of investors with the help of different behavioural finance theories. The theoretical concept of different behaviour finance theories like disposition effect and herd behaviour theory were used to understand the investors' behaviour.

2.2 Scope of Study

The scope of study is restricted to the investors of Mumbai. The views of people who actually invest their money is taken into consideration.

2.3 Statement of Hypothesis

Hypothesis is usually considered as the principal instrument in research. Its main function is to suggest new experiments and observations. Hypothesis should be limited in scope and must be specific. There are two types of hypothesis:

- Null hypothesis.
- Alternative hypothesis.

Ho = 60% investors are affected by Disposition Effect.
Ho = 60% investors are affected by Herd behaviour.
The behaviour can't be 100% same for all situations and for all human being. So for hypothesis testing, 60% was taken as a benchmark for getting inventors' behaviour. The alternative hypothesis for all Ho was "less than 60%."

2.4 Data Collection

Data for study was primarily collected through a survey in the form of questionnaire as well as through the secondary data, research based on existing material concerning behavioural finance and historical data.

Primary data - Primary data refers to data, which is collected for a specific purpose and which is required in order to support secondary data. The primary data in research consists of survey in the form of questionnaire.
Secondary data - Secondary data refers to the existing collected and summarized material of the subject. This data is collected from sources such as databases, literatures, journals and the internet.

2.5 Research Instrument

Research deals with the factors affecting individual investor's financial decision-making.
The questionnaire consists of questions which are to be filled by person having knowledge of the financial market above the average knowledge of randomly selected person from Mumbai population.
The research instrument, used wasquestionnaires which consist of 5 questions.

2.6 Research Design

The formidable problem that follows the task of defining the research problem is the preparation of the design project, popularly known as the "research design." Decisions regarding what, where, when, how much, by what means concerning an inquiry or a research study constitute a research design. Thus a research design is the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure.

The study was done to find out whether theories like 'Disposition Effect' and 'Herd Behaviour' affect the investor's decision while making an investment.Thus the research proposed was Descriptive cross Sectional in nature.

2.7 Sampling Plan

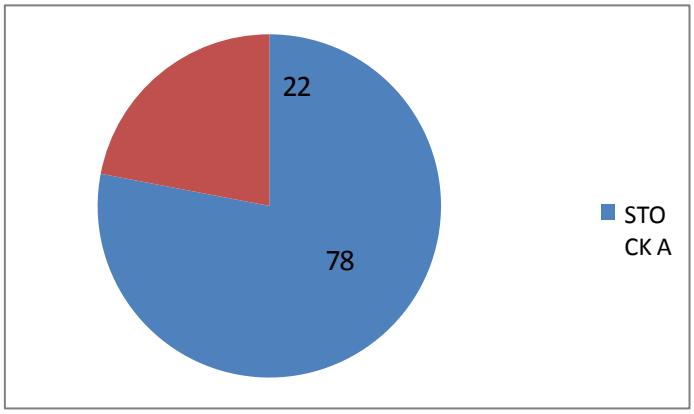
The survey was conducted in the city of Mumbai. People showing interest towards investments. Questionnaire was filled by person having knowledge of the financial market above the average knowledge of randomly selected person from Mumbai population. Questionnaire was filled by100 investors actively participating in investing practice.

2.8 Limitation of Study

- The research was limited to the investors in Mumbai only.
- Only 100 surveys were taken into consideration.
- Survey was limited to "investors" only.

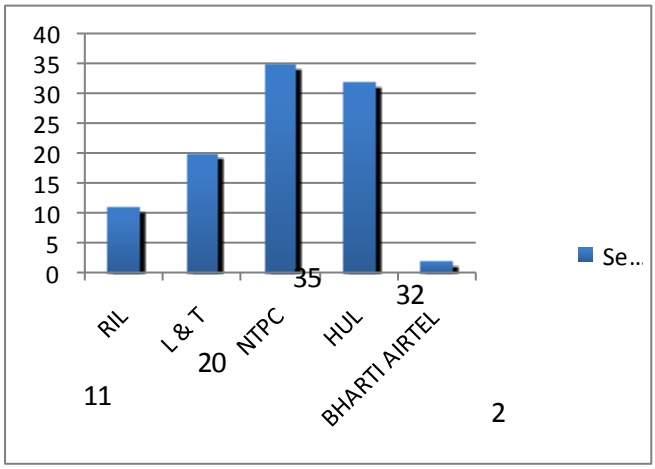
III. DATA ANALYSIS AND INTERPRETATION

1. You bought share A for Rs.350 which is currently being sold @ Rs.400 & share B for Rs.500 which is also currently being sold @ Rs.400. You are in need of money. Which share would you like to sell?



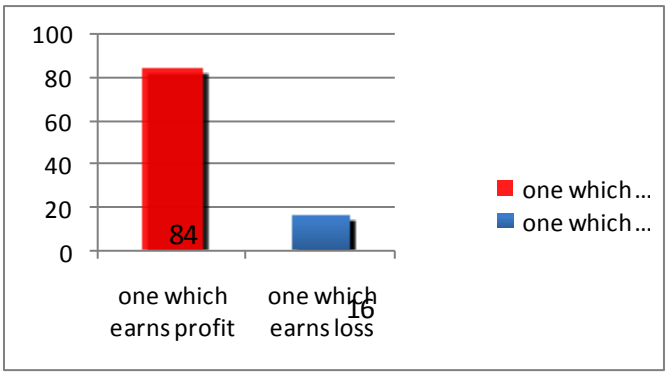
Out of the 100 people surveyed 78% (78 people) selected or chose stock "A" to sell when given a situation as stated above while only 22% (22 people) chose stock "B"

2. You are having following stocks in your portfolio. You are in need of Rs. 1,50,000. Which stock would you like to sell?



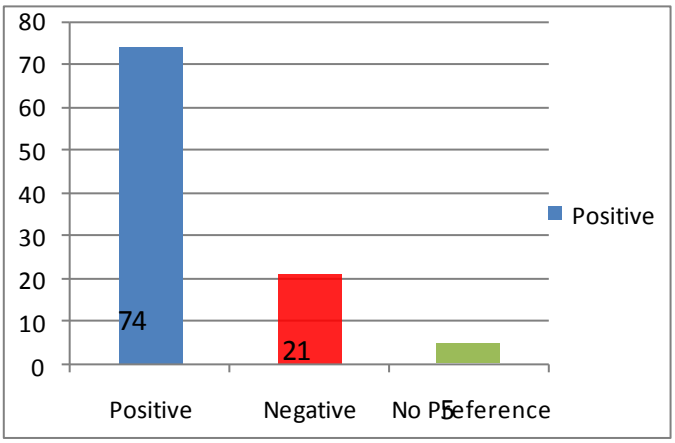
In the above given situation 35% of people chose NTPC shares, 32% people chose HUL shares,
20 % people chose L & T shares while hardly a few people chose RIL's and BHARTI AIRTEL's shares amounting to 11% and 2% respectively.

3. In the period of high volatility market, which group of stock would you prefer to sell?



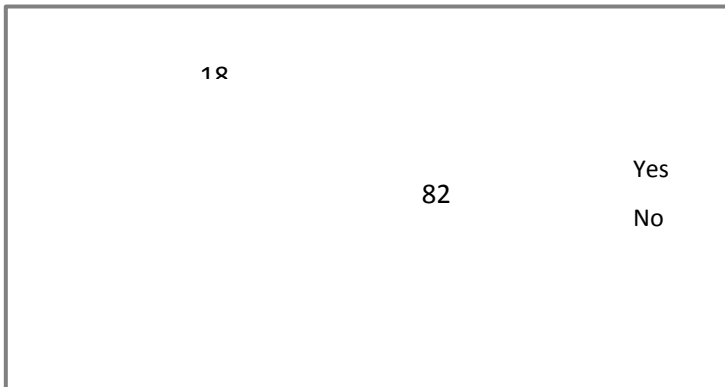
From the above graph it can be easily seen that in a period of high volatility market 84% of the 100 surveyed people opted to sell the shares which would earn them profit while the rest went for option B i.e. one which earns loss.

4. When you are uncertain about investing in Co X's stock and suddenly your colleagues and competitors buy the stock in bulk. How does this affect to you?



It can be clearly seen from the above bar graph that people follow what others choose. They follow the herd. 74% of the 100 surveyed people showed positive effect towards the above question while 21 % people stated that they were not affected by it and 5% of the people didn't have any answer for the question.

5. If a big brokerage house buys stock of a company in bulk, would you buy the stock of the same company?



82 % of the people chose option A while a mere 18% of the people chose option B.

Hypothesis Testing

Let, P = be the factor of "less than 60%"

& Po= 60%

If "H_0" is false then the equation " $Z < -Z\alpha$ " should be satisfied. This is applicable to both the tables.

Hypothesis 1:- 60% investors are affected by Disposition Effect.

Table 1 - Affected by Disposition Effect.

Question no	Option for Disposition Effect	Disposition Effect	No Disposition Effect	Total
1	1	78	22	100
2	2,3 & 4	20+35+32 = 87	11+2 = 13	100
3	1	84	16	100

The disposition effect means sell the winner stock too soon and hold the looser stock too long. To check the disposition effect 3 questions were formed in a case form. Investors were asked about their decision for holding or selling winning stock and looser stock. The investors who prefer to sell winning stock and ready to hold looser stock were categorized as investors affected by Disposition Effect.

N=100, x=(249/3) = 83, p^ =83/100=0.8300, p=.60, q=.40, □ = 5%,
confidence level =95%

$Z_{cal} = \frac{p\hat{}-p}{\sqrt{pq/n}}$

$= \frac{0.8300-0.6000}{\sqrt{(0.60)(0.40)/100}} = \frac{0.23}{0.0489} =$ **4.7034**

Z_{tab} at 5% LOS from the normal table is = -1.64, therefore $Z_{cal} > Z_{tab}$

Reject H_0

Thus 60% investors are affected by Disposition Effect.

Hypothesis 2:- 60% investors are affected by Herd Behavior.

Table 2 - Affected by Herd Behavior.

Question no	Option for Herd Behavior	Herd Effect	No Herd Effect	Total
4	1	74	21+5 = 26	100
5	1	82	18	100

The herd effect means to watch what other people do and act just like them. Be it any action or any decision regarding investment. To check the herd effect 2 questions were formed in a case form. Investors were asked if they would buy a company's shares only because their peers or a big brokerage company has bought the shares in bulk. The investors who preferred to buy the stock and followed the actions of others were categorized as investors affected by Herd Behavior.

N=100, x=(156/2) = 78, p^ =78/100=0.7800, p=.60, q=.40, □ = 5%,

Confidence level =95%

$Z_{cal} = \frac{p\hat{}-p}{\sqrt{pq/n}}$

$= \frac{0.7800-0.6000}{\sqrt{(0.60)(0.40)/100}} = \frac{0.18}{0.0489} = 3.6809$

Z_{tab} At 5% LOS from the normal table is = -1.64, $Z_{cal} > Z_{tab}$

Thus Reject H_0

Therefore 60% investors are affected by Herd Behaviour.

IV. CONCLUSION

1. Though the above examples of illusions are widely observed, behavioural finance does not claim that all the investors will suffer from the same illusion simultaneously.
2. The susceptibility of an investor to a particular illusion is likely to be a function of several variables. For example, there is suggestive evidence that the experience of the investor has an explanatory role in his regard with less experienced investors being prone to extrapolation (representativeness) while more experienced investors commit gambler fallacy.
3. Similarly, behavioural factors play a vital role in the decision making process of the investors. Hence the investors has to take necessary steps to minimise or avoid illusions for influencing in their decision making process, investment decisions in particular.
4. From the above graphs and research we can conclude that most of the investors are affected by "behavioural finance". Though the scope of study is limited to Mumbai, it is found that investors here are affected by risk aversion r disposition effect behaviour and herd behaviour.

V. RECOMMENDATIONS

The following suggestions are made on the basis of finding of the study to avoid mistakes in financial investments decisions by applying behavioral finance:

1. Fundamental Analysis, alone can lead to wrong conclusions. The Psychological mood of the market should be studied before making investments.
2. Check the source of your information, before reacting to it. The announcements from the companies should be sufficiently adjusted in the portfolio as soon as possible
3. The losing stocks should be disposed of if there is negative news associated with it.
4. Anchoring to an expectation can be reasonable, but the quality of anchored figure can beinsufficient and should be checked.

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