

Behavioral Biases, Risk Tolerance, Knowledge, and Investment on Cryptocurrency: A Moderated Mediation Analysis

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ABSTRACT

The emergence of the cryptocurrency market has revolutionized the monetary system by transforming investments into a global payment system. The uniqueness of this investment has attracted many investors. Many countries are interested in cryptocurrencies and blockchain technology, including the Philippines. The sudden popularity of cryptocurrency investing has impacted the financial landscape of many countries. However, there is a disconnect between investing and awareness about cryptocurrency investments. The study aims to determine the factors influencing the relationship between knowledge and cryptocurrency investment. This study examines a descriptive exploratory research design with moderated mediation analysis. The result of the study showed a significant influence of cryptocurrency knowledge on investing in cryptocurrencies. Furthermore, the non-mediating effect of risk tolerance may not be the primary factor through which knowledge influences investment decisions in the cryptocurrency market. In contrast, the negative moderating effect of behavioral biases on knowledge and cryptocurrency investment suggests that even with a higher level of knowledge, investors with higher behavioral biases weaken the positive impact on investment. This study sheds light on the complexities of cryptocurrency trading and suggests that understanding investor behavior can help investors make better investing decisions.

Keywords: Cryptocurrency, Behavioral Biases, Risk Tolerance, Investment.

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1. INTRODUCTION

Cryptocurrencies has transformed the global payment system on an unthinkable scale (Bunjaki et al., 2017). Cryptocurrencies have several distinctive qualities, but their most defining feature is their decentralized structure. This means they operate without a central authority (Terada et al., 2020). The underlying technology powering this decentralized system is blockchain, which provides a high level of security for cryptocurrencies. This investment's distinctiveness has attracted a vast number of investors. Numerous investors welcome cryptocurrencies because they allow funds to transfer between two parties in a secure transaction using public and private keys. In addition, cryptocurrencies provide lower transaction fees, improved efficiency, the possibility of higher transaction security and anonymity, and the absence of taxation (Rejeb et al., 2021). According to Nurbarani and Soepriyanto (2021), the rising price of bitcoins is another factor that draws investors. These critical properties of the

cryptocurrency sparked a worldwide frenzy among investors. According to Vora (2015), the emergence of cryptocurrencies and other virtual currencies has become a positive development because they can compete with the current monetary system, are exempt from governmental control, offer an alternative method of conducting transactions, and should be encouraged for their innovative nature. Unlike stocks and bonds, digital assets known as cryptocurrencies lack inherent value, a promise to pay, and dividends (Geuder et al., 2019). In addition to bonds and stocks, other financial assets provide sluggish returns and greater risk. Investing in stocks may yield a greater return but at the expense of greater risk, while investing in bonds may offer greater security at the expense of a lesser return. Realizing an investment may take some time if the investor desires a higher rate of return. These attributes of financial assets motivated the investor to invest in cryptocurrencies, a financial investment that delivers a flexible and cutting-edge monetary system. However, despite the distinctive attributes of cryptocurrencies, their susceptibility to illicit activities, including money laundering, and their high degree of volatility remain a significant concern. According to Weaver (2018), the risks connected to the cryptocurrency environment are numerous and diverse, primarily affecting those actively participating in this field.

According to the 2020 Global Crypto Adoption Index, cryptocurrency investment has become a global phenomenon. Based on the cryptocurrency index, there is an increasing number of crypto owners from different countries, with millions of its population participating. The first decentralized cryptocurrency created was the famous Bitcoin. This unique cryptocurrency was created in 2009 and has since experienced massive acceptance and growth globally. Bitcoin's success since 2009 has startled the financial sector and exposed weaknesses in the established banking system. From 2012 to 2020, Bitcoin gained over 193,639.36% of its value from its first creation. As of February 2021, its market capitalization had risen to \$1,072.21 billion, with the highest number of Bitcoin transactions done daily worldwide, hitting 367,536 in the first quarter of 2021.

The emergence of Bitcoin has led to the development of thousands of other cryptocurrencies referred to as altcoins (McGovern, Thomas, 2022). However, despite this massive participation in this investment, a low level of crypto awareness is seen. This development shows that even with little knowledge about cryptocurrencies, many people are becoming interested in them. For instance, the Philippines exhibits a startling interest in cryptocurrencies. The Philippines has approximately 4,360,579 cryptocurrency owners, accounting for an estimated 3.98 percent of the country's population. However, the Philippines is ranked seventeenth among the fifty countries that invest in cryptocurrencies based on its crypto awareness level of 29.2 percent. In this data, individual and institutional investors appear to be making impulsive cryptocurrency investments. The gap between cryptocurrency participation and crypto awareness has made it necessary to study the variables affecting such investment choices. This study aims to explore the factors that affect cryptocurrency investment decisions and how risk tolerance and behavioral biases moderate and mediate the relationship between knowledge and investment in cryptocurrency. The following research question underpins this study: To what extent does knowledge of cryptocurrency influence cryptocurrency investment, and how do risk tolerance and behavioral biases mediate and moderate the relationship between knowledge and investment in cryptocurrency?

The result of the study is helpful to investors in examining behavioral biases that influence their financial decisions and enhancing their understanding of the factors that influence their intention to invest in cryptocurrencies. Likewise, the government and

other financial institutions discuss cryptocurrency investors' security, risk, and privacy concerns. Finally, scholars should broaden their interest in how cryptocurrencies revolutionize technology outside the financial sector.

2. REVIEW OF THE LITERATURE

2.1. Knowledge and awareness of cryptocurrencies

We define financial awareness as the "ability to make informed judgments and effective decisions regarding the use and management of money." (PH & Uchil, 2020). Knowledge is accumulating facts and understanding about a particular subject, leading to a high awareness. These knowledge and awareness may result from information or ideas from the internet, the media, social contacts, personal referrals, or intermediaries. Since the media significantly impacts investing choices, it has become an essential source of information forecast and market movement data. According to a previous study, the evolution of financial education mainly influences the psychological components of investors (PH & Uchil, 2020). Knowledge is an integral part of the investment choice. Proper education on investment horizons and resource allocation strategies can prevent investors from making illogical cryptocurrency decisions. PH & Uchil emphasize that training and adequate instruction on behavioral factors can enhance knowledge, resulting in much better decisions and avoiding behavioral biases.

Previous research suggested that successful cryptocurrency investors possess more in-depth knowledge of the market and a self-assessed understanding of cryptocurrency (Steinmetz et al., 2021). However, numerous studies have examined the knowledge of Bitcoin investors about cryptocurrency. According to Ante et al. (2020), successful crypto-investors are more knowledgeable about bitcoins than those with less knowledge, leaving some crypto-investors in the dark. Even though the majority of Germans are familiar with cryptocurrencies, just a minority of them understand bitcoins (Steinmetz, 2021). Similarly, BearingPoint (2019, cited by Steinmetz, 2021) reports that a small fraction of German investors know cryptocurrencies and own cryptocurrency.

Moreover, BearingPoint (2019, cited by Steinmetz, 2021) projected that while awareness of Bitcoin has expanded dramatically, few individuals possess it. The study by English et al. (2020) determined that the British conducted thorough research and analysis before purchasing a substantial number of bitcoins. Crowder (2019) contends that although Americans thoroughly understand bitcoins, they must consider them an investment. According to Steinmetz et al. (2021), cryptocurrency awareness is low, but informed respondents frequently possess and trust cryptocurrencies, whereas less-knowing respondents are wary about non-criminal use and trustworthiness. These previous findings show that appropriate Bitcoin understanding and awareness leads to a prudent investing selection. This supposition could encourage investment since crypto-investors with appropriate information may be more confident and prudent. Further, a Deutsche Postbank (2018) study shows that half of the crypto owners had insufficient knowledge about bitcoins, and more than half cited risk. This observation may be a reason for individual and institutional investors to increase their knowledge and awareness before investing in cryptocurrencies.

2.2. Behavioral Finance Theory

One of the factors that influences investment decisions is behavioral finance. Behavioral finance theory seeks to explain and enhance understanding of investor thinking patterns,

including the emotional component and the degree to which these factors influence decision-making (Nurbarani & Soepriyanto, 2022). Specifically, behavioral finance explores the rationale behind investing decisions from a human perspective. This reason helps individuals understand why they make certain judgments and how to improve them in the future. These factors include biases that affect the investor's emotions and logical reasoning. Behavioral biases are crucial in all aspects of investments. The investors' prejudices and beliefs could cause them to overreact or underreact to information, emotions, perceptions, and social influences, resulting in illogical decision-making and an increased likelihood of taking risks (PH & Uchil, 2020). Researchers conducted several studies to assess the effect of behavioral biases on investment decisions. According to Al-Mansour (2020), the cryptocurrency market is driven by behavior finance variables, implying that the herding theory factors, prospect theory, and heuristic theory substantially impact the investing decisions of cryptocurrency market participants.

2.2.1. Herding

King and Koutmos (2021) found empirical evidence that herding behavior, or "trend-chasing," causes price fluctuations in various cryptocurrency markets. This evidence explains why social pressure and bitcoin noise affect people's buying decisions. According to PH and Uchil (2020), investors engage in herd or herding behavior when they imitate the actions of others. Investors appear to observe others' investments before making their selections. Previous literature has determined that herd behavior is the most prevalent irrational investing behavior that could result in short-term destabilization or acceleration of the price adjustment process (PH & Uchil, 2020). Herding significantly impacts the price movement of assets as it incentivizes investors to take excessive risks, which may affect price volatility. The inability of investors to make independent decisions and their tendency to merely imitate others leads to the continued cacophony of cryptocurrency. This behavior may explain why investment in cryptocurrencies has generated so much noise among individual and institutional investors, resulting in hype. Previous studies have shown contradictory findings about the effect of HERDING on investment in cryptocurrency. For example, Kartini and Nahda (2021) discovered that herding behavior influences investing decisions significantly, while Al-Mansour (2020) argues that herding behavior significantly influences cryptocurrency investment. It suggests that investors are more likely to rely on the aggregate information of other investors than on their personal information. However, according to Nurbarani and Soepriyanto's (2022) research, herd behavior does not significantly affect cryptocurrency investments. Investors tend to be sensible because other investors do not influence them and do not follow market noise. This assertion may imply that the actions of others may not impact a person's decision to invest in cryptocurrency.

2.2.2 Prospect

Prospect bias, often known as the prospect theory, is the tendency for investors to base their financial decisions on potential gains or losses rather than the predicted value (Goyal et al., 2023). This bias is more sensitive to losses than to gains. Investors may be more willing to accept risks to avoid future losses than to achieve future benefits. When investing in cryptocurrencies, investors look to the returns on their investments to compensate for any potential losses. According to prior research, the prospect factor does not substantially impact investing decisions in the Bitcoin market (Juwita et al.,

2022). This notion may imply that, due to prospect bias, bitcoin investors may not evaluate risk or losses and instead concentrate solely on gains.

2.2.3 Heuristic

According to the concept of heuristics, decision-makers use heuristics to avoid the risk of loss in ambiguous situations. Heuristics suggests that investors make investing decisions through discretion to avoid complexities in decision-making (Kahneman & Tversky, 1974, 2013). Rather than performing extensive research and analysis, investors simplify their decision-making by collecting easily accessible data. This action includes relying on mental shortcuts or rules of thumb when making decisions. For instance, an investor may consider information regarding the previous profitability of investments or social media noise without examining relevant factors. Prior research has examined the influence of heuristic biases on investors' investment decisions. Al-Mansour (2020) and Juwita et al. (2022) conclude that heuristics biases considerably favor investing decisions. In contrast, Shah et al. (2018) argue that heuristic biases have had a significant negative impact on the investment decisions of individual investors, arguing that minimizing the risk of losses in uncertain scenarios has led to errors in judgment that have resulted in irrational decisions by the investors.

2.2.4 Overconfidence

According to Kartini and Nahda(2021), overconfidence is a condition in which investors believe their abilities are superior to the average of other investors and have an inaccurate self-assessment. Overconfidence is a high level of self-belief in one's knowledge, skills, and abilities, which assures one to make risky financial judgments. A more confident disposition can harm financial judgment, especially in stock investment. Nurbarani and Soepriyanto (2022) argue that this overconfidence can lead to irrational behavior, causing investors to overestimate returns without considering the risks. Researchers conducted several studies to assess the influence of overconfidence on investment decisions. For instance, a study by Katrina and Nahda(2021) argues that overconfidence bias positively influences investment decision-making. In contrast, Shah et al. (2018) highlight the negative influence of overconfidence on investment decisions, arguing that investors cannot make better investment selections due to overconfidence bias.

2.2.5. Risk tolerance

According to Kogan and Wallach(1964), risk tolerance is the readiness of an individual to engage in behavior where the fulfillment of a desirable goal is unclear and loss is a possibility. While risk tolerance is often associated with the potential for higher returns, it's important to note that the diversification benefits of certain asset classes, such as Bitcoin, remain uncertain (Lavelle et al., 2022). Risk tolerance is the capacity and disposition of an individual to accept investment risk. This risk tolerance involves the anticipation of a financial loss while anticipating the possibility of more significant gains. Risk tolerance is seen as essential in investment decision-making because it assists the investor in evaluating the portfolio's composition. Based on a previous study, risk tolerance influences investors' investing decisions, where those with a high-risk tolerance are more likely to invest in high-risk assets.

In contrast, those with a low-risk tolerance tend to avoid high-risk assets (Nguyen et al., 2016). Risk tolerance in cryptocurrency pertains to an investor's confidence despite

the volatility and unpredictability of the cryptocurrency market. Previous literature posited that "financial knowledge is a reliable and statistically significant predictor of risk tolerance" (Grable & Joo, 2000, p155). Risk tolerance is determined by the investor's level of financial knowledge, implying that an investor with a solid grasp of finance can tolerate risk. Previous literature argues the relationship between risk tolerance and investment decisions. For example, according to Nguyen et al. (2016), a positive association exists between financial risk tolerance and investment decisions. Ainia et al. (2019) argue that risk tolerance has a significant positive effect on investment decisions. Previous research indicates that investors' risk tolerance is proportional to their investment decisions, reflecting their willingness to face risks in their investment choices.

Based on the preceding literature, researchers raised the following arguments:

H1. Knowledge of Cryptocurrency significantly affects investment in Cryptocurrencies.

H2. Risk Tolerance mediates the relationship between Knowledge of Cryptocurrencies and Investment in Cryptocurrencies.

H3. Behavioral Biases moderate the relationship between Knowledge of Cryptocurrencies and Investment in Cryptocurrencies.

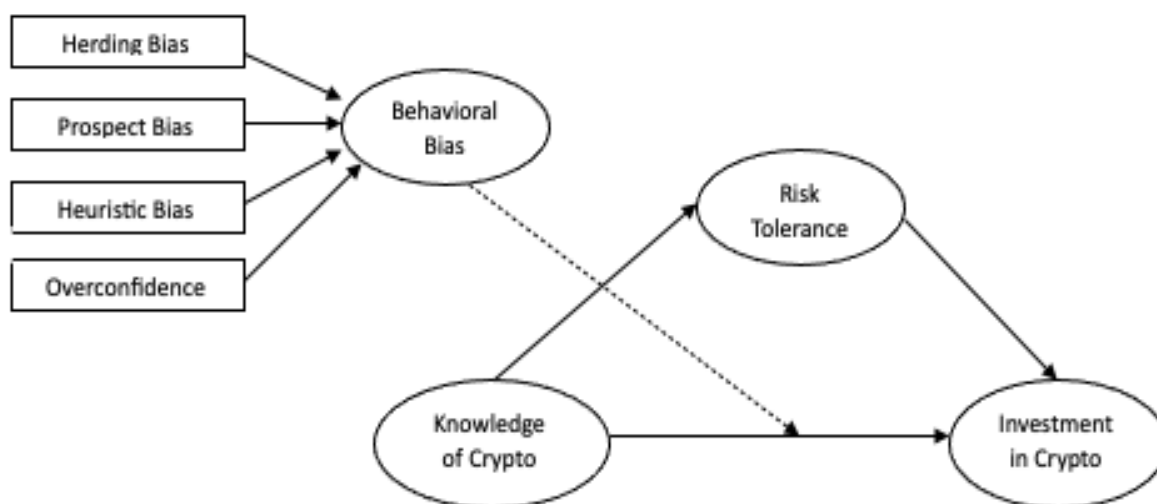


Figure 1. Moderating and mediating the effect of Behavioral Biases and Risk Tolerance on the relationship between Knowledge of Cryptocurrency and Investment in cryptocurrency

3. METHODS

The study explores a descriptive exploratory with mediation and moderation analysis. Researchers deem the method appropriate as the study explores the current cryptocurrency phenomenon. With mediation and moderation analysis, the study can determine how behavioral biases and risk tolerance play a significant role in the knowledge and investment in cryptocurrencies. The descriptive portion of the study looks at the bitcoin investors' degree of knowledge and risk tolerance. In order to describe the investors' knowledge and risk tolerance, the researcher examines a central frequency with mean and standard deviation.

Researchers conducted a Linear Regression to measure the effect of Knowledge of Cryptocurrency on Investment in Cryptocurrency. To strengthen the assumption of this relationship, a control variable, "Level of Education," was added as an independent variable to determine how education influences cryptocurrency investment.

The researcher explored Mediation analysis by examining the three regressions in the framework above. Researchers used SPSS to determine complete mediation by testing whether the independent variable's effect on the dependent variable becomes zero after controlling for the mediator. Researchers determine partial mediation when controlling for the mediator reduces the independent variable's influence on the dependent variable, but the coefficient remains nonzero. Researchers will interpret statistical results using a significance level of $p < .05$.

Researchers conduct the Mediation analysis with Investment in Cryptocurrency as the dependent variable, Knowledge in Cryptocurrency as the Predictor, and Risk Tolerance as the Mediator. The analysis shows Indirect, Direct, and Total Effects indicating Mediation of Risk Tolerance on the relationship between Knowledge and Investment in Cryptocurrency.

Researchers conducted a Moderation analysis using SPSS to assess how behavioral biases influence the relationship between knowledge of cryptocurrency and investment in cryptocurrency. The analysis shows the increase or decrease in the effect of Knowledge in Cryptocurrency on Investment decisions when moderated by Behavioral Biases.

Data was collected through convenience sampling, recruiting respondents via participation in multiple cryptocurrency investor groups on social media platforms. The researcher administered the survey instruments using SurveyMonkey, which facilitated the distribution of the survey instruments and provided real-time access to the survey results. This survey was conducted directly on the investor's social media page, ensuring it was openly accessible to all members without imposing any limitations based on age or educational background. The survey instrument included questions to gather information on investment behavior and knowledge. It consisted of five variables, Behavioral Biases and Risk Tolerance, each assessed using a 6-point Likert scale, allowing participants to express their opinions and attitudes across various responses.

The survey asked participants to rate their cryptocurrency knowledge on a scale of 1 to 5, with 1 being the lowest level of knowledge and five being the highest. The measurement of cryptocurrency investment comprises two indicators in this study: ownership, respondents' affirmative or negative response to the question, and intention to invest in cryptocurrency, assessed using a 5-level Likert Scale ranging from 1 (Less Likely) to 5 (Very Likely). The Likert Scale items were carefully constructed based on an extensive review of pertinent literature and research in the field. The researcher carefully crafts the survey questions to measure participants' investment decision-making tendencies accurately. In the statistical analysis, the dependent variable utilized is the Intention to Invest, which indicates the participant's level of commitment to cryptocurrency investment. Researchers assessed the reliability of the scale items using Cronbach's alpha, a measure of internal consistency. The results indicate satisfactory levels of reliability for all variables under consideration. Specifically, the Cronbach alpha values for the tested variables were as follows: Herding ($\alpha = 0.77$), Prospect ($\alpha = 0.75$), Heuristic ($\alpha = 0.70$), overconfidence ($\alpha = 0.70$), and Risk Tolerance ($\alpha = 0.70$). These values, all exceeding the commonly accepted threshold of 0.70, affirm the internal consistency of the scales, indicating that the items within each variable reliably measure the intended constructs. The reliability test outcomes demonstrate the

robustness of the measurement instruments and provide confidence in the validity of the collected data.

4. RESULTS

Table 1. Profile of respondents

Variable	n	%	Variable	n	%
GENDER			LEVEL_OF_EDUCATION		
Male	226	58	Graduate	108	28
Female	164	42	Post-Graduate	19	5
AGE			Undergraduate	248	63
18-25	301	77	Others	15	4
25-30	76	20	EXPERIENCE_IN_TRADING		
Above 35	13	3	Below five years	351	90
			6-8 years	34	9
			10-15 Years	1	0
			8-10 years	4	1

Note. Due to rounding errors, percentages may not equal 100%.

Table 1 shows essential details on the study participants' characteristics. The survey sample consisted of male and female participants, with a majority being male, accounting for 58% of the respondents. Female respondents constituted 42% of the sample. This gender distribution indicates a relatively balanced representation within the survey. Respondents exhibited a diverse range of educational backgrounds. A significant portion of the participants, 63%, were undergraduates. Additionally, 28% held graduate degrees, while 5% possessed post-graduate degrees, indicating a notable presence of respondents with higher educational qualifications. The remaining 4% fell into an "others" category, suggesting the inclusion of individuals with different or unspecified educational backgrounds. The age distribution of the respondents revealed three distinct categories. The majority, comprising 77% of the sample, fell within the 18-25 age group, indicating a significant presence of younger investors. The 25-30 age group accounted for 20% of the respondents, while individuals above 35 constituted a smaller portion, at 3% of the total sample. This distribution reflects a relatively youthful demographic profile among the survey participants. Regarding experience in trading, the data indicates that most respondents, representing 90% of the sample, reported having less than five years of experience in trading. A smaller proportion, 9%, had 6-8 years of trading experience. Notably, very few respondents possessed more extensive trading experience, with only 1% reporting 10-15 years and another 1% reporting 8-10 years of trading experience. This data suggests that most surveyed individuals were new to trading or cryptocurrency investments.

Table 2. Summary Statistics Table for Interval and Ratio Variables

Variable	<i>M</i>	<i>SD</i>	<i>n</i>	<i>SE_M</i>	Min	Max	Skewn ess	Kurtosis
RISK TOLERANCE	3.47	0.81	390	0.04	1.00	6.00	-0.40	1.44
BEHAVIORAL BIASES	4.10	0.52	390	0.03	1.00	6.00	-0.52	4.00
•Herding Bias	4.30	0.76	390	0.04	1.00	6.00	-0.36	1.57
•Prospect Bias	4.49	0.83	390	0.04	1.00	6.00	-0.20	0.57

•Heuristic Bias	4.04	0.66	390	0.03	1.00	6.00	-0.46	2.45
•Overconfidence	3.56	0.73	390	0.04	1.00	6.00	-0.40	0.98

Note. '-' indicates the statistic needs to be defined due to constant data or an insufficient sample size.

Table 2 shows the variables' central tendency, variability, and distribution characteristics related to risk tolerance and behavioral biases among the survey respondents. Based on the 390 responses, the mean score indicates an average risk tolerance of 3.47, showing that, on average, respondents have a moderate level of risk tolerance. In contrast, the standard deviation of 0.81 indicates some variation in respondents' risk tolerance scores. The Mean (M) average score for Behavioral Biases is 4.10, indicating that, on average, respondents exhibit a somewhat high level of behavioral biases. Standard Deviation (SD) of 0.52 indicates that behavioral bias scores are variable. Prospect (M=4.49; SD=0.83) and Herding Biases (M=4.3; SD=0.76) exhibit more behavioral biases than other biases, with standard deviation reflecting variation in responses across respondents.

Table 3. Binomial Test of Knowledge and Investment in Cryptocurrency

	Level	Count	Total	Proportion	p	
Knowledge of Cryptocurrency						
Least	1	3	390	0.008	< .001	
	2	34	390	0.087	< .001	
	3	125	390	0.321	< .001	
	4	200	390	0.513	0.649	
Highest	5	28	390	0.072	< .001	
Investment in Cryptocurrency						
a. Ownership in Cryptocurrency	No	31	390	0.079	< .001	
	Yes	359	390	0.921	< .001	
b. Intention to Invest	Very Unlikely	1	0	0	0	
	Not Likely	2	18	390	0.046	< .001
	Neutral	3	54	390	0.138	< .001
	Likely	4	210	390	0.538	0.142
	Very Likely	5	108	390	0.277	< .001

Note. H_a is proportion ≠ 0.5

Table 3 shows the variation in the level of Knowledge about Cryptocurrency. The table shows the respondents' distribution across different knowledge levels of cryptocurrency. Most respondents (51.3%) fall into the "4" category, indicating they have a moderately high level of knowledge about cryptocurrency. The "3" category also

has a significant number of respondents (32.1%), suggesting an average level of knowledge. The "2" category represents respondents with some knowledge but less than the "3" category (8.7%). The "Least" category has the smallest number of respondents (0.8%), indicating a minimal knowledge of cryptocurrency. The "Highest" category includes 7.2% of respondents with the highest knowledge level. The p-values for all categories, except the "4" category, are highly significant ($p < 0.001$), indicating that the differences in proportions between these categories and the total are statistically significant. However, the "4" category has a p-value of 0.649, suggesting that the proportion difference between this category and the total is not statistically significant.

Table 3 also shows the investment in cryptocurrency, presenting the level of ownership among respondents, showing 92% who participated in the survey own cryptocurrency (in whatever form) and the level of intention to invest. Further, Table 3 provides insights into the distribution of respondents' investment intentions in cryptocurrency, showing variations in likelihood levels among the surveyed individuals. Most respondents (53.8%) fall into the "Likely" category, indicating a high intention to invest in cryptocurrency. The "Very Likely" category also includes many respondents (27.7%), suggesting a strong investment intention. The "Neutral" category represents respondents with a neutral stance (13.8%). The "Not Likely" category indicates that a smaller proportion of respondents (4.6%) do not intend to invest strongly. The "Very Unlikely" category has no respondents in this sample. The p-values for all categories, except the "Likely" category, are highly significant ($p < 0.001$), indicating that the differences in proportions between these categories and the total are statistically significant. However, the "Likely" category has a p-value of 0.142, suggesting that the proportion difference between this category and the total is not statistically significant. The results may explain the 92% investment in cryptocurrencies.

Table 4. Model coefficient between Knowledge and Investment to Crypto with Gender, Age, Level of Education, and Experience in Trading as a control variables.

Model Coefficient	Estimate	SE	t	p
Intercept*	3.038	0.1774	17.13	<.001
Knowledge of Cryptocurrency	0.332	0.0472	7.03	<.001
Gender-Male to Female	0.2605	0.0789	3.303	<.001
Age: 26-30 – 18-25	0.1328	0.1243	1.069	0.286
Above 35 – 18-25	0.2216	0.2393	0.926	0.355
Level of Education				
Others - Graduate	-0.523	0.1997	-2.62	0.009
Post Graduate - Graduate	-0.209	0.1802	-1.16	0.246
Undergraduate Graduate	-0.223	0.0838	-2.55	0.008
Experience in Trading				
6-8 years – 10-15 years	-1.3154	0.7869	-1.672	0.095
9-10 years – 10-15 years	-0.8405	0.8659	-0.971	0.332
Below 5years –10-15 years	-1.8442	0.7760	-2.376	0.018

Note: Model Fit Measure shows: $R(0.366)$ and $R^2(0.134)$

Table 4 presents the Model fit measures and model coefficient of knowledge and education on cryptocurrency investment. The Correlation Coefficient ($R=0.366$) represents the strength and direction of the relationship between Knowledge of Cryptocurrency, Education, and Investment in Cryptocurrency. The result indicates a positive correlation among variables. The Coefficient of Determination ($R^2= 0.134$)

indicates the proportion of variance in the outcome variable (Investment in Crypto) that the included variables can explain. The result explains that for each unit increase in knowledge of cryptocurrency, there is a 0.332 unit increase in investment. This relationship is statistically significant. The Model with education as a control variable explains about 13.4% of the variability in investment in cryptocurrency. Incorporating education as a control variable strengthens the Model's explanatory capacity by providing valuable insights into the complex relationship between education, cryptocurrency knowledge, and investment decisions. Further, results show that gender and trading experience play a big role in cryptocurrency investments. Men are more likely to invest in crypto than women. But people with less than 5 years of trading experience are less likely to invest in crypto compared to those with 10-15 years of experience. The result supports the hypothesis, stating a significant effect of knowledge of cryptocurrency on cryptocurrency investment.

Table 5. Mediation estimates between Knowledge of Cryptocurrency, Risk Tolerance, and Investment in Cryptocurrency.

Effect	Estimate	SE	z	p
Indirect	-00151	0.00314	-0.480	0.631
Direct	0.32886	0.04719	6.969	<.001
Total	0.32735	0.04726	6.927	<.001

Table 5 shows the mediation analysis between knowledge of cryptocurrencies, risk tolerance, and investment in cryptocurrencies. The mediation analysis results suggest that risk tolerance does not mediate the relationship between knowledge of cryptocurrency and investment in cryptocurrency. The indirect effect, which represents the influence of knowledge on investment through risk tolerance, is not statistically significant ($p = 0.631$). The direct effect of knowledge on cryptocurrency investment ($p < .001$) is the primary driver of the relationship, and it is both positive and statistically significant. The result means that independent of risk tolerance, higher knowledge of cryptocurrencies is associated with increased cryptocurrency investment. The result failed to support hypothesis 2, which states that risk tolerance mediates the relationship between knowledge and investment in cryptocurrency.

Table 6. Moderation analysis between Behavioral Biases, Knowledge, and Investment in Cryptocurrency

Variable	Estimate	SE	z	p
Knowledge of Cryptocurrency	0.3117	0.0470	6.630	<.001
Behavioral Biases	0.0487	0.0711	0.685	0.493
Knowledge of Cryptocurrency*Behavioral Biases	-0.2162	0.0878	-2.462	0.014
Factors of Behavioral Biases				
Knowledge of Cryptocurrency	0.3452	0.0469	7.355	<.001
Herding Bias	-0.0962	0.0484	-1.986	0.047
Knowledge of Crypt0*Herding Bias	-0.0615	0.0623	-0.986	0.324
Knowledge of Cryptocurrency	0.3385	0.0470	7.21	<.001
Prospect Bias	-0.0610	0.0441	-1.38	0.167
Knowledge of Crypto*Prospect Bias	-0.1246	0.0579	-2.15	0.031

Knowledge of Cryptocurrency	0.3039	0.0476	6.391	<.001
Heuristic Bias	0.0830	0.0562	1.475	0.140
Knowledge of Crypto*Heuristic Bias	-0.0530	0.0653	-0.812	0.417
Knowledge of Cryptocurrency	0.336	0.0465	7.23	<.001
Overconfidence	0.170	0.0497	3.42	<.001
Knowledge of Crypto*Overconfidence	-0.196	0.0643	-3.05	0.002

Table 6 presents the moderation analysis with Behavioral Biases moderating the effect of Knowledge on Cryptocurrency investment. Knowledge of Cryptocurrency: The positive estimate (0.3117) with a highly significant p-value (<.001) indicates that an increase in Knowledge of Cryptocurrency is associated with a significant positive effect on Investment in Cryptocurrency. Behavioral Biases: The estimate (0.0487) with a non-significant p-value (0.493) suggests that, on its own, Behavioral Biases do not significantly impact Investment in Cryptocurrency. Interaction Term (Knowledge of Cryptocurrency * Behavioral Biases): The negative estimate (-0.2162) with a significant p-value (0.014) implies that the interaction between Knowledge of Cryptocurrency and Behavioral Biases has a significant moderating effect on Investment in Cryptocurrency. The level of behavioral bias affects how knowledge of cryptocurrency influences cryptocurrency investment. The negative sign suggests that higher behavioral bias may weaken the positive impact of cryptocurrency knowledge on investment.

5. DISCUSSION

With the current hype in cryptocurrency investments, this study examines the effect of knowledge of cryptocurrency on the intention to invest in cryptocurrency and the mediating and moderating effect of risk tolerance and behavioral biases. The findings suggest a non-mediating impact of risk tolerance and a negative moderating effect of behavioral biases on knowledge and intention to invest in cryptocurrency. The findings offer interesting perspectives on decision-making dynamics within the cryptocurrency investment context.

5.1 Knowledge of Cryptocurrency, Level of Education, and Investment in Cryptocurrency

The results of the linear regression analysis reveal a significant relationship between Knowledge of Cryptocurrency, Level of Education, and Investment in Cryptocurrency. A positive and statistically significant coefficient for Knowledge of Cryptocurrency indicates that, as individuals' knowledge about cryptocurrencies increases, there is a corresponding increase in their likelihood to invest in cryptocurrencies. The result suggests that a greater willingness to invest in cryptocurrencies is associated with a more comprehensive understanding of the investment. This result is supported by Steinmetz et al. (2021), who assert that successful cryptocurrency investors have a significantly greater self-assessed awareness of the cryptocurrency market and its intricacies. Moreover, the level of education emerges as a pivotal factor influencing cryptocurrency investment. When comparing various education levels to the reference group, the substantial coefficients of education on cryptocurrency investment signify that specific individuals are more inclined to invest, particularly those with higher education levels. This finding is consistent with Ph and Urchil (2020), who claim that the advancement of financial education has a significant psychological effect on

investors.

The findings of this study challenge the notion that cryptocurrency investors persist despite needing more knowledge and education in the field. While a 2018 Deutsche Postbank survey reveals a lack of sufficient knowledge among over half of cryptocurrency owners, other researchers such as Ante et al. (2020) and Steinmetz et al. (2021) argue that success in cryptocurrency investing hinges on having a solid understanding of the market. Acknowledging knowledge and education as critical factors in making informed decisions, this study underscores the potential benefits for both individual and institutional investors in enhancing their awareness and understanding of cryptocurrencies before venturing into this dynamic investment landscape.

5.2 Risk Tolerance, Knowledge, and Investment in Cryptocurrency

The non-mediating effect of risk tolerance suggests that risk tolerance does not serve as an intermediate factor through which knowledge of cryptocurrency influences investment decisions. The results suggest that risk tolerance may not significantly mediate the influence of knowledge on cryptocurrency investment, indicating a more direct impact of knowledge on individuals' decisions. This finding indicates that investors may base cryptocurrency investment decisions on factors other than risk tolerance, such as specific knowledge, market trends, or external influences. Contrary to the perspective of Nguyen et al. (2016) regarding the impact of risk tolerance on investment decisions, the positive correlation between risk tolerance and intention to invest may need to fully explain the correlation between cryptocurrency knowledge and actual investment behavior. These results highlight the complexity of investment decisions, influenced by various factors such as cognitive biases, market conditions, knowledge, and risk tolerance. However, the distinctive characteristics of cryptocurrencies may introduce additional complexities subject to different determinants governing traditional investment decisions. Moreover, Xi et al. (2020) propose that individuals with higher risk tolerance are more inclined to invest in cryptocurrency, aligning with the general understanding of risk tolerance's positive influence on investment decisions. However, the non-mediating result in our study suggests that, within the context of our analysis, risk tolerance might not serve as the primary explanatory factor linking knowledge of cryptocurrency to actual investment decisions.

While conventional wisdom suggests that risk tolerance plays a significant role in investment decisions, particularly in cryptocurrencies, the unique considerations inherent in cryptocurrency investments, such as market volatility, technological aspects, and regulatory uncertainties, may introduce additional factors influencing decision-making. Previous research by Vora (2015) highlights these complexities. This finding underscores the importance of identifying and understanding the specific factors that significantly influence the decision-making process regarding cryptocurrency investments. By recognizing the nuanced interplay between knowledge, risk tolerance, and other pertinent factors, investors and researchers can gain deeper insights into the dynamics of cryptocurrency investment behavior.

5.3 Behavioral Biases, Knowledge of Cryptocurrency, and Investment in Cryptocurrency

The investigation into the moderating effects of behavioral biases on the relationship between knowledge of cryptocurrency and investment in cryptocurrency has revealed

nanced insights into the decision-making processes within the cryptocurrency domain. The findings of this study reveal a negative moderating effect of behavioral biases on the relationship between knowledge and investment in cryptocurrency. The results indicate that high behavioral biases can diminish the positive impact of knowledge on investment, even with a higher level of knowledge. Based on the perspective of Al-Mansour (2020), behavior finance variables, including herding theory, prospect theory, and heuristic theory, have a substantial impact on the investing decisions of cryptocurrency market participants. The result implies that behavioral factors play a significant role in shaping investment choices. On the other hand, the negative moderating effect in the study indicates that when behavioral biases are present, the positive influence of knowledge on cryptocurrency investment is diminished or altered. The result suggests that certain behavioral biases may hinder translating that knowledge into effective investment decisions even if individuals know about cryptocurrencies.

The study examines the impact of a range of relevant behavioral bias indicators on the results. The results of the moderation analysis for Herding Bias on the relationship between Knowledge of cryptocurrency and Investment in crypto provide valuable insights. The interaction of Herding Bias between Knowledge of cryptocurrency and herding bias is not statistically significant. The result suggests that herding bias does not significantly influence the relationship between knowledge and investment in cryptocurrency. From the perspective of different authors, Kartini and Nahda (2021) found that herding behavior significantly influences investment decisions. This argument aligns with the notion that investors may be more prone to follow the crowd or rely on the actions of others in the market.

In contrast, Al-Mansour (2020) argues that herding behavior significantly influences cryptocurrency investment. This notion supports the idea that, in the cryptocurrency market, investors may exhibit herding tendencies, relying on the collective actions of others to inform their own decisions. However, Nurbarani and Soepriyanto (2020) suggest that herd behavior does not significantly affect cryptocurrency investments. Investors in their study tended to be sensible, not influenced by others, and did not follow market noise. This assertion implies a more independent decision-making process, where the actions of other investors may not significantly impact individual decisions to invest in cryptocurrency. In the context of the non-moderating effect observed in this study, it may indicate that, even when investors possess knowledge about cryptocurrencies, herding bias does not significantly alter the relationship between that knowledge and their actual investment decisions.

On Prospect Bias, the study's results reveal that Knowledge of Cryptocurrency independently positively and significantly affects the outcome. However, Prospect Bias alone does not significantly impact the outcome. This argument is consistent with Juwita et al.'s (2022) finding that the prospect factor does not substantially influence investment decisions. The significant interaction effect implies that the joint consideration of Knowledge of Cryptocurrency and Prospect Bias is crucial in understanding cryptocurrency investment decisions. It suggests that prospect bias alters the relationship and influences the investment outcome even if investors possess knowledge about cryptocurrencies.

Contrary to expectations, heuristic bias does not exhibit a statistically significant moderating effect on the knowledge-investment relationship. While individuals may rely on mental shortcuts and rules of thumb in decision-making, this bias does not substantially alter the positive impact of cryptocurrency knowledge on investment. The result is consistent with Al-Mansour (2020) and Juwita et al. (2022), who conclude that

heuristic biases considerably impact investing decisions. This notion aligns with the non-moderating result, indicating that, in the current study context, the relationship between Knowledge and Investment in cryptocurrency is not significantly altered by Heuristic Bias.

The negative moderating result of overconfidence on the relationship between knowledge and investment in cryptocurrency suggests that the joint effect of overconfidence and knowledge of cryptocurrency negatively influences the outcome, presumably cryptocurrency investment. Independently, the study asserts that overconfidence bias enhances investment decision-making. This assumption aligns with the study of Kartini and Nahda (2021), who suggest that higher levels of overconfidence are associated with more favorable investment decisions. However, this contrasts with Shah et al. (2018), who highlighted the negative influence of overconfidence on investment decisions, asserting that investors may make suboptimal choices due to overconfidence bias. This assertion contrasts with the positive effect observed in the study. However, the interaction effect of Knowledge of Cryptocurrency and Overconfidence may contribute to the differences in findings. The interaction of Knowledge of Crypto and Overconfidence has a negative and statistically significant effect on cryptocurrency investment. This argument suggests that the joint impact of higher knowledge and overconfidence negatively influences investment decisions. The results suggest that the interplay between knowledge and overconfidence in the cryptocurrency investment context may lead to outcomes that differ from the general expectations derived from individual effects. Cryptocurrency investors should be aware of the potential pitfalls associated with overconfidence, especially when combined with a higher level of knowledge.

6. CONCLUSION

In this study, we set out to explore the intricate relationship between knowledge, education, and investment in cryptocurrencies with mediating and moderating analysis of Risk Tolerance and Behavioral Biases on Investment in Cryptocurrency. Our findings shed light on several vital aspects that contribute to a comprehensive understanding of investor behavior in the cryptocurrency market. Our analysis affirmed that higher knowledge about cryptocurrencies positively influences investment decisions. Additionally, the level of education emerged as a significant factor, with individuals possessing higher education levels showing varying propensities for cryptocurrency investment. Contrary to expectations, our study did not find a significant mediating effect of risk tolerance on the relationship between knowledge, education, and intention to invest in cryptocurrency. The result suggests that risk tolerance may not be the primary channel through which knowledge and education influence investment decisions in the cryptocurrency market. The moderating effects of behavioral biases added a nuanced layer to our understanding. While certain biases, such as overconfidence, were found to positively impact investment decisions individually, their interaction with knowledge introduced complexities. The negative moderating effect implies that the joint presence of overconfidence and higher knowledge may not enhance investment outcomes as expected.

The study's result suggests that investors in the cryptocurrency market should be mindful of the intricate interplay between knowledge, education, and behavioral biases. Considering both knowledge and behavioral tendencies, a balanced and nuanced approach may be crucial for making informed investment decisions.

Our study opens avenues for future research, urging scholars to delve deeper into the specific dynamics of how knowledge, education, and behavioral biases interact in the cryptocurrency investment context. Further exploration may unveil additional insights to guide both investors and policymakers. In conclusion, this study contributes valuable insights into the evolving landscape of cryptocurrency investments. Understanding the multifaceted influences on investor behavior can empower market participants to navigate this dynamic space with greater awareness and strategic acumen.

Limitation of the Study

Our study has several limitations. The researcher based the study's findings on a 390 sample size, which may limit the generalizability of the results to a broader population. The reliance on self-reported data introduces the possibility of self-report bias, where participants may provide responses influenced by their perceptions. Behavioral biases are measured based on participants' self-assessments, which cognitive biases may influence. This limitation could affect the accuracy of the reported behavioral biases. The study employs mediation and moderation, which have assumptions and limitations. Interpretation should be cautious; unmeasured factors or Model assumptions may influence the results.

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