



The New Era of Finance: Neurofinance and Investment behavior

Dr. Priya Jinda*

Assistant Professor
MMIM,MMU, Mullana

Shilpa Bahl**

Research Scholar
MMIM,MMU, Mullana

Article history:

Received July 16th, 2016;
Approved July 25th, 2016;
Available online: Aug 2st, 2016.

Keyword :

Human Mind,
Investment Decision Making,
Neurofinance,
Neuroscience

Abstract

This paper highlight the effect of neurofinance which is the study of brain of humans and their financial decision making behavior which explains the cause why humans are not balanced as per the rules of the conventional theory of finance. We have tried to explain and present the literature review and fusion of the literature on neurofinance in this paper.

Neuroscience is the subject which studies the functioning of human mind and how the financial decisions making process are influenced by the affective of neurological basis. When the neuroscience is studied with respect to investment environment, it is explained in form of Neurofinance. In this paper, role of important brain parts and enzymes like, **Dopamine, Serotonin, Amygdala, Prefrontal Cortex** etc at the events of loss, gain or volatility of stock price etc has been discussed.

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Authors Correspondence :

Shilpa Bahl*

MMIM,MMU, Mullana
Research Scholar

Introduction

On a regular basis it has been found that, the decisions made by the investors are rational in nature. According to Markowitz (1952), he proposed the modern portfolio theory (MPT), which shows that when rational investors make a decision for selection of portfolio is mainly depend on the two categories, that is projected rewards and variations which helps to optimize their portfolios they should diversify them. MPT is based on the expected utility theory; the biggest disadvantage of this model is that it fails to explain how investors make their decision in reality, where individuals disobey the rules of expected utility. It can be clearer from this example as many investors are comfortable to invest in some category and do not diversify their portfolio and these types of investors are not risk averse. Therefore, to choose the optimal portfolio with the help of efficient deviations, gave rise to new era of finance i.e. behavioral finance and behavioral economics. According to Kahneman and Tversky's (1974, 1979), they work on behavioral finance studies, in which they discussed about the different biases, heuristics and prospect theory which tells about the investors behavior and decision making by them in indecisive and uncertain situations, they also enlighten the performance of the investor while making the financial decisions but they fail to clarify why and how these behaviors occur (Edwards, 2004; Tseng, 2006; Kuhnen, 2007; Sapia and Zak, 2008). The study of human brain gives the clarification why and how of financial decision making behaviors occurs. To understand the human financial decision making behaviour more enormously, it gave a rise the study of field called neurofinance. Neurofinance is the study of brain of humans and their financial decision making behavior which explains the cause why human's behavior are not balanced as per the rules of the conventional theory of finance. We have tried to explain and present the literature review and fusion of the literature on neurofinance in this paper. Neurofinance has developed out of neuroscience which tries to explain the working of the brain of the humans when decisions are taken by them. It also studies about the behavior of the investors prior to making the choice of the investment. With the help of neuroscience researchers, it helps to tell about the how affect influences the financial decision making and many psychological biases which also influence the decision choices.

Neuroscience is the subject which studies the functioning of human mind and how the financial decisions making process are influenced by the affective of neurological basis. According to (Peterson, 2007a, b), in his research he emphasize on decision making process with the help of

innovative tools and knowledge available, it also observed the transform in the brain which can be experiential in real time which helps to understand the process of decision making.

According to neuroscience, the human brain is categorized into three main parts.

1. The forebrain
2. Mid-brain
3. Hind-brain

The largest and rational part of the brain is known as forebrain. The forebrain is also known as the cerebrums which consist of the cortex and the limbic system. According to (Morse, 2006; Peterson, 2007a, b), the cortex contain of the neopallium and the prefrontal cortex, is connected with advanced brain functions which includes thinking and action and because of it is also known as the balanced part of the brain. The limbic system is called as “expressive brain” which is consists in the handing out of the feeling and also carries the memories. The limbic system is the foundation of ancient inspirations and feelings which includes fear and enthusiasm, it also carries the insula and nucleus accumbens. The fore brain helps in while taking a financial decision and the expressive part of the brain, which is common between animal and human beings and is measured more ancient and the cognitive part of the brain, it is the part which is more energetic in the human beings, which is also taken as the superior brain, is of present origin.

The function of body we do such as mental picture, hearing, eye movement and body movement is because of the mid-brain which consists of the tectum and tegmentum.

The hind-brain consists of the cerebellum which is known as little brain, the pons and the medulla oblongata, which works simultaneously to maintain vital bodily processes.

The main purpose of this paper is on development of neurofinance as a field of study to understand the behavior of the investor and the process of choice of the investment decision.

Neurofinance: An Overview

Neurofinance is an emerging field which provides lots of explanation of the investor’s behavior by using the tool of Neuroscience. In other way, neurofinance can be explained as a discipline which attempts to give a better understanding of human decisions related to money by using brain science and economic theory.

Questions like,

Role of emotion in decision making?

What people think about an uncertain decision?

People's feelings towards risk, are of interest for a wealth manager as well as a neuroeconomist.

At the instance of investment decision making, investors encounters with the emotions like anxiety, fear, happiness, feeling of satisfaction or dissatisfaction with the returns generated by their investments. The above mentioned feelings are also associated with the risk component of the investment alternatives.

Now we will discuss above mentioned feelings with reference to neurophysiology and their implication on investor behavior. Neurophysiology deals with the structures and secretion from brain responsible for investor behavior.

Neurofinance has come forward as a derivation of neuroeconomics and field to the study and relevance of neuroscience while taking a investment decision making by the individual investors. The main purpose of the study of neurofinance is to concentrate on the monetary decision making while studying the execution of the brain when it stumble upon a financial decision choices. Techniques to determine the brain activity are various and comprise of functional magnetic resonance imaging (fMRI), positron emission tomography, EEG, eye tracking or blood pressure.

Literature Review

Kuhnen and Knutson (2005), they are the first one who develops the neurofinance study by using brain. In their study they present the function of sentiments in financial decision making. Their assessment of brain imaging studies analysis that "affect suggest by the expectation of achieve and defeat may bear distinct neural signatures".

Lo et al. (2005) also emphasize the function of sentiments method in financial decision making and also originate that the investors respond to both financial gains and losses, underneath the outlook

that two impetus forces are also part of the limbic system of the brain conduct the individual's decision under threat and ambiguity.

Morse (2006), in his paper he stated that the more active the primeval, risk-anticipating brain area, the more risk reluctant the investors are.

Peterson (2007a, b), in their research they present the two neurotransmitters namely dopamine and anterior insular. The dopamine (also called the delight element of the brain) which is linked with craving and serotonin which is linked with shyness. The anterior insular is linked with expressive experience and mindful thoughts, which includes feelings of hurt, rage, pleasure, repulsion, terror and irritation.

Stenstrom and Saad (2011), in their analysis on testosterone, risk-taking and betting and establish that, "high-testosterone investors have a higher craving for monetary risk-taking and are more probable to surrender to definite impulsivity-related pathologies".

Objectives

1. To present a analysis and creation of the literature on neurofinance.
2. The relation between neurofinance and investment decision of the investors.
3. To present the difference between standard finance, behavioral finance and neurofinance.

Neuro finance and Investment Decisions

Usually we find that investor's behavior is affected by certain emotions. Optimistic expressive states such as enthusiasm leads to risk taking behavior and to be overconfident in their capacity to estimate investment choices as compare to pessimistic emotions such as nervousness have the contradictory effects like over investigation, framing etc. Beliefs also play important role in indentifying any decision making process. Beliefs are mental state which forces to continue a optimistic expressive state by overlook that piece of information which contradicts with individuals' prior choices. Cognitive Dissonance is one behavioral bias developed because of beliefs and the discomfort developed at the time of contradiction of belief and the latest information. The physiological process of developing such cognitive dissonance in investment environment can be well explained in form of Neuroefinance.

Now we will discuss above mentioned feelings like overconfidence, risk aversion, mental accounting, anxiety etc with reference to neurophysiology and their implication on investor behavior.

Neuroscience deals with the structures and secretion from brain responsible for investor behavior.

Brain secretions responsible for Investor behavior

- **Role of Dopamine**

Dopamine is a chemical secreted in brain at the time of a feeling of pleasure. More quantity of dopamine is secreted at the time of unexpected profits earned easily. At the same time when investors face an unexpected loss, the secretion of dopamine completely stops, and the person feels depressed.

Suggestion on Investment Decisions

As Dopamine is responsible for the feeling of pleasure and depression, dopamine influences the risk taking behavior of investors. Dopamine secretion rests on an increased level when the predictions made by investors are bringing gains to him, where as dopamine level reduces to a great extent if the predictions bring losses. Dopamine is responsible for behavioral biases like Herd Behavior, Overconfidence and Optimism in the investors.

- **Role of Serotonin**

Serotonin is a transmitter available in central nervous system and digestive tract. Serotonin is responsible for the feelings of anxiety, depression and appetite.

Suggestion on Investment Decisions

Level of Serotonin reduces at the times of unfulfilled expectations like, investment losses. Such situations lead to depression, anxiety and loss of hunger in the investor. Under the influence of deep anxiety, investor may take erratic decisions to avoid losses and depression, but it may further lead to multiplied losses and high transaction costs.

Reduced levels of serotonin cause investors to sell winning positions too early. Loss Aversion may be a result of reduced levels of serotonin.

“Take the money and run” is the tendency developed because of reduced supply of serotonin.

Brain structures responsible for Investor behavior

- **Role of Amygdala**

Almond shaped body situated in brain's temporal medial lobe is responsible for feeling of emotions like fear, pleasure, developing phobia and post traumatic stress. Amygdala is responsible for **“fight or flight”** behavior of investors.

Suggestion on Investment Decisions

Selling behavior of investors in falling markets are due to functioning of amygdala. Investors want to **flight away** from the falling markets because of the feeling of fear, but actually it is the time to **fight with** the bear phase and add some fundamentally strong stocks at corrected value.

- **Role of Prefrontal Cortex**

The prefrontal cortex of brain is responsible of complex cognitive decision making in social behavior and expression of personality. The prefrontal cortex is responsible for memorizing, analyzing and drawing conclusions from different situations.

Suggestion on Investment Decisions

Whenever investors commit cognitive errors, it means that prefrontal cortex does not have proper data in form of accurate, appropriate and update information for drawing decisions. Education in form of either self education or advice of professional advisor is required to provide proper data to prefrontal cortex to have a better decision making.

- **Role of Nucleus Accumbens and Anterior Cingulate**

Nucleus Accumbens is a group of neurons located behind the ears of a human being. This group of neurons plays a role in developing addictive behavior.

Anterior Cingulate, which is the frontal portion of cingulated cortex plays important role in reward anticipation and decision making.

Together, the nucleus Accumbens and anterior cingulate help people to identify patterns and evaluate alternatives.

Suggestion on Investment Decisions

As the nucleus accumbens and anterior cingulate are responsible for patterns, they make investors to believe on trends without seeking any detailed explanations.

For Example: if a company is declaring every quarter that they have increased their earnings estimates and with the response of this information the prices of stock increases in the market. Now after every quarter the above two parts of human brain will make a pattern that after every quarter the price of stock are going to show a jump, without making any detailed fundamental analysis about the stock.

Also this has been observe that most of the investors commit the errors of pattern recognition in investment and prone to miss the investment opportunity in case of companies which have inconsistency earnings.

Difference between Standard finance, behavioural finance and Neurofinance

Standard Finance	Behavioral Finance	Neuro Finance
Standard Finance believes in existence of Rational Markets and Rational investors	Behavioral Finance believe in existence of irrational markets and irrational Investors	Neurofinance studies the investment behaviour of people who were emotional were not rational.
Standard helps in building a rational portfolio	Behavioral finance helps in building an optimal portfolio	Neuro finance helps in building an optimal portfolio.
Standard Finance theories rest on the assumptions that oversimplify the real market conditions	Explanations of behavioral finance are in light with the real problems associated with human psychology	Neurofinance applies neurotechnology to recognize the behaviors of the financial market investors.
Standard Finance explains how investor “should” behave	Behavioral Finance explains how “does” investor behave	Neuro finance explains “how and why” the investor behavior occurs.
Standard Finance assumptions	Behavioral finance assumptions	Neurofinance helps to

believe in idealized financial behavior	believe in observed financial behavior	understand the internal procedures that lead to the thinking that visible as an external action.
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Conclusion

Homo sapiens are a collection of multifaceted structure which is prejudiced by diverse factors that affect their decision making choices. Neurofinance is an extremely new discipline in the era of finance. It aims to relate the brain functioning to the investment behaviour and one of the necessary conclusion of the field pertains to the essential role of sentiments in monetary decision making. Study of neurophysiology in form of neuroeconomics does not end with the limited study, but it is an upcoming field of modern finance, in which the study of human behavior and responses can be extended to the extent of study of neurology and neuroscience to seek the answers of biasness in the investor's behavior.

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