Decoding the Investor's Mind: Exploring Neurofinance in Decision-Making

[1]Greeshma Francis., [2]Dr Madhavi Lokhande

[1]ISME Bengaluru (Research Scholar -University of Mysore) Bengaluru

[2]ISME Bengaluru, Research Supervisor

DOI: https://doi.org/10.51244/IJRSI.2025.120800393

Received: 06 October 2025; Accepted: 12 October 2025; Published: 18 October 2025

ABSTRACT

This paper explores neurofinance as a new domain integrating neuroscience, psychology, and behavioural finance to understand how investors make decisions. Risk-taking, reward expectation, and loss aversion—all core behavioural biases in investments—are driven by the activity of certain neural structures, the nucleus accumbens, amygdala, and insula. The author proposes the use of artificial intelligence and machine learning in neurofinance to improve the predictive capabilities of robo-advisers. While mentioning the primary obstacles of laboratory settings, ethics, and privacy, the author also alludes to the growing prospects of neurofinance in the development of future emotionally and rationally balanced investments. The anticipated outcomes are encouraging, but research in the neurofinance domain suffers from a number of limitations - lackluster laboratory conditions, low participant numbers, and a paradigm shift towards the need for knowledge in neuroscience. Through the lenses of neuroscience and behavioural finance, this research hopes to make a step toward understanding investor behaviour and the mental aspects associated with financial choices.

Keywords: Behavioural finance, Traditional finance, Neurofinance, Investment decision

INTRODUCTION

The search for financial well-being is a lifelong companion in human existence. As humans are emotional beings, our wants go beyond the satisfaction of our immediate desires and encompass security, stability, and a future that will be shaped by the decisions we make today. The paper attempts to shed light on the relationships between saving and investing and the ways in which the developing discipline of neurofinance influences the choices we make that determine our financial futures. The human psyche is fundamentally driven by the desire for security, comfort, and the ability to satisfy desires, which gives rise to the quest for riches. Money serves as a symbol of authority and independence, and it can be used to achieve personal goals. As a result, the urge to increase money through investments makes logical because it provides the opportunity for both financial gain and social progress.

People make their way through the maze of investing options while balancing risk and return to achieve both financial success and a deep feeling of fulfillment. People begin investing because they wish to increase their income. However, not everything about this process is rational and well-considered. Many biases in our thinking cause us to make judgments that may not be the best use of our financial resources. In fact, the human brain also makes contradictory conclusions. That is extremely clear in terms of what motivates a person to play the lottery and what mindset a person has while purchasing insurance.

It’s interesting to analyze why people buy lottery tickets and insurance. Insurance is a financial hedge from unanticipated losses with a negative expected return on investment. Buying lottery tickets is a form of gambling that involves accepting a lower-than-expected return in the goal of obtaining a larger profit. Strangely, while buying lottery tickets to make money, we also get insurance to protect ourselves from potential losses.

The emerging science of neurofinance is shedding light on the complex interplay between money and cognition and demonstrating how our brains actually affect the investment decisions we make.

It is a multidisciplinary field at the juncture of neurology, psychology, and finance that is gaining importance in understanding and influencing investment decisions. The world of Neurofinance is a recent field that probes into the inner workings of the human psyche to reveal the cognitive mechanisms underlying financial judgment. It offers a prism through which we may see the brain mechanisms influencing our decisions as individuals struggle with risk, reward, and the intricate interaction of emotions. The brain landscape plays a complex role in determining one's financial fate

Traditional Finance, Behavioural Finance, And Neuro Finance

The transition from classical finance to behavioral finance, and then to microfinance, marks a paradigm shift in understanding and explaining financial decision-making processes. Conventional theories, like Efficient Market Hypothesis (EMH), assume that people make rational decisions based on all available information. (Peterson, 2010) Conventional finance explains how markets work and how to distribute resources most effectively when there are risky, uncertain, time-sensitive, and strategic financial options.

Behavioural finance challenged the rationality assumption, recognizing that people frequently avoid strictly rational decision-making due to cognitive biases, emotions, and psychological factors. The genesis of behavioural finance stems from the study of cognitive psychology. It is a branch of psychology that focuses on an individual's internal processes, such as language, visual perception, recall, thinking, learning, feeling, problem-solving, judgment, and decision-making. From a cognitive psychological perspective, emotion is viewed as a reaction to a stimulus or event following some form of evaluation or consideration (Merkle, 2007). Hence, while emotional elements greatly impact a person's financial decision, there are also default human mental condition constraints that are bound to exist. In this case, there is bound to be a shift in thinking which is considered bias and needs recalibration (Pompian, 2006). Emotions and affect, which evoke certain levels of mental activity and action, are now known not to undermine mental functions by design (Zajonc, 1979; Haselton et al., 2005; Peterson, 2007a, b).

Neurofinance examines the neurological underpinnings of economic judgments by monitoring brain activity during financial activities using state-of-the-art methods like functional magnetic resonance imaging (fMRI). The discipline of neurofinance emerged as a result of certain academics going above and beyond to investigate how and why these violations occur in the brain. This evolution enables researchers to identify specific brain regions involved in risk perception, reward anticipation, and decision making. The shift from behavioural finance to neurofinance enhanced our understanding of financial decision-making. When Behavioural finance illuminates our decision-making biases and heuristics as people negotiate the turbulent waters of investing, risk aversion, and reward-seeking. In addition, neurofinance provides a detailed explanation of the cognitive processes influencing financial behaviour by revealing the brain circuitry coordinating these very biases. The studies on neurofinance provide a broad perspective that helps us understand the complex interplay between the financial world and the human psyche, paving the way for a more thorough understanding of economic decision-making. It advances our knowledge of the cognitive biases and heuristics that influence investor behaviour in concert with behavioural finance. Various theories, such as prospect theory, loss aversion, and the endowment effect, identify neurological correlates that clarify the processes by which people depart from conventional economic rationality.

RESEARCH DESIGN AND METHODOLOGY

The present study adopts a conceptual research design guided by extensive theoretical and empirical works in the areas of traditional finance, behavioural finance, and neurofinance. There is no primary data collection and quantitative analysis; hence, the focus is on integrative synthesis and not statistical testing. This study employs a narrative literature review in which the author analyses the literature in a flexible manner, but with a degree of structure to demonstrate the progression of the literature and to show new developing interdisciplinary connections between psychology, economics, and neuroscience.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

The relevant studies were identified from searches in the Scopus, Web of Science, Science Direct, and Google Scholar databases by combining several keywords such as “neurofinance,” “behavioural biases,” “investor decision-making,”.The inclusion criteria were peer-reviewed journal articles, book chapters, and conference papers published

Neurofinance In Individual Investor Decision-Making

Numerous studies highlight the critical role that brain processes play in influencing economic decisions, which have ramifications for how people perceive risk, anticipate rewards, and behave while investing, which is frequently irrational

(Fama, 1998)The efficient market hypothesis (EMH), which holds that one cannot continuously outperform the market, is the foundation of conventional financial theory. It asserts that prices are based on a rational evaluation of all available information, providing little to no opportunity for arbitrage. (Markowits, 1952) It’s primarily assumed that humans are rational agents and utilize perfect information to make rational decisions. (Barberis, 2003)However, further studies proved that individual experience biases like loss aversion and narrow framing. (Tversky A., 1992)Subsequently prospect theory captures a major observation that loss incurred appears larger than the gain. This gives a different perspective for losses and gains. (Hirshleifer, 2015)While several research show that integrating behavioural and psychological insights might help to lessen the gaps between theory and empirical data, these more realistic models' prediction ability still needs to be enhanced. The transition from traditional finance to behavioral finance acquired importance in the early twenty-first century, representing a relatively recent evolution in the study of financial decision-making. It reflects a growing realization that human behaviour differs from the rational assumptions of traditional economic models. Behavioral finance recognizes that psychological biases, emotions, and cognitive errors play a substantial role in determining financial decisions

(Ratcliff R., 1998)A cognitive process that happens often and is fundamental to human conduct is decision-making. Based on preset criteria, a selection is produced from a collection of items. It is well acknowledged in the field of cognitive research that a person's ability to make decisions is diminished when they suffer a frontal lobe lesion.

In another study, De Martino et al. (2006) studied the neural correlates of the ‘framing effect’, which is a cognitive bias where people respond to the same financial problem differently depending on how it is presented. Their research tied the framing effect to increased activity in the amygdala, further strengthening the impact of emotions on financial decision-making. Emotions, on the other hand, do impact investment behaviour, which Peterson (2007) documented. According to his research, the lack of proper control over affective systems in the brain could result in mistaken financial decisions. Peterson proposed that the integration of psychology is needed to understand the behavioural mechanisms underlying financial choices.

Supporting this view further, Knutson and Bossaerts (2007) studied the interplay between reward and risk processing in the brain. They reported that the ventral striatum is essential in the encoding of gratification, especially concerning the expected reward contained in income streams, while the insula is more heavily involved in life risk perception representation. This difference indicates that separate brain circuits are responsible for reward anticipation and risk evaluation, which helps explain some dangerous, inconsistent risk-taking patterns people display under different circumstances. Equally, Tom et al. (2007) demonstrated that loss expectancy diminishes activation in the areas associated with the subjective value, not with greater activation in the areas related to negative emotions. These results offer neurobiological accounts for loss aversion, which is known to be a behaviourally biased phenomenon in finance.

The interdisciplinary characteristics of neurofinance were described by Goetz and James (2008), who supported the application of neuroscience to economics, psychology, and biology, arguing that these fields must be integrated to appreciate the complexities of financial decision-making. Their conceptual work argued that financial planning should incorporate far more than simply economic models; underlying neural mechanisms associated with behaviour need to be taken into account. This was supported by Knutson et al. (2008), who showed that reward-evoking stimuli, even if incidental, could trigger spontaneous NAcc

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

activation, which in turn biased participants towards greater risk-taking in finance. This means that external stimuli, even when unrelated to actual financial returns, may subconsciously alter one's willingness to take risks.

Preuschoff et al. (2008) provided a more comprehensive literature review examining neural mechanisms underlying different levels of decision-making, along with reward expectation and risk perception influencing financial choices. Their work vindicated Markowitz's Modern Portfolio Theory (MPT) as it proposed that neural activity is associated with valuation processes formulated by return and risk analysis. Proposing further argument to this hypothesis, Kuhnen and Chiao (2009) studied the role of neurotransmitters such as dopamine and serotonin on financial decision-making. Their analysis showed that the processes assessing financial risks and returns are so affected by genetic variation influencing these neurotransmitter pathways, suggesting biological predisposition leads some investors to be more risk-seeking while others are more risk-averse.

Kuhnen and Knutson (2011) evaluated how emotions affect financial decision-making and observed that investors in a good mood tend to take higher risks, whereas those in a bad mood tend to be more conservative with their finances. These observations correspond with behavioural finance concepts, which posit that the psychology of an investor is crucial to both market movements and volatility. Stenstrom and Saad (2011) went on to study the effect of hormones, particularly the role of testosterone, on the behaviour of individuals in finance. Their findings claimed that high testosterone levels, for example, are likely to endorse the pathological gambling risk syndrome and aggressive behaviour in financial decision-making.

Wu et al. (2011) studied how financial skewness, or the asymmetry in potential outcomes associated with an investment, affects neurophysiology and emotional reaction. Their results suggested that emotion-laden motivations, not mere logical factors, lead investors to act upon the opportunity to exploit highly skewed financial chances. This research provided more evidence that suggests financial decisions are made in relation to emotional and psychological factors, instead of reasoning and logic.

To summarize the milestones of studies conducted in the field, it can be identified that in the early 2000s, the research focused on identifying neural correlates of financial decision-making. By mapping reward and risk-related brain areas using neuroimaging methods, research aimed to find neurological correlates of financial decision-making. From the middle of the 2000s to the beginning of the 2010s, research combined behavioral finance theories with brain data to investigate how emotions and cognitive biases affect investing decisions. The mid-2010s saw a change in focus towards real-world uses, such as comprehending how stress hormones affect risk choices and investigating strategies to enhance decision-making.Post 2020 A more individualized approach to financial behavior analysis is reflected in recent research that highlights technical innovations, such as EEG neurofeedback and explores the function of emotions in certain demographic circumstances

Thus, neurofinance arose as an organic development to understand the complex neural systems that influence economic decisions. with neuroimaging techniques acquired unparalleled insights into the brain circuits linked with risk perception, reward processing, and decision-making.

The significant correlational study offered relevant proof that investment decisions are influenced by emotions that are artificially stirred up through different brain circuits.Studies demonstrates how neural mechanisms impact financial decision-making as investment behavior is shown to be dominated by irrational factors such as cognitive biases and emotional responses. The intricate network of the nucleus accumbens, amygdala, insula, and various neurotransmitter systems involved in financial decision-making argue for amplifying traditional economic models of investor behavior to include neurobiological perspectives.

Neural Correlates Of Behavioral Biases

The results of numerous neuroscience studies demonstrate that specific brain regions become active prior to the actual decision behaviour, which occurs before the decision is made.

The behaviour is not acting in a way that makes sense. It can therefore be said that an individual's genetic makeup and personality have an impact on brain activity. Additionally, a person's genetic makeup may cause them to react affectively to some stimulants but not to others.Neurofinance examines behavioural biases by

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

analysing brain activity associated with decision making with uncertain outcomes. Each bias utilises unique neural pathways responsible for valuation, emotion, memory, and social cognition (Kuhnen & Knutson, 2005).

Overconfidence Bias

Overconfidence, in which investors tend to greatly inflate their knowledge or skills, is linked to neural pathways in the dorsolateral prefrontal cortex (DLPFC) associated with executive control and the reward anticipation (Kuhnen & Knutson, 2005) mechanisms of the ventral striatum, particularly the nucleus accumbens. This bias implies that the DLPFC is malfunctioning, and so the investor in question is deemed to be overconfident, and thus their risk is underestimated (De Martino et al., 2006). fMRI studies have shown that the prediction of risk-seeking behaviour appears greatly overestimated in the nucleus accumbens and, simultaneously, the insula is underactivated. Thus, overconfidence is suggestive of a neural disproportion of reward expectation and cognitive appraisal of risk.

Loss Aversion

Loss aversion manifests as the disutility suffered as the result of the potential for loss as opposed to the gains achievable, and is the result of the amygdala and insula, with the corresponding fear and emotional responses to loss, together with the amygdala's mPFC for its valuation (Tom et al., 2007). fMRI data shows losses result in greater neural action as opposed to comparable gains in the strata, and mPFC, and serves as reinforcement to Kahneman and Tversky's prospect theory in biological terms. Kuhnen and Knutson (2011) in addition showed amygdala activation is greater for those who sell prematurely, suggesting the respondent is in an emotionally hypersensitive state to loss.

Anchoring Bias

Anchoring is the phenomenon of pegging and therefore valuing heavily the first piece of information. It is the result of the posterior parietal cortex (PPC) as well as the orbitofrontal cortex (OFC). Engelmann et al. (2009) observed the PPC records and remembers numerical 'anchors' before the corrective phase of the thinking process, while the OFC frames and interprets the value to create biased reference points. The insula in this instance serves to explain the discomfort to transgressing the anchors, suggesting areas of loss in the emotional span as well as rigidity in thinking.

Herding Bias

Herding behaviour, or post, follows the personal conclusion of an individual's decision-making process and supports the group conclusion by appending their opinions; the decision of focus of interest is probably centred around the ACC, the so-called anterior cingulate cortex, and the temporoparietal junction which delineates the boundaries of social thinking and the application of the theory of mind (Klucharev et al., 2009). Burke et al., 2010 postulated that the ventral striatum is also involved, or more precisely, herds cow postulates the winner of dopamine and ventral striatum influenced that the decision winner is pleasing. Burke et al. consider a group opinion is also accepted, evidence clusters that support conformity are Burke et al., 2010. Ipsative scoring is non-voluntary herding at the lowest net social level is by no means an instance of social imitation.

Mental Accounting and Framing

Mental accounting has been described as the division of money into non-related subcategories, which is also a labour of skill, and the amygdala respectively. The influence of framing also Knutson et al., 2007 framed that the desire to ask finances that are primary eluded and is more common than those which come on an emotional level rather than on rational (Kahneman et al. 2003). Still in rampant comparable De Martino et al., 2006 extends the observation that the amygdala is that her Why is so an apple pie unable to framed means version to a linear promise value.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

Regret Aversion and the Endowment Effect

Knutson et al. (2008) showed that the avoidance of future remorse (regret aversion) engages the insular region of the brain and the posterior cingulate cortex (PCC) and, in particular, the cingulate cortex and other areas of the brain that self-reference and self-evaluate and emotionally contest (Knutson et al. 2008). Weber, where the orbitofrontal cortex (OFC) is crucial, and others (2009) showed the case of the Endowment Effect (ownership increases perceived value).

This seems to suggest that regret aversion and endowment bias might differ in reasoning yet share the same neural mechanisms.

Biases of Availability and Representativeness

The Availability and Representativeness Bias overlap (especially in scenarios of "over-relying" on the preference of the most dominant information) and are controlled by the hippocampus (retrieval) and are often paired with the amygdala (with emotions) and the ventromedial prefrontal cortex (decisions).

A fluent example is the work of Bechara et al. (2000) who showed that, with respect to the Iowa Gambling Task, dysfunction of the ventromedial prefrontal cortex (vmPFC) and amygdala was associated with impaired risk perception. Subsequently, Camille et al. (2011) illustrated that vmPFC injury patients, contrary to other patients in whom reduced reliance on emotional heuristics is observed, provide evidence in support of the neural model of judgement that is often correct, but in other cases misguided.

Brain And Decision Making

Human brains engage in a remarkable movement of neurotransmitters and neuronal connections when we anticipate rewards. An important factor in determining an individual's financial preferences is this brain reaction. The complex dynamics of human behaviour in financial affairs are not well captured by the conventional finance theory, which is predicated on the idea that people make rational decisions within a controlled framework. Humans are driven by a complex mix of emotions, instincts, and cognitive processes, unlike the predictable and regulated entities envisaged in economic models.

The recognition of the human natural capacity for empathy and social cognition is a critical component in comprehending the relationship between neurology and investment choices. Making decisions is not a lonely activity that takes place inside one's own head; rather, it requires the capacity to understand and reproduce the feelings and experiences of others, particularly when they are in a public place. Investment decisions are heavily influenced by this social component since people might be influenced by the opinions of their peers, market trends, or the group's overall emotion.it's interesting to note, though, that this association does not explain why financial decisions are predictable, even with improvements in neuroscience and brain research. The intricate relationship between neurology and investment preferences is shown by the fact that unpredictable results frequently result from actions that appear to be sensible.

(Fliessbach K, 2007) demonstrate a substantial relationship between individual variances in brain responses to wins and losses and variations in information search across risky bets. (Niklas, 2016)Individual differences in brain reactivity to wins and losses are linked to variances in information search vs risky gambles. Activity in the ventromedial prefrontal cortex during gain processing correlates favorably with attention to the monetary value of risky gambles. The activity in the ventral striatum and posterior cingulate cortex during loss processing is positively linked with subjects' attention to gambling probabilities

Brain Imaging To Understand The Mind

Understanding the complexities of making investment choices has been a key emphasis in the science of neurofinance. As financial markets grow, understanding the intricacies of making choices becomes increasingly important for forecasting market trends and optimising investment strategies. Researchers can investigate the brain networks that underpin financial decisions using cutting-edge technologies such as functional magnetic resonance imaging (fMRI) and electroencephalography (EEG). EEG readings often capture spontaneous and event-related brain activity. Spontaneous EEG reflects unprovoked neural responses, including behavioural manifestations. (Williamson SJ, 1997)Spontaneous EEG is commonly utilised in clinical settings to evaluate seizure disorders, but has not been widely used in cognitive neuroscience research.

fMRI is one of the most current types of neuroimaging techniques. Because of its minimal invasiveness, lack of radiation exposure, and widespread availability, fMRI has emerged as the main tool in cognitive neuroscience since the early 1990s.

Techniques For Brain Mapping

Technique	Purpose
Electroencephalography (EEG)	Detects electrical activity in the brain by recording wave patterns.
Computerized Tomography (CT) Scan	Uses X-rays to generate cross-sectional images of the brain.
Magnetic Resonance Imaging (MRI)	Provides high-resolution images of brain structures without ionizing radiation.
Positron Emission Tomography (PET)	Uses radioactive tracers to assess metabolic activity and chemical processes.
Magnetoencephalography (MEG)	Measures magnetic fields produced by brain activity for real-time monitoring.
Diffusion Tensor Imaging (DTI)	An MRI-based technique that maps white matter tracts by tracking water diffusion.
Near-Infrared Spectroscopy (NIRS)	Measures oxygen levels in brain tissues using near-infrared light.
Source: psychcentral.com,Medically reviewed by Seunggu Han, M.D. ,Updated on October 22, 2021 ,Consolidated by Author	

Application Of Neuro Finance And Future Scope

In terms of investment, neurofinance approaches provide essential insights regarding the psychological variables that influence market behaviour. The field of neurofinance has deeply shed light on how investors perceive risk, make decisions, and respond to financial uncertainty. Unlike classical finance theories which assume rational decision-making, neurofinance analyses the impact of brain activity, through various imaging techniques such as fMRI and EEG, on financial choices (Lo, 2012). It has been established that the prospect of financial rewards activates an important brain area known as the nucleus accumbens (NAcc), which has high associations with pleasure-seeking and risk-taking activities (Knutson & Bossaerts, 2007). On the other hand, the anterior insula – known for associating with perception of fear and loss – leads individuals to risk aversion and panic-driven financial decisions (Kuhnen & Knutson, 2005).

One major application of neurofinance is in portfolio management, where investors can be trained to become aware of their biases and work to overcome them. For example, behavioural finance is rapidly finding its way into automated financial advisory systems (robo-advisers) which alter managing funds heuristically or based on an individual’s risk perception and cognitive biases (Frydman & Camerer, 2016). Moreover, neurofinance explains why herd behaviour exists in financial markets, where traders ignore inherent risks and blindly follow market trends, causing speculative bubbles and crashes (Shiller, 2000).

Investors have been documented to be influenced by cognitive biases such as overconfidence, loss aversion, and framing, which have been integrated within the domain of behavioural finance (Kahneman & Tversky, 1979). With regard to these cognitive biases, neurofinance validates Kahneman and Tversky’s work by

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

providing a biological basis through the identification of neural correlates of biases. For example, Kuhnen and Chiao (2009) found that individual differences in risk-taking behaviour are related to genetic variation that affects dopamine and serotonin neurotransmission. This shows that an investor's appetite for risk is not only learned, but depends upon biological underpinnings.

Moreover, neurofinance furthers behavioural finance by addressing the realm of emotional investing and explaining situations when investors do not act logically due to fear or exhilaration (Lo & Repin, 2002). In particular, the phenomenon of loss aversion is described by Kahneman and Tversky (1979), who state that the emotional experience associated with financial losses is more severe than that associated with financial gains. Through the incorporation of biometric measurements and brain imaging, institutions can design customised plans aimed at reducing the impact of emotions on strategic decision-making. Neurofinance has a particularly bright future with the developments of AI and machine learning that can use neural information to anticipate the actions of investors (Frydman et al., 2014). One such development is called neuroadaptive financial advising, which utilises real-time neural data to provide advice for a particular strategy/method (Sapra & Zak, 2019).

Another unexplored future area of research is the application of wearable neurotechnology, particularly EEG headsets, that monitor real-time stress levels and cognitive load of investors (Hafner et al., 2021). More attention is also being given to studying the differences between men and women in neurofinance as some studies point out that there are different neural pathways engaged by risks in finances in the two sexes (Sapienza et al., 2009).Alongside the potential benefits, some ethical issues related to the area of privacy, data protection, and possible alteration of behaviour of investors present a difficulty (Ariely & Berns, 2010). Regulations need to be formulated to protect against the ethical misuse of neurofinance tools in the market.

The amalgamation of neuroscience and behavioural finance has augmentatively changed investment decision-making through neurofinance by providing a more detailed understanding of risk perception, emotional biases, and financial behaviour. With further development in technology, neurofinance is destined to evolve along with AI-driven financial management systems and real-time tracking of investor activities. Regardless, there are ethical and methodological issues that need to be resolved to guarantee the adequate employment of neurofinance principles within the scope of finance.

(P. Burrell, 1997)The use of neural networks in finance, particularly investment, has produced promising outcomes in terms of decision-making and forecasting . (Sahi, 2012).The discipline of neurofinance, which tries to understand the brain processes that drive investment behaviour, is still in its early stages . (James, 2011) Integrating neuroscience results into financial planning practice has the potential to increase financial planner effectiveness.

For instance, fMRI enables analysts to monitor brain activity in actual time whereas investors make investments. Researchers can identify risk perception regions by comparing brain activation patterns to risk assessments. financial professionals could utilize fMRI data to measure individual risk tolerance and adjust investment portfolios to match investors' brain reactions to risk.

By better understanding how the brain receives information and makes decisions, investors may streamline their decision-making processes and steer clear of frequent pitfalls by learning about the neurology of decision-making. Understanding the psychological underpinnings of market events and how investors often respond to them will help them to predict and respond to market movements more effectively. With this knowledge, one can manage the stress and make more educated decisions under unpredictable market conditions.

People will be able to recognize how emotions influence their decision-making when they have a better understanding of how the brain functions during decision-making. With this knowledge, they will be able to make better selections.

Constraints Of Neurofinance

Neurofinance has enhanced the understanding of investors by merging neuroscience with behavioural finance, but there are many methodological and practical issues that restrict its use in actual decision-making in finance.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

These challenges arise from the issues of laboratory research, sampling and selection bias, sociobiological ethics, and the multidisciplinary knowledge needed to perform and analyse neurofinance research.

The majority of neurofinance studies tend to emphasise the participant observation method which is conducted solely in the confines of a laboratory. This, along with the medical supervision that comes with it, does not capture the essence of actual financial decision-making, far removed from the decision to be made in the real world. Self-reports may bias their responses due to altered phenomenic concourse changes engagements in the frame, leading to range-bound behaviour at least temporarily, resulting in a change of emotions. Different phenomena may manifest different variations in behaviour solely because they know that they're being observed. This assumption is widely known as the Hawthorne effect (McCarney et al., 2007). For example, heightened stress levels within laboratory conditions may subsequently lead to altered cortisol secretion which affects risk-taking behaviour (Kandasamy et al., 2014). This represents a challenge arising from the controllable validity issues neurofinance leaves to be explored, as investment behaviour from real markets highly relies on myriad uncontrolled factors that influence emotions and market sentiments which tends to be makeup constrained in the laboratory.

Peterson (2010) and Lohrenz et al (2007) note that many neurofinance studies, especially those reliant on fMRI and EEG technologies, utilise fewer than one hundred participants, most of whom are students or medical patients. One of the most fundamental challenges in neurofinance research is the small sample size, as this greatly limits their statistical power and generalizability. These narrow sample populations often lack the heterogeneity needed for generalisability, for example, institutional traders and hedge fund managers alongside retail investors and self-directed investors are seldom included (Camerer, 2018). Age, gender, cultural background, and even one's past investment behaviour are critical to forming one's identity, which in turn shapes that person's unique approach to financial decision-making. The lack of diversity among samples used means that such research will be fundamentally flawed.

The integration of neuroscience, psychology, and behavioural finance makes neurofinance research extremely complex and interdisciplinary in nature. Functional MRI scans, EEGs, and neurochemical measures offer rich data, but lack proper training and annotation can lead to erroneous interpretations and diagnostic pathways (Poldrack, 2012). In addition, numerous studies portray differing accounts of the amygdala, prefrontal cortex, and ventral striatum involvement in risk-taking, indicating that the processes underlying neural mechanisms are highly context-sensitive (Knutson & Bossaerts, 2007; De Martino et al., 2006). Furthermore, just because some change in a certain brain area is associated with some activity in a particular region during the execution of an investment decision does not imply that this region exerts control over the decision (Ariely & Berns, 2010). The application of neuroscientific methods poses ethical questions around privacy, manipulation, and consent due to their integration into finance. Neurofinance exploitation may aid investment firms and financial institutions in developing neuro-marketing strategies that prey on investors' cognitive heuristics (Zak, 2007). For example, if neural correlates of impulsive choices are detected, firms may indiscriminately market certain investor populations with aggressive risk-taking financial products. This behaviour raises ethical and legal concerns about finance and protectionism (Lo, 2012). In addition, acquiring neural information through fMRI or EEG requires consent, and there is always a concern about how such sensitive information is kept, processed, and abused (Farah, 2012).

Costs associated with neuroimaging techniques like fMRI, PET, and EEG limit the scope of neurofinance research to small-scale studies. Each fMRI scan can cost anywhere from £500–£1,000, making it economically unfeasible for countless institutions and researchers (Poldrack & Farah, 2015). Furthermore, neuroimaging devices are non-portable, making it impossible to gather data in real-time during financial trading activities, which are decision-making races that occur in milliseconds (Lo & Repin, 2002). These constraints on technology inhibit exploration of the neural underpinnings of decision-making in high-pressure trades. Lastly, neurofinance has not been able to develop a unified theory that consolidates its different empirical findings, as is the case with the Efficient Market Hypothesis (Fama, 1970) or Prospect Theory (Kahneman & Tversky, 1979). Neurofinance research seems to be lacking a model that explains how the distinct contributions of various brain regions to the perception of risk, reward expectancy, and emotion regulation is integrated (Camerer, 2018). Also, there are no practical recommendations on how investors, policymakers, and financial advisors can utilise the insights of neurofinance for real-world investment decision making (Loomes, 2010).

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue IX September 2025

Key Findings Of The Study

The findings of this research indicate that investor choices are made in part due to physiological internal workings of the body. Past research in neurofinance showed that the nucleus accumbens (NAcc) region of the brain associated with pleasure and anticipation of reward works to modulate risk-taking and impulsive investing (Kuhnen & Knutson, 2005). NAcc activation accounts for investor preference for high-risk investments even when losing investments is more rational. There are other brain areas that when more activated explain the emotional response syndrome (amygdala, and insula) to losses, fear, and regret in the form of investing loss aversion and in the panics of market decline. These studies have shown that decisions made during investments cannot be purely rational, as there is a strange entanglement of emotions and cognition in the brain that must be also considered.

The conceptual synthesis very much shows that neurofinance, in addition to AI and machine-learning technologies, can greatly improve financial advisory services. Future robots that serve as financial advisors, or robo-advisors, can use neural or physiological proxies for investment sentiment including stress, emotional arousal, or decision delay, to predict investor emotions and alter portfolio suggestions in real time. This greatly helps in investment behavioural coaching, risk calibration, and personalised financial advice.

Nonetheless, the study outlines crucial shortcomings. The majority of current research within neurofinance continues to be constrained to the domains of laboratory settings, and within the context of small and homogenous samples. In addition, the excessive expenditure on neuroimaging and the ethical issues around data privacy, informed consent, and potential manipulation also pose challenges.

The scope of neurofinance stems from its ability to reshape our comprehension of behavioural finance, but is impeded by a lack of method and sample size, coupled with ethical and technological constraints. There is an urgent need to evolve research design to allow more naturalistic observation, broaden the scope of sampling, enhance collaboration across disciplines, and ensure ethical use of neuroscientific tools in finance. Other questions that need attention include the use of portable neuroimaging devices, the recording of neural activity during trading, and the creation of computational models that incorporate neurofinance principles. Closing this gap would be essential to legitimising neurofinance as a subfield of behavioural economics and financial decision-making.

CONCLUSION

A relatively new branch of study called "neurofinances" combines technology and neuroscience knowledge to examine how our brains function when we make financial decisions. Traditional financial theories, such as the Efficient Market Hypothesis, are being refuted by Neurofinances, which demonstrates that traders do not behave like perfect rational decision makers, but rather employ a variety of techniques. Integration of neurofinance into other financial theories, like limited rationality and adaptive market hypothesis, is regarded as a critical topic for future development (Tseng, 2017). Neurofinance, as a field of study, is novel and attempts to connect brain processes with activities of investing. The fundamental ideas of neurofinance state that feelings are particularly important when it comes to making financial decisions. The majority of neurofinance research focusses on trading conduct. Studying the brain may also be beneficial for other investing habits, such credit, retirement planning, asset management, and personal financial planning choices. Furthermore, only event-based experiments have been used in the corpus of research in this area of neuroscience. According to neuroscientists, they may use brain scanning methods such as fMRI to predict an observer's emotional reaction to an investment and whether or not they would buy it. This indicates that for an application of this study, people would need to be placed within an fMRI during a certain financial decision-making event. These and other behavioural reasons may render live research settings impossible outside of ethical and medical constraints. More work needs to be done on techniques appropriate for live neurofinance studies without irrefutable ethical implications. Neurofinance is another instrument that could further explain the concept of the financial consumer. Furthermore, more effort should be focused on explaining how knowledge of the relevant regions of the brain dealing with financial decision-making contributes to the lack of rational behaviour.This understanding will aid the process of financial advising, and the allocation of positions will be optimally structured on the relevant investor paradigms related to their needs. More work is needed in this area in order to understand how the brain functions when it is analysing decision-making, risk categorisation, and reward anticipation in dynamic interaction with one another

Neurofinance sheds light on the subconscious mechanisms that influence financial decisions by finding neurological correlates of investor behaviour. This knowledge is crucial for investors, financial professionals, and policymakers, as it improves forecast accuracy, optimizes investment strategies, and contributes to a more complete and effective approach to navigating the intricacies of financial markets.

REFERENCE

1. Ariely, D., & Berns, G. S. (2010). Neuromarketing: The hope and hype of neuroimaging in business. Nature Reviews Neuroscience, 11(4), 284-292.
2. Barberis, N., & Thaler, R. (2003). A survey of behavioral finance. Handbook of the Economics of Finance, 1, 1053-1128.
3. Burrell, P., & Oh, B. (1997). The impact of neural networks in finance. Neural Computing & Applications. https://doi.org/10.1007/BF01501506
4. Camerer, C. (2018). The promise and challenges of neuroeconomics. Journal of Economic Literature, 56(1), 29-57.
5. De Martino, B., Kumaran, D., Seymour, B., & Dolan, R. J. (2006). Frames, biases, and rational decision-making in the human brain. Science, 313(5787), 684-687.
6. Fama, E. F. (1970). Efficient capital markets: A review of theory and empirical work. The Journal of Finance, 25(2), 383-417.
7. Fama, E. F. (1998). Market efficiency, long-term returns, and behavioral finance. Journal of Financial Economics, 49(3), 283-306.
8. Farah, M. J. (2012). Neuroethics: The ethical, legal, and societal impact of neuroscience. Annual Review of Psychology, 63, 571-591.
9. Fliessbach, K., Weber, B., Trautner, P., Dohmen, T., Sunde, U., Elger, C. E., & Falk, A. (2007). Social comparison affects reward-related brain activity in the human ventral striatum. Science, 318, 1305-1308.
10. Frydman, C., & Camerer, C. (2016). The psychology and neuroscience of financial decision making. Trends in Cognitive Sciences, 20(9), 661-675.
11. Glimcher, P. W., & Fehr, E. (2013). Neuroeconomics: Decision making and the brain. Academic Press.
12. Hafner, M., Pollitt, A., Dufort, L., & Cattaneo, A. (2021). The use of EEG neurofeedback in financial trading: A systematic review. Frontiers in Neuroscience, 15, 1-12.
13. Hirshleifer, D. (2015). Behavioral finance. Annual Review of Financial Economics, 7, 133-159.
14. James, R. (2011). Applying neuroscience to financial planning practice: A framework and review. https://doi.org/10.2139/ssrn.1968995
15. Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. Econometrica, 47(2), 263-291.
16. Kandasamy, N., et al. (2014). Cortisol shifts financial risk preferences. Proceedings of the National Academy of Sciences, 111(9), 3608-3613.
17. Knutson, B., & Bossaerts, P. (2007). Neural antecedents of financial decisions. Journal of Neuroscience, 27(31), 8174-8177.
18. Kuhnen, C. M., & Chiao, J. Y. (2009). Genetic determinants of financial risk-taking. PLoS ONE, 4(2), e4362.
19. Kuhnen, C. M., & Knutson, B. (2005). The neural basis of financial risk taking. Neuron, 47(5), 763-770. https://doi.org/10.1016/j.neuron.2005.08.008
20. Lo, A. W. (2012). Adaptive markets: Financial evolution at the speed of thought. Princeton University Press.
21. Lo, A. W., & Repin, D. V. (2002). The psychophysiology of real-time financial risk processing. Journal of Cognitive Neuroscience, 14(3), 323-339.
22. Loomes, G. (2010). Modeling the cognitive processes underlying risky choice. Journal of Economic Behavior & Organization, 75(2), 179-194.

23. Markowitz, H. M. (1952). Portfolio selection. Journal of Finance, 7(1), 77-91. https://doi.org/10.1111/j.1540-6261.1952.tb01525.x
24. McCarney, R., et al. (2007). The Hawthorne Effect: A randomised, controlled trial. BMC Medical Research Methodology, 7(30), 1-7.
25. Niklas, A. (2016). Gain- and loss-related brain activation in risky gambles: An fMRI and eye-tracking study. http://dx.doi.org/10.1523/ENEURO.0189-16.2016
26. Peterson, R. L. (2010). Neuroeconomics and neurofinance. https://doi.org/10.1002/9781118258415.ch5
27. Poldrack, R. A. (2012). Inferring mental states from neuroimaging data: From reverse inference to large-scale decoding. Neuron, 72(5), 692-697.
28. Poldrack, R. A., & Farah, M. J. (2015). Progress and challenges in neuroimaging studies of human decision-making. Current Opinion in Behavioral Sciences, 5, 1-6.
29. Ratcliff, R., & Rouder, J. N. (1998). Modeling response times for two-choice decisions. Psychological Science, 9(5), 347-356. https://doi.org/10.1111/1467-9280.00067
30. Sahi, S. K. (2012). Neurofinance and investment behaviour. https://www.emerald.com/insight/publication/issn/1086-7376. https://doi.org/10.1108/10867371211266900
31. Sapra, S., & Zak, P. J. (2019). Neuroscience and financial decision-making. Review of Behavioral Finance, 11(3), 299-316.
32. Sapienza, P., Zingales, L., & Maestripieri, D. (2009). Gender differences in financial risk aversion and career choices. Proceedings of the National Academy of Sciences, 106(36), 15268-15273.
33. Shiller, R. J. (2000). Irrational exuberance. Princeton University Press.
34. Tversky, A., & Kahneman, D. (1992). Advances in prospect-theory—Cumulative representation of uncertainty. Journal of Risk and Uncertainty, 5(4), 297-323. http://doi.org/10.1007/Bf00122574
35. Wang, X.-J. (2008). Decision making in recurrent neuronal circuits. Neuron, 215-234.
36. Williamson, S. J., & Kaufman, L. (1997). Study of human occipital alpha rhythm: The International Journal of Psychophysiology, 26(1-3), 63-76.
37. Zak, P. J. (2007). The neuroeconomics of trust. Scientific American, 296(3), 88-95.