The Influence of Neurotransmitters on Cryptocurrency Investment Decision-Making : The Mediating Role of Risk Tolerance and Moderating Role of Investment Experience

Shubhangi Gautam [1]
Pardeep Kumar [2]
Preeti Dahiya [3]

Abstract

Purpose : The current study examined the influence of neurotransmitters on cryptocurrency investment choices. Moreover, the research assessed the mediator risk tolerance (RT) and moderator investment experience on the connection between neurotransmitters and investment choices.

Research Design/Methodology : The analysis of the data involved 504 responses from individuals in India's Western and Northern regions who either invested in cryptocurrencies or had knowledge of such investments. The proposed theoretical model of cryptocurrency investment choices was examined in the study using "variance-based partial least square structural equation modeling" (PLS-SEM).

Findings : The outcomes of this research specified that neurotransmitters play a substantial role in cryptocurrency investment choices, and they had a substantial impact on making investment choices. It was also noted that a significant moderator between neurotransmitters and Bitcoin investment decisions is RT. However, it was determined that investment experience had no moderating effect.

Practical Implications : This study revealed that, in order to make better-informed investment decisions, businesses, governments, and investors should consider the impact of neurotransmitters.

Value/Originality : The study was innovative since it is one of the first to examine how neurotransmitters, together with mediator RT and moderator investment experience, affected Bitcoin investment decisions. Additionally, the conceptual framework could be very helpful to cryptocurrency portfolio managers and investors in understanding how the brain functions during the decision-making process. They would then be better equipped to allocate their assets with knowledge and efficiency.

Keywords : **cryptocurrency, neurotransmitters, investment decision, risk tolerance (RT), investment experience**

JEL Classification Codes : G11, G40, G41

Paper Submission Date : September 25, 2023 ; Paper sent back for Revision : April 23, 2024 ; Paper Acceptance Date : May 25, 2024 ; Paper Published Online : October 15, 2024

[1] *Assistant Professor (Corresponding Author),* Mittal School of Business, Lovely Professional University, Phagwara - 144 411, Punjab. (Email : gautamshubhangi111@gmail.com)
ORCID iD : https://orcid.org/0000-0002-0236-0216
[2] *Associate Professor,* University School of Business, Chandigarh, University, Mohali - 140 413, Punjab.
(Email : pardeep.e8925@cumail.in)
[3] *Assistant Professor,* Panipat Institute of Engineering & Technology, Panipat - 132 101, Haryana.
(Email : preeti.sangwan@gmail.com)

DOI : https://doi.org/10.17010/ijf/2024/v18i10/174613

The idea of behavioral finance was first introduced in the early 1980s, and it has subsequently seen significant development. Investors were formerly thought to be "irrational" from an economic viewpoint because they frequently yielded to cognitive biases in their desire for what traditional finance refers to as "rational" desires (Al-Mansour, 2020; Tseng, 2006). However, further studies revealed that people have "normal" desires, which are likely to support and shape many aspects of financial behavior rather than cognitive errors as well as shortcuts (Dangi & Kohli, 2018; Singh et al., 2016). The knowledge gained and its impact on financial theories encouraged more research in this area (Annapurna & Basri, 2024). Hence, some researchers went a step further and questioned whether developing new neuroscience information may improve existing models as well as how and why specific behaviors occur in the brain. This led to the development of the field of neurofinance. Neurofinance is an interdisciplinary approach that enhances the micro-foundations of financial decisions by integrating economics, neuroscience, and psychology (Miendlarzewska et al., 2019; Tseng, 2006).

Kuhnen and Knutson (2005) conducted the first study to investigate the role of neurotransmitters in financial decision-making. This study increased awareness of neurofinance among investing enthusiasts, including stock market analysts and advisors. The chemicals that carry messages from one neuron to another in the human brain are called neurotransmitters. Neurotransmitters promote traits such as optimism, risk-taking, and investor trust (Ahmad, 2018; Khan & Mubarik, 2020). Neurotransmitters have a major function in altering memory, which helps the investor feel secure, and special psychological conditions arise in the brains of those who participate in the Bitcoin market (Sen & Banerjee, 2024).

Previous research has demonstrated that behavioral aspects have a greater influence on Asian investors' judgments (Chuang et al., 2014). Ghosh (2021) noted that the growing number of investors in India necessitates the study of additional behavioral aspects when making investment decisions. According to Kuhnen and Knutson (2005), Miendlarzewska et al. (2019), and Yokoyama et al. (2014), the majority of existing studies on neurotransmitters and investor behavior are conducted in developed countries. These studies assert a link between dopamine, serotonin, stock trading, the purchase and sale of stocks, and trading conduct within the stock market (Patel, 2017). As a result, this idea has been met with incredible enthusiasm by researchers in a related subject.

Consequently, this study makes a prominent contribution to understanding the influence of neurotransmitters on investment choices in the cryptocurrency market, with risk tolerance (RT) as a mediator and investment experience as a moderator. The study aims to evaluate the influence of neurotransmitters on cryptocurrency investing choices, with RT acting as a mediator, using a conceptual model based on the theory of neurofinance.

(1) What is the influence of neurotransmitters on investment choices in the cryptocurrency market?

(2) Does RT mediate the connection between neurotransmitters and investment choices in the cryptocurrency market?

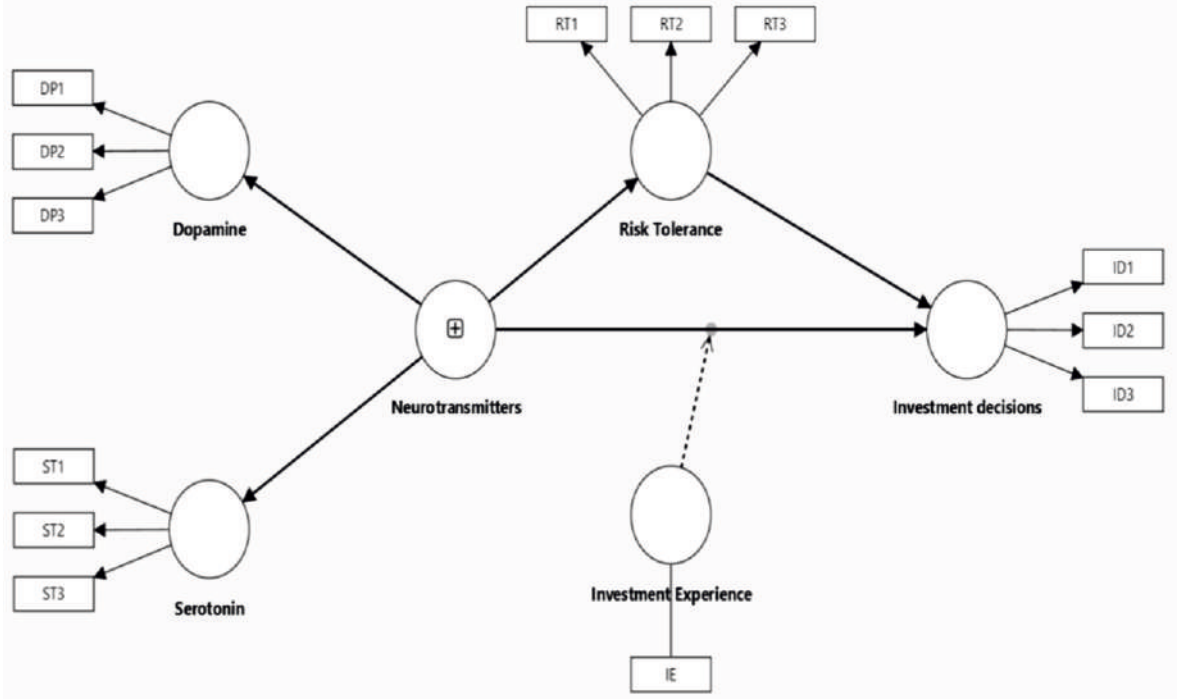
(3) Does investment experience moderate the connection between neurotransmitters and investment choices in the cryptocurrency market?

Literature Review

Theoretical Framework

The "hot" and "cold" systems are two different brain pathways that are thought to be involved in making investment decisions, according to the dual process hypothesis of neurofinance. The hot system handles emotional information and produces quick, automatic reactions, while the cool system deals with logical, analytical information and delivers deliberate, reflective responses. Both of these systems are vulnerable to

Figure 1. ***Research Path Model***



various effects of neurotransmitters. For instance, the neurotransmitter dopamine is connected to motivation and reward. People are more likely to take risks and make impulsive decisions when their dopamine levels are high. This could lead to increased investment activity and potentially higher profits, but it may also raise the likelihood of hasty or poorly considered decisions.

On the other hand, Serotonin (neurotransmitter) is linked to social behavior and mood control. High serotonin levels are associated with increased anxiety and risk aversion in individuals. This may lead to a decrease in investment activity and, as a result, lower profits, but it could also aid in avoiding rash or impulsive decisions. To better understand how biological factors impact these processes and how they can be optimized to improve investment decision-making and outcomes, neurofinance researchers are investigating the neural mechanisms involved in investment decisions, as shown in Figure 1.

Hypotheses Formulation

Neurotransmitters Impacting Cryptocurrency Investment Decisions

Neurotransmitters are chemical messengers that carry electrical impulses from one to another neuron in the human brain. Khan and Mubarik (2020) indicated that specific neurotransmitters, like serotonin and dopamine, may influence an individual's risk perception and decision-making process. These neurotransmitters are controlled by genes that impact personality characteristics and the processing of information about rewarding and dangerous stimuli (Manzoor et al., 2023). Dopamine is typically linked to positive feelings, such as the satisfaction gained from completing a task. It plays a vital role in motivation, memory, and attention and is also essential for movement. On the other hand, serotonin is important for happiness, and low levels of serotonin are directly associated with mood disorders like depression. Additionally, serotonin can affect a variety of behavioral

elements, including memory, attention, reward, and anger. Serotonin and dopamine are both neurotransmitters, which are rain chemicals that move information between neurons in the brain. Dopamine and serotonin are referred to as the "happy hormones" because they make people feel calmer and happier.

Various previous research has been conducted in neurofinance with decision-making in economic games, risk-associated decisions, purchase decisions (Raghuraman & Padoa-Schioppa, 2014; Yokoyama et al., 2014), financial decision-making (Hiser & Koenigs, 2018; Lemmers-Jansen et al., 2017; Padoa-Schioppa & Conen, 2017), and investor behavior (Conway & Slavich, 2017). Lang et al. (2017) and Pertl et al. (2017) also discovered a link between neurotransmitters and investment decisions. It has been discovered that dopamine and serotonin are significant risk variables when making investment decisions (Kuhnen & Chiao, 2009). Singh et al. (2017) found that serotonin and dopamine influence stock market investing decisions. So, the hypotheses developed from the previous evidence are as follows:

- **H1 :** Neurotransmitters have a substantial influence on cryptocurrency investment decisions.
- **H2 :** Neurotransmitters have a substantial impact on the RT of cryptocurrency investors.

Risk Tolerance (RT) as a Mediator

RT refers to a person's ability and willingness to take on investment risks. It is an essential factor that investors need to consider when making any investment decisions (Lippi & Rossi, 2020). According to Linge et al. (2024), there is a wide range of variation in RT across individuals, contingent upon several characteristics such as age, financial standing, and investing objectives. If an investor is older and nearing retirement and needs to protect their savings, they may be less RT than younger investors. According to Malik et al. (2019), investors who earn a high income might be able to take on more risk.

Gautam and Kumar (2023a) and Gautam et al. (2024) stated that it is imperative to take RT into account before undertaking any kind of asset investment. Investors may encounter difficulties and sell cryptocurrencies at the wrong time if they are taking on more risks than they can handle (Rodrigues & Gopalakrishna, 2023). The risk of investing in cryptocurrencies is higher than that of regular investments (Gautam & Kumar, 2024).

The studies of Christoffersen and Stæhr (2019), Raheja and Dhiman (2019), and Ritika and Kishor (2022) found the association between behavioral biases, RT, as well as investment decisions to be statistically significant. The research on behavioral biases and investing decisions has shown that RT is a statistically significant mediator (Raheja & Dhiman, 2019). The association between neurotransmitters and RT is complex and not entirely understood yet. Khan and Mubarik (2020) suggested that certain neurotransmitters can influence an individual's perception of risk and their decision-making process. So, the research hypotheses derived from the previous evidence are as follows:

- **H3 :** RT significantly impacts cryptocurrency investment decisions.
- **H4 :** RT is a substantial mediator between neurotransmitters and cryptocurrency investment decisions.

Moderating Effect of Investment Experience

Knowledge or skill about investing is acquired by direct participation in financial markets or investment activities. Investment experience can play a substantial role in shaping investment decisions. With experience, people can become fully informed about the financial markets, the products available, and the potential advantages and disadvantages of different investing strategies (Zhao & Zhang, 2021).

Individuals responsible for managing and regulating risk will find it challenging to assess whether data

connected to risk is functioning predictably or in an unpredictable way without understanding how financial report users think about risk (Gomes et al., 2007). Therefore, it is essential for those in charge of managing and regulating risk to comprehend how users of financial reports perceive and interpret risk (Nag & Shah, 2022). Baker et al. (2019) found investment experience as a demographic variable to be the most vital factor related to the individual investor's behavioral biases. According to Yalcin et al. (2016), individual investors' investment decisions are significantly influenced by the moderating effect of investment experience. Xi et al. (2020) and Zhao and Zhang (2021) have reported that there is a positive correlation between cryptocurrency investing and financial literacy and investment experience, with investment experience having a stronger influence. So, the research hypotheses developed from the previous evidence are as follows:

- **H5 :** Investment experience significantly impacts cryptocurrency investment decisions.

- **H6 :** Investment experience is a substantial moderator between neurotransmitters and cryptocurrency investment decisions.

Research Methodology

Data Collection

The study employed primary data from investors who either made cryptocurrency investments or had knowledge of such investments, and the study's unit of analysis is Indian investors from the northern zone because, it is evidenced by a Bloomberg report, almost 15 million Indians have invested in cryptocurrency assets. The study is descriptive, and by using a snowball sampling method, the investors were approached, and in this case, a group of brokers, close contacts who had made significant investments, and notable broking houses were addressed for questionnaire responses from June to August 2023. This means of data collection is supposed to be an appropriate practice when we need to collect data from a specific group of people who might otherwise be tough to identify.

Statistical Methods

The hypotheses were examined and verified through the use of nonparametric structural modeling and the "variance-based partial least square method (PLS-SEM) in SmartPLS 4.0.8.2 software" (Ringle et al., 2022). According to Hair Jr. et al. (2021), PLS-SEM is a suggested method for identifying and defining important target constructs, such as the dependent variable, as well as for analyzing a theoretical model focused on prediction. Additionally, in order to make investment decisions, the data analysis in this study uses predictor factors that have been described by Sarstedt et al. (2019) and Cheah et al. (2019) with respect to cryptocurrencies in an emerging market. PLS-SEM is deemed suitable for predicting outcomes in the theoretical framework of behavioral and social sciences (Hair Jr. et al., 2019). Moreover, PLS-SEM was selected for this investigation because it enables the investigation of moderation and mediation effects (Saari et al., 2021). Initial assessments involved analyzing the "first-order and second-order" measurement models before proceeding to 10,000 bootstrap subsamples using the "bias-corrected percentile" approach (two-tailed test) for "structural model assessments" (Hair Jr. et al., 2021).

Data Analysis and Results

Descriptive Analysis

The respondents' demographic aspects are described in Table 1. All of the respondents are over the age of 18, yet

Table 1. ***Descriptive Analysis***

Category	Subcategory	Number	Percentage
Age	18–30 years	248	49.4
	31–40 years	192	38.2
	41–50 years	45	8.8
	51 years and above	19	3.6
	Total	**504**	**100**
Gender	Male	352	69.8
	Female	153	30.2
	Total	**504**	**100**
Income	Less than 250,000	40	7.8
	250,001–500,000	222	44.2
	500,001–1,000,000	178	35.4
	More than 1,000,001	64	12.6
	Total	**504**	**100**
Investment Experience	1–3 years	274	54.6
	3–6 years	183	36.4
	6–9 years	35	6.8
	10 years and above	12	2.2
	Total	**504**	**100**

49.4% of them were observed to be grouped in the 18 to 30 age bracket. There were 349 men and 151 women among the 504 respondents. It was determined as a result that responses were largely from men. The major finding of the demographic research is that men were mostly investing in the cryptocurrency market.

First-Order Assessment

A combination of "first-order and second-order" assessments was used in the evaluation of the measurement model, as per the protocols outlined by Hair Jr. et al. (2019, 2021). Table 2 displays the reliability of indicators for all latent constructs along with metrics for internal consistency, convergent validity by "Henseler's RhoA and composite reliability," and "average variance extracted." The "discriminant validity" was assessed using the "Heterotrait – Monotrait" (HTMT) correlation ratios. Sarstedt et al. (2017) discovered that the indicator loadings for every construct are above the 0.70 criterion. Table 2 illustrates the quality assessment of first-order constructs

Table 2. ***Reliability and Validity***

Construct	Items	FL	rho_A	CR	AVE
Dopamine	*DP1*	0.845	0.821	0.893	0.736
	DP2	0.858			
	DP3	0.870			
Serotonin	*ST1*	0.877	0.821	0.893	0.737
	ST2	0.829			
	ST3	0.868			

Investment Decisions	*ID1*	0.800	0.837	0.891	0.672
	ID2	0.846			
	ID3	0.779			
	ID4	0.851			
Risk Tolerance	*RT1*	0.875	0.815	0.889	0.729
	RT2	0.823			
	RT3	0.862			

Note. Please see the Appendix for the variable statements.

Table 3. ***Discriminant Validity***

HTMT	*DP*	*ID*	*RT*	*ST*
DP	**1**			
ID	0.637	**1**		
RT	0.626	0.855	**1**	
ST	0.752	0.690	0.679	**1**

within the study. The HTMT was used to assess the first-order constructs' discriminant validity. Table 3 shows that all HTMT ratios are found to be below the crucial threshold (0.85) in accordance with the recommendation of Henseler et al. (2015). This suggests that all latent components have good discriminant validity.

Second-Order Measurement Model Assessment

In this study, neurotransmitters were assessed using a reflective–reflective approach. Sarstedt et al. (2019) employed the values of lower-order constructs that represent neurotransmitters as a means of evaluating second-order constructs. Rho_A, CR, and AVE assessed the second-order reliability. Table 4 shows that the values of AVE (0.809), CR (0.894), and Rho_A (0.767) exceed the threshold limits. On the other hand, the "discriminant validity" and "convergent validity" of the second order were established using the "HTMT method" and AVE, respectively. Table 5 represents the discriminant validity of the second order by using the HTMT method. Henseler et al. (2015) found that all of the HTMT ratio values are less than the required margin (0.85), with the exception of one acceptable value, which is ≤ 0.90 (Gold et al., 2001).

Table 4. ***High-Order Reliability and Validity***

	Rho_a	CR	AVE
Neurotrasmitters	0.767	0.894	0.809

Table 5. ***High-Order Discriminant Validity***

HTMT	*ID*	*IE*	*NT*	*RT*	*IE × NT*
ID	1				
IE	0.026	1			
NT	0.765	0.024	1		
RT	0.855	0.024	0.753	1	
IE × NT	0.089	0.038	0.119	0.021	1

Structural Model Assessment

The guidelines provided by Hair Jr. et al. (2019, 2021) were followed to assess the results of the structural model for hypothesis testing as well as its predictive and descriptive capabilities (Hair Jr. et al., 2020). Ghasemy et al. (2020) and Saari et al. (2021) techniques were employed to record the path coefficients' importance within the structural model. All path coefficients are statistically significant ($p < 0.05$), except for the moderator IE, which is found to be not significant ($p = 0.467$), as shown in Table 6. The substantial predictors of investment decisions are neurotransmitters ($\beta = 0.160$, $t = 3.356$, $p < 0.05$, supporting H1). However, in order to evaluate the mediating role of RT, a mediation analysis was carried out. Using 10,000 subsamples, bootstrapping was used to investigate the mediation (Hair Jr. et al., 2021). Table 6 data indicates that RT has a substantial mediating impact ($\beta = 0.315$, $t = 8.755$, $p = 0.000$). The overall effect of second-order neurotransmitters on investment decisions is substantial ($\beta = 0.458$, $t = 10.644$, $p = 0.001$), and even after including the mediator, the direct influence remains significant ($\beta = 0.160$, $t = 3.356$, $p = 0.05$). The moderation effect of investment experience on the association of neurotransmitters and investment decisions is found to be insignificant ($\beta = –0.026$, $t = 0.727$, $p = 0.467$). The PLS-SEM analysis of the structural model accounts for age, gender, and income as controlling factors. The variables for age and income are coded as 0 for 18–40 years and 1 for 41 years and above, respectively. Gender is represented as a dummy variable (0 for male, 1 for female). The findings suggest a higher propensity for cryptocurrency investment decisions among male investors aged 18–40 years, with incomes ranging from 250,000 to 500,000 and 500,001 to 1,000,000. However, these findings do not achieve statistical significance.

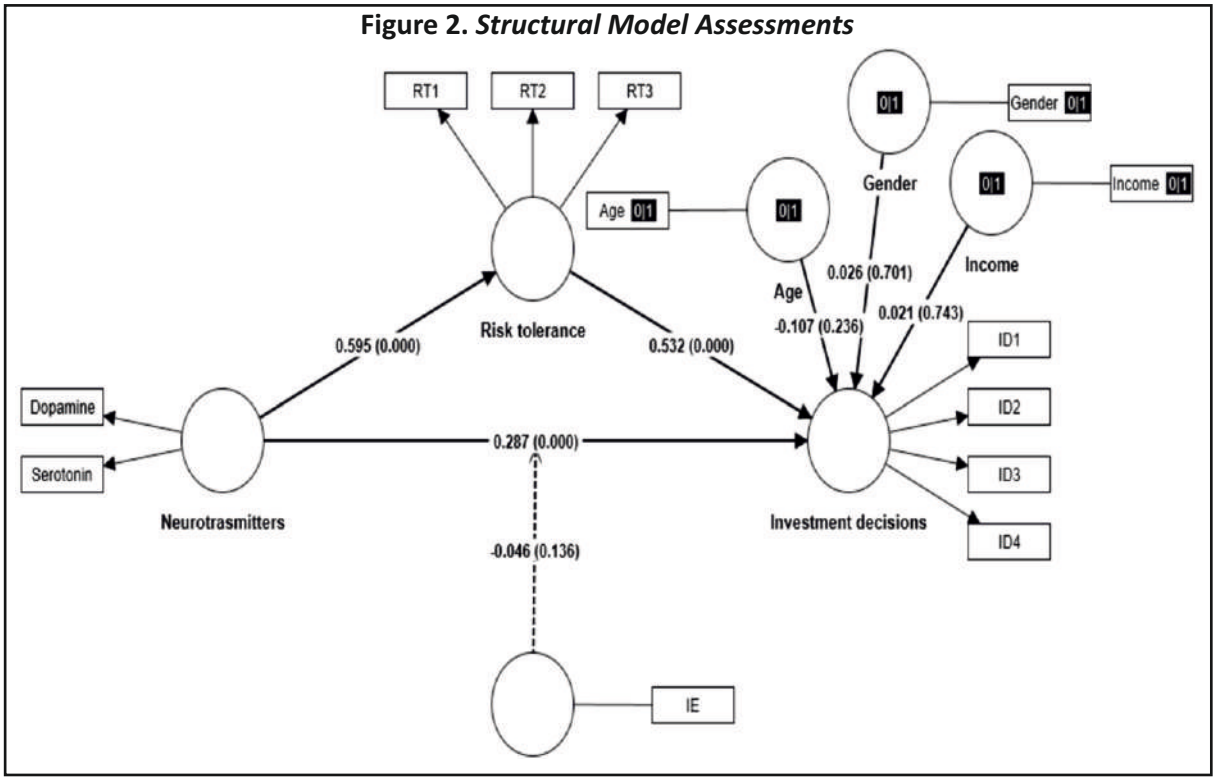
Figure 2 illustrates the final causal relationships among the examined constructs. The goodness-of-fit index is assessed using the standardized root mean square residuals (SRMR), with a value of 0.056 for the estimated model, indicating a good fit as it falls below the critical threshold of 0.08 (Hair Jr. et al., 2021). Mediation effects are examined using the bootstrapping approach with 10,000 subsamples. As shown in Table 6, it is discovered that RT significantly mediates the association ($\beta = 0.315$, $p < 0.01$) between emotional intelligence and investment decisions in the setting of a developing country like India. However, the moderating effect of investment experience on the relationship between neurotransmitters and investment decisions is found to be insignificant ($\beta = –0.046$, $p > 0.05$).

Table 6. *Structural Model Assessments*

Hypotheses	Variable Relationship	Beta	STDEV	*t*-stats.	*p*-values	Result
H1	*NT –> ID*	0.287	0.044	6.596	0.000	Accepted
H2	*NT –> RT*	0.595	0.039	15.373	0.000	Accepted
H3	*RT –> ID*	0.532	0.045	11.861	0.000	Accepted
H4	*NT –> RT –> ID*	0.315	0.036	8.755	0.000	Accepted
H5	*IE –> ID*	–0.018	0.031	0.590	0.555	Rejected
H6	*IE × NT –> ID*	–0.046	0.031	1.491	0.136	Rejected
	Age –> *ID*	–0.107	0.091	1.184	0.236	Rejected
	Gender –> *ID*	0.026	0.068	0.384	0.701	Rejected
	Income –> *ID*	0.021	0.066	0.327	0.743	

STDEV : Standard deviation.

Figure 2. ***Structural Model Assessments***



Discussion

The results demonstrate that neurotransmitters (dopamine and serotonin) have a substantial impact on cryptocurrency investment decisions. These outcomes support the previous studies (Ahmad, 2018; Khan & Mubarik, 2020). Dopamine is thus considered to be a reliable factor to enhance investment decisions. Thus, the findings suggest that when dopamine levels are high, investors are more likely to take chances and make rash financial judgments. Understanding the role dopamine plays in investing can help investors make more informed decisions and manage risk more skillfully (Gautam & Kumar, 2023b).

Another factor, serotonin, is also found to positively and significantly influence cryptocurrency investment decisions. These results are consistent with earlier research by Ahmad (2018) and Khan and Mubarik (2020), which found that serotonin could significantly influence investing decisions. When serotonin levels are low, investors are more inclined to take risks and make impulsive investment decisions, seeking higher returns but also facing higher potential losses. Investors can be more conscious of potential biases resulting from fluctuations in serotonin levels by comprehending the function of serotonin in investment decisions.

The major findings of this research also indicate the indirect relationship of neurotransmitters with investment choices, while RT mediates the association between them significantly. However, it is discovered that there is little evidence of a moderating effect of investment experience on neurotransmitters and investment decisions. Thus, the results of earlier research by Malik et al. (2019) and Zhao and Zhang (2021) are confirmed. The verdicts of the current research propose that dopamine and serotonin should be considered while making decisions regarding cryptocurrency investment decisions. Ahmad (2018), Khan and Mubarik (2020), and Tseng (2006) also recommended putting special attention on neurotransmitters to make investment decisions.

Implications

Theoretical Implications

The study proposes a comprehensive conceptual framework with highly useful theoretical contributions. This study highlights the vital factors for making sound investment choices. This research adds to the neurofinance theory, specifically the dual process theory. The theory suggests that there are two distinct neural pathways involved in investment decision-making: the "hot" system and the "cold" system. Neurotransmitters can influence both of these systems in different ways. For example, persons who have high dopamine and low serotonin levels are more likely to take risks and act impulsively, which also applies to bitcoin investing decisions. This can lead to increased investment activity and potentially higher returns, but it can also increase the likelihood of making hasty or ill-considered decisions. Hence, the verdicts of the study are associated with the dual process theory and find the "hot" system in the case of cryptocurrency investment decision-making. Hence, this study makes significant contributions to the neurofinance literature and the dual process theory regarding investment decision-making within the cryptocurrency markets, particularly in the Indian context.

Managerial Implications

The understanding of behavior influenced by neurotransmitters opens avenues for formulating behavioral interventions that target the mitigation of impulsive investment choices. Approaches such as mindfulness training or cognitive-behavioral interventions could be investigated to aid investors in cultivating more deliberate decision-making processes. Furthermore, the study's revelations hold the potential to enhance comprehension of market volatility, particularly within the realm of cryptocurrencies. The impact of neurotransmitters might elucidate the underlying causes of market irrationalities and abrupt fluctuations, thus advancing our grasp of the dynamics at play in cryptocurrency markets.

Conclusion

This paper starts with the observation that behavioral finance has evolved since it was initially established in the early 1980s. For example, investors were formerly thought to be "irrational," whereas further research reveals that people have "normal" desires, which are likely to support and shape many aspects of financial behavior rather than cognitive errors as well as shortcuts. The field of neurofinance is born out of researchers who take it a step further and wonder how and why certain actions take place in the brain. In neurofinance, neurotransmitters are found prominent in choice-making. So, this study explores and analyzes the factors of neurotransmitters and their influence on cryptocurrency investment choices with the mediator RT and the moderator investment experience. The verdicts of this study specify that neurotransmitters play a vital part in investment decision-making as a substantial direct impact is observed during the study. Furthermore, "risk tolerance" is found to act as a significant mediator amid neurotransmitters and cryptocurrency investment choices. However, the moderator's "investment experience" is observed as an insignificant one.

Limitations of the Study and the Way Forward

The investigation into the impact of neurotransmitters on cryptocurrency investment choice-making opens up a convincing avenue for future research with significant implications. This study is for a short period. However, further longitudinal studies could provide insights into the dynamic nature of neurotransmitter profiles and their

evolution over an investor's journey. An investigation of the relationship between these modifications and variations in investing approaches and results may provide important new information on the long-term effects of decisions influenced by neurotransmitters.

Second, the potential of neurofeedback interventions justifies exploration. Investigating whether investors can learn to modulate their neurotransmitter-related behaviors through training and feedback mechanisms could have practical implications for enhancing decision-making processes. Third, expanding the scope beyond cryptocurrencies to traditional financial markets could yield comparative insights. Investigating whether neurotransmitter influences differ when investing in more established assets like stocks, bonds, or real estate could provide a comprehensive view of the role neurotransmitters play in various investment contexts. The future scope of research in the realm of neurotransmitters and cryptocurrency investment decision-making is promising. To close the gap between neuroscience and finance, it entails delving deeper into neurobiological causes, evaluating larger investment contexts, and exploring treatments.

Authors' Contribution

Dr. Shubhangi Gautam conceived the idea and developed qualitative and quantitative designs to undertake the empirical study. Furthermore, extracted research papers with high reputations, filtered these based on keywords, and generated concepts and codes relevant to the study design. Dr. Pardeep Kumar verified the analytical methods. Dr. Shubhangi Gautam and Dr. Pardeep Kumar conducted the survey. The analysis was done by Dr. Shubhangi Gautam using SmartPLS 4 and verified by Dr. Pardeep Kumar. Then wrote the manuscript in consultation with both the authors. Preeti Dahiya helped during the revision process and made a significant contribution.

Conflict of Interest

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Funding Acknowledgment

The authors received no financial support for the research, authorship, and/or for the publication of this article.

References

Ahmad, M. (2018). Impact of neurotransmitters, emotional intelligence, and personality on investor's behavior and investment decisions. *Pakistan Journal of Commerce and Social Science, 12*(1), 330–362. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85049638765&partnerID=40&md5=20fd9ccad0cc12621d42a937d0939ea4

Al-Mansour, B. Y. (2020). Cryptocurrency market: Behavioral finance perspective. *The Journal of Asian Finance, Economics and Business, 7*(12), 159–168. https://doi.org/10.13106/JAFEB.2020.VOL7.NO12.159

Annapurna, R., & Basri, S. (2024). Role of emotions in stock investment decisions : A critical review of the literature. *Indian Journal of Finance, 18*(5), 50–65. https://doi.org/10.17010/ijf/2024/v18i5/173842

Baker, H. K., Kumar, S., Goyal, N., & Gaur, V. (2019). How financial literacy and demographic variables relate to behavioral biases. *Managerial Finance, 45*(1), 124–146. https://doi.org/10.1108/MF-01-2018-0003

Cheah, J.-H., Ting, H., Ramayah, T., Memon, M. A., Cham, T.-H., & Ciavolino, E. (2019). A comparison of five reflective–formative estimation approaches: Reconsideration and recommendations for tourism research. *Quality & Quantity, 53*(3), 1421–1458. https://doi.org/10.1007/s11135-018-0821-7

Christoffersen, J., & Stæhr, S. (2019). Individual risk tolerance and herding behaviors in financial forecasts. *European Financial Management, 25*(5), 1348–1377. https://doi.org/10.1111/eufm.12231

Chuang, W.-I., Lee, B.-S., & Wang, K.-L. (2014). US and domestic market gains and Asian investors' overconfident trading behavior. *Financial Management, 43*(1), 113–148. https://doi.org/10.1111/fima.12030

Conway, C. C., & Slavich, G. M. (2017). Behavior genetics of prosocial behavior. In *Compassion: Concepts, research and applications* (1st ed.). Routledge. https://www.taylorfrancis.com/chapters/edit/10.4324/9781315564296-9/behavior-genetics-prosocial-behavior-christopher-conway-george-slavich

Dangi, M., & Kohli, B. (2018). Role of behavioral biases in investment decisions: A factor analysis. *Indian Journal of Finance, 12*(3), 43–57. https://doi.org/10.17010/ijf/2018/v12i3/121997

Gautam, S., & Kumar, P. (2023a). Behavioral biases of investors in the cryptocurrency market. In *AIP Conference Proceedings* (Vol. 2782, Iss. 1), 020105. AIP Publishing. https://doi.org/10.1063/5.0154194

Gautam, S., & Kumar, P. (2023b). Prominent behavioral biases affecting investment decisions: A systematic literature review with TCCM and bibliometric analysis. *International Journal of Indian Culture and Business Management*. https://doi.org/10.1504/IJICBM.2023.10059339

Gautam, S., & Kumar, P. (2024). A study of the evolutionary trends in blockchain and cryptocurrency: A bibliometric approach. In S. Taneja, P. Kumar, K. Sood, E. Özen, & S. Grima (eds.), *Finance analytics in business* (pp. 251–266). Emerald Publishing Limited. https://doi.org/10.1108/978-1-83753-572-920241013

Gautam, S., Kumar, P., Dahiya, P., & Sandhu, S. (2024). Emotional intelligence and cryptocurrency investments: Unraveling the mediating role of risk tolerance and moderating role of investment experience. *International Journal of Business Innovation and Research*. https://doi.org/10.1504/IJBIR.2024.10065382

Ghasemy, M., Teeroovengadum, V., Becker, J.-M., & Ringle, C. M. (2020). This fast car can move faster: A review of PLS-SEM application in higher education research. *Higher Education, 80*(6), 1121–1152. https://doi.org/10.1007/s10734-020-00534-1

Ghosh, S. K. (2021, June 22). Rising retail participation in stock market: Is it the beginning of a long-term behavioural change? (Issue 23). *SBI Ecowrap*. https://sbi.co.in/documents/13958/10990811/220621-Ecowrap_20210622.pdf/98268407-3a8a-bacf-085b-3daef4984292?t=1624355750351

Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information Systems, 18*(1), 185–214. https://doi.org/10.1080/07421222.2001.11045669

Gomes, A., Gorton, G., & Madureira, L. (2007). SEC regulation fair disclosure, information, and the cost of capital. *Journal of Corporate Finance, 13*(2–3), 300–334. https://doi.org/10.1016/j.jcorpfin.2006.11.001

Hair Jr., J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research, 109*, 101–110. https://doi.org/10.1016/j.jbusres.2019.11.069

Hair Jr., J. F., Hult, G. T., Ringle, C. M., & Sarstedt, M. (2021). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). SAGE Publications Inc. https://us.sagepub.com/en-us/nam/a-primer-on-partial-least-squares-structural-equation-modeling-pls-sem/book270548

Hair Jr., J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review, 31*(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Hiser, J., & Koenigs, M. (2018). The multifaceted role of the ventromedial prefrontal cortex in emotion, decision making, social cognition, and psychopathology. *Biological Psychiatry, 83*(8), 638–647. https://doi.org/10.1016/j.biopsych.2017.10.030

Khan, A., & Mubarik, M. S. (2020). Measuring the role of neurotransmitters in investment decision: A proposed constructs. *International Journal of Finance & Economics, 27*(1), 258–274. https://doi.org/10.1002/ijfe.2150

Kuhnen, C. M., & Chiao, J. Y. (2009). Genetic determinants of financial risk taking. *PLoS ONE, 4*(2), e4362. https://doi.org/10.1371/journal.pone.0004362

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

Lang, M., Bahna, V., Shaver, J. H., Reddish, P., & Xygalatas, D. (2017). Sync to link: Endorphin-mediated synchrony effects on cooperation. *Biological Psychology, 127*, 191–197. https://doi.org/10.1016/j.biopsycho.2017.06.001

Lemmers-Jansen, I. L., Krabbendam, L., Veltman, D. J., & Fett, A.-K. (2017). Boys vs. girls: Gender differences in the neural development of trust and reciprocity depend on social context. *Developmental Cognitive Neuroscience, 25*, 235–245. https://doi.org/10.1016/j.dcn.2017.02.001

Linge, A. A., Jiwani, A., & Kakde, B. B. (2024). Factors affecting risk attitude and investors' happiness of newly employed individuals. *Indian Journal of Finance, 18*(5), 66–80. https://doi.org/10.17010/ijf/2024/v18i5/173843

Lippi, A., & Rossi, S. (2020). Run for the hills: Italian investors' risk appetite before and during the financial crisis. *International Journal of Bank Marketing, 38*(5), 1195–1213. https://doi.org/10.1108/IJBM-02-2020-0058

Malik, M. S., Hanif, M. I., & Azhar, M. Z. (2019). The impact of overconfidence bias on investment decisions : Mediating role of risk tolerance. *International Journal of Research and Innovation in Social Science, 3*(8), 154–160. https://www.rsisinternational.org/virtual-library/papers/the-impact-of-overconfidence-bias-on-investment-decisions-mediating-role-of-risk-tolerance/

Manzoor, A., Jan, A., & Shafi, M. (2023). Do personality and demographic variances of individual investors challenge the assumption of rationality? A two-staged regression modeling-artificial neural network approach. *Indian Journal of Finance, 17*(10), 64–78. https://doi.org/10.17010/ijf/2023/v17i10/168549

Miendlarzewska, E. A., Kometer, M., & Preuschoff, K. (2019). Neurofinance. *Organizational Research Methods, 22*(1), 196–222. https://doi.org/10.1177/1094428117730891

Nag, A. K., & Shah, J. (2022). An empirical study on the impact of gen Z investors' financial literacy to invest in the Indian stock market. *Indian Journal of Finance, 16*(10), 43–59. https://doi.org/10.17010/ijf/2022/v16i10/172387

Padoa-Schioppa, C., & Conen, K. E. (2017). Orbitofrontal Cortex: A neural circuit for economic decisions. *Neuron, 96*(4), 736–754. https://doi.org/10.1016/j.neuron.2017.09.031

Patel, R. J. (2017). Co-movement and integration among stock markets : A study of 14 countries. *Indian Journal of Finance, 11*(9), 53–66. https://doi.org/10.17010/ijf/2017/v11i9/118089

Pertl, M.-T., Benke, T., Zamarian, L., & Delazer, M. (2017). Effects of healthy aging and mild cognitive impairment on a real-life decision-making task. *Journal of Alzheimer's Disease, 58*(4), 1077–1087. https://doi.org/10.3233/JAD-170119

Raghuraman, A. P., & Padoa-Schioppa, C. (2014). Integration of multiple determinants in the neuronal computation of economic values. *Journal of Neuroscience, 34*(35), 11583–11603. https://doi.org/10.1523/JNEUROSCI.1235-14.2014

Raheja, S., & Dhiman, B. (2019). Relationship between behavioral biases and investment decisions: The mediating role of risk tolerance. *DLSU Business and Economics Review, 29*(1), 31–39.

Ringle, C. M., Sven Wende, & Becker, J.-M. (2022). *SmartPLS 4. Boenningstedt: SmartPLS*. https://www.smartpls.com/

Ritika, & Kishor, N. (2022). Risk preferences for financial decisions: Do emotional biases matter? *Journal of Public Affairs, 22*(2), e2360. https://doi.org/10.1002/pa.2360

Rodrigues, C. G., & Gopalakrishna, B. V. (2023). Optimism and self-control : Complementary predictors of financial risk-taking propensity among working adults. *Indian Journal of Finance, 17*(7), 8–24. https://doi.org/10.17010/ijf/2023/v17i7/170966

Saari, U. A., Damberg, S., Frömbling, L., & Ringle, C. M. (2021). Sustainable consumption behavior of Europeans: The influence of environmental knowledge and risk perception on environmental concern and behavioral intention. *Ecological Economics, 189*, 107155. https://doi.org/10.1016/j.ecolecon.2021.107155

Sarstedt, M., Hair Jr., J. F., Cheah, J.-H., Becker, J.-M., & Ringle, C. M. (2019). How to specify, estimate, and validate higher-order constructs in PLS-SEM. *Australasian Marketing Journal, 27*(3), 197–211. https://doi.org/10.1016/j.ausmj.2019.05.003

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2017). Partial least squares structural equation modeling. In C. Homburg, M. Klarmann, & A. Vomberg (eds.), *Handbook of market research* (pp. 1–40). Springer. https://doi.org/10.1007/978-3-319-05542-8_15-1

Sen, S., & Banerjee, S. (2024). Exploring the relationship between psychological maturity and leadership personality traits – A discourse analysis. *Prabandhan: Indian Journal of Management, 17*(5), 60–70. https://doi.org/10.17010/pijom/2024/v17i5/173482

Singh, H. P., Goyal, N., & Kumar, S. (2016). Behavioural biases in investment decisions: An exploration of the role of gender. *Indian Journal of Finance, 10*(6), 51–62. https://doi.org/10.17010/ijf/2016/v10i6/94879

Singh, S., Mallaram, G. K., & Sarkar, S. (2017). Pathological gambling: An overview. *Medical Journal of Dr. D.Y. Patil University, 10*(2), 120–135. https://doi.org/10.4103/0975-2870.202105

Tseng, K. C. (2006). Behavioral finance, bounded rationality, neuro-finance, and traditional finance. *Investment Management and Financial Innovations, 3*(4), 7–18. https://www.researchgate.net/publication/265357711

Xi, D., O'Brien, T. I., & Irannezhad, E. (2020). Investigating the investment behaviors in cryptocurrency. *The Journal of Alternative Investments, 23*(2), 141–160. https://doi.org/10.3905/JAI.2020.1.108

Yalcin, K. C., Tatoglu, E., & Zaim, S. (2016). Developing an instrument for measuring the effects of heuristics on investment decisions. *Kybernetes, 45*(7), 1052–1071. https://doi.org/10.1108/K-05-2015-0130

Yokoyama, R., Nozawa, T., Sugiura, M., Yomogida, Y., Takeuchi, H., Akimoto, Y., Shibuya, S., & Kawashima, R. (2014). The neural bases underlying social risk perception in purchase decisions. *NeuroImage, 91*(1), 120–128. https://doi.org/10.1016/j.neuroimage.2014.01.036

Zhao, H., & Zhang, L. (2021). Financial literacy or investment experience: Which is more influential in cryptocurrency investment? *International Journal of Bank Marketing, 39*(7), 1208–1226. https://doi.org/10.1108/IJBM-11-2020-0552

Appendix. ***Questionnaire Items***

Constructs	Statements	Sources
Serotonin (*ST*)	I rarely lack the ability to be positive after making investment decisions (*ST1*).	(Khan & Mubarik, 2020)
	I rarely experience challenges with confidence after making investment decisions (*ST2*).	
	I generally get comfortable after making investment decisions (*ST3*).	
Dopamine (*DP*)	I seek an opinion from my friends and colleagues regarding investment decisions (*DP1*).	(Khan & Mubarik, 2020)
	My interest in other activities increases after making investment decisions (*DP2*).	
	I often feel happy after making investment decisions (*DP3*).	
Risk Tolerance (*RT*)	If I believe the investment will carry profit, I am willing to borrow money to make this investment (*RT1*).	(Kannadhasan et al., 2016)
	I believe I need to take more investment risks if I want to improve my financial position (*RT2*).	
	I am attracted, rather than scared, by risk (*RT3*).	
Investment Decisions (*ID*)	Making money is one of the most important goals of my life (*ID1*).	(Ogunlusi & Obademi, 2019)
	It is more satisfying to invest than to save money (*ID2*).	
	I would invest a larger sum of money in cryptocurrency (*ID3*).	

About the Authors

Dr. Shubhangi Gautam is working as an Assistant Professor at Lovely Professional University. She has various publications in the field of behavioral finance and cryptocurrency investments in different prestigious journals indexed in Scopus, ABDC listed, Web of Science, and UGC care. She is also serving as a reviewer for Scopus, ABDC-listed finance, and multidisciplinary journals.

Dr. Pardeep Kumar is working as an Associate Professor at Chandigarh University. He is a versatile educator and researcher with more than 14 years of professional experience. He is a life member of the ISTE.

Preeti Dahiya is working as an Assistant Professor at Panipat Institute of Engineering & Technology, Panipat, and pursuing a Ph.D. from Chandigarh University, Chandigarh. She has a vast experience of 15 years in teaching and research.