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BEHAVIORAL BIAS AND RISK PERCEPTION IN CRYPTOCURRENCY INVESTMENT DECISIONS OF GENERATION Z

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ABSTRACT

Purpose: This research aims to examine the influence of herding and overconfidence bias, as well as gambler's fallacy on investment decisions among Generation Z cryptocurrency investors in Malang City.

Methodology: This quantitative research comprised 96 respondents selected using purposive sampling. Data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) to test direct and mediating relationships among variables.

Findings: The results showed that overconfidence bias had a significant positive effect on investment decision, while herding bias and gambler's fallacy did not directly affect the variable. However, herding and overconfidence bias significantly influenced risk perception. The relationship between cognitive bias and investment decisions was not influenced by risk perception.

Practical implications: The results report the need for targeted behavioral-based financial education, specifically for young and inexperienced investors in high-risk asset classes such as cryptocurrency. Recognizing and managing cognitive bias particularly overconfidence is essential to improve investment decisions quality.

Originality/value: This research contributes by integrating behavioral finance, heuristic theory, and risk perception into the context of Generation Z investors in cryptocurrency market. The segment of cryptocurrency market has been underexplored in previous research.

Keywords: Behavioral Bias; Cryptocurrency Investment; Generation Z; Investment Decision; Risk Perception.

ABSTRAK

Tujuan penelitian: *Penelitian ini bertujuan untuk menguji pengaruh herding bias, overconfidence bias, dan gambler's fallacy terhadap keputusan investasi pada investor kripto Generasi Z di Kota Malang, dengan persepsi risiko sebagai variabel mediasi.*

Metode/pendekatan: *Penelitian ini menggunakan pendekatan kuantitatif dengan melibatkan 96 responden yang dipilih melalui teknik purposive sampling. Analisis data dilakukan menggunakan metode Partial Least Squares Structural Equation Modeling (PLS-SEM) untuk menguji hubungan langsung maupun mediasi antar variabel.*

Hasil: *Hasil penelitian menunjukkan bahwa overconfidence bias berpengaruh positif dan signifikan terhadap keputusan investasi. Sementara itu, herding bias dan gambler's fallacy tidak berpengaruh langsung secara signifikan terhadap keputusan investasi, namun keduanya terbukti berpengaruh signifikan terhadap persepsi risiko. Di sisi lain, persepsi risiko tidak terbukti berperan sebagai mediator dalam hubungan antara ketiga bias kognitif dengan keputusan investasi.*

Implikasi praktik: *Temuan ini menekankan pentingnya edukasi keuangan berbasis perilaku, khususnya bagi investor muda dan pemula dalam instrumen berisiko tinggi seperti kripto. Pengendalian terhadap bias kognitif terutama overconfidence perlu menjadi perhatian utama untuk meningkatkan kualitas pengambilan keputusan investasi.*

Orisinalitas/kebaharuan: *Penelitian ini memberikan kontribusi dengan mengintegrasikan teori behavioral finance, heuristic theory, prospect theory dan risk perception tehory dalam konteks investor Gen Z di pasar kripto, yang masih jarang diteliti, khususnya di Indonesia.*

Kata kunci: *Bias Perilaku; Generasi Z; Investasi Kripto; Keputusan Investasi; Persepsi Risiko.*

INTRODUCTION

The increasing participation of young people in cryptocurrency investment is becoming a prominent phenomenon in the digital financial landscape of Indonesia. In this context, the 2022 Global State of Cryptocurrency Report showed that 41% of the people possessed cryptocurrency assets, placing Indonesia first among 20 surveyed countries (Agustin & Lim, 2024). Data from Otoritas Jasa Keuangan (2025) suggested that the number of cryptocurrency investors reached 22.11 million in November 2024 from 21.63 million in the

previous month. This growth has been largely driven by young investors, particularly Generation Z. According to Badan Pengawas Perdagangan Berjangka Komoditi (2024), Generation Z investors dominate the demographic of cryptocurrency, with the 18–30 age group accounting for more than 56% of the total. However, this high level of participation is not accompanied by rational decision-making. Several research have indicated that Generation Z investors tend to be more susceptible to cognitive bias in investment decision, such as herding bias, overconfidence bias, and gambler's fallacy (Girish & Vidya, 2023; Pughethaa & Deepa, 2024; Wang, 2023). Investment behavior influenced by bias has the potential to lead to impulsive decisions and increase exposure to financial losses.

Behavioral finance provides a theoretical framework for understanding investor behavior that deviates from rational assumptions. This perspective emphasizes that investment decisions are influenced by psychological factors, limited information, and risk perception (Ahmed et al., 2022). Herding bias also reflects the tendency of investors to follow the decisions of the majority, particularly in uncertain market environments such as cryptocurrency (Ahmad & Shah, 2022). Meanwhile, overconfidence bias refers to excessive belief of investors in the ability to assess risk and select assets (Kumari et al., 2022). Gambler's fallacy describes the mistaken belief that random patterns show regularity, leading investors to expect a trend reversal after certain outcomes occur repeatedly (Rahman & Gan, 2020).

Risk perception becomes a crucial variable mediating the influence of cognitive bias on investment decisions. Slovic (1987) emphasized that individuals' risk perception was shaped by objective information, emotions, past experiences, and cognitive representations. Several previous research by Almansour et al. (2023, 2024), Jain et al. (2023), and Kaban & Linata (2024) have shown that risk perception can serve as a mediating factor in the relationship between psychological factors and financial decisions. Therefore, this research positions risk perception as a mediating variable used to explain the effect of cognitive bias on investment decisions.

The four theoretical methods adopted to explain the investment behavior of Generation Z in cryptocurrency assets include behavioral finance, prospect theory, heuristic theory, and risk perception theory. These perspectives complement each other in explaining the formation of bias, risk perception, and their influence on decision-making. Behavioral finance shows that investment decisions are influenced by bias, emotions, and social pressure, specifically in volatile cryptocurrency markets without strong fundamentals (Shiller, 2003; Thaler, 1999). Prospect theory explains that investors tend to be more sensitive to losses than to gains, which may lead to excessive risk (Kahneman & Tversky, 1979). Heuristic theory suggests that investors rely on mental shortcuts in complex situations, such as the availability and representativeness heuristics, leading to inaccurate judgments (Gigerenzer & Gaissmaier, 2011; Tversky & Kahneman, 1974). Meanwhile, risk perception theory explains that risk perception is shaped by a subjective combination of emotions, personal experiences, and cognitive bias (Slovic, 1987).

Alternative methods such as the Theory of Planned Behavior, Cognitive Dissonance Theory, and Emotional Finance by Ajzen (1991), Festinger (1957), and Tuckett & Taffler (2012) used to enrich the understanding of investment behavior are considered with the main theoretical frameworks. However, this research focuses on cognitive bias and risk perception in speculative decision-making. Behavioral finance method is considered the most contextually relevant through prospect theory, heuristics, and risk perception.

Most of the numerous research on cryptocurrency investment remain focused on direct determinants or a single type of bias. Research comprehensively integrating herding,

overconfidence, and gambler's fallacy in a single model, while considering risk perception as a mediating variable, particularly among Generation Z in Indonesia, remains exceedingly limited. The application of heuristic, prospect, and risk perception methods in the context of digital-native demographics such as Generation Z has not been fully explored. Therefore, this research aims to address the gaps by analyzing the relationship between cognitive bias and investment decision, as well as assessing the mediating role of risk perception in cryptocurrency asset investment among Generation Z in Indonesia.

Malang City was selected as the research site based on strategic and purposive considerations. According to Pemerintah Kota Malang (2022), the city records a digital financial literacy rate of 69.43%, significantly above the national average of 49.68%. Moreover, the active participation of young people in cryptocurrency investment is in line with the national data. Approximately 28.2% and 28.5% of investors are aged 18–24 and 25–30 years, respectively (Badan Pengawas Perdagangan Berjangka Komoditi, 2024). This combination of high literacy and youth engagement positions Malang City as a relevant and representative context for examining cognitive bias and investment decision-making among Generation Z. Based on the discussion, the proposed research questions are:

1. Do herding bias, overconfidence bias, and gambler's fallacy influence cryptocurrency investment decisions among Generation Z?
2. Does risk perception mediate the influence of the three bias on investment decisions?

Empirical contributions are provided to behavioral finance literature in explaining the interactive influence of cognitive bias and risk perception on cryptocurrency investment decisions among young investors. In making investment decisions, investors often do not act rationally. A common behavioral deviation is herding bias, which refers to the tendency to follow the majority without adequate analysis of market information (Bikhchandani et al., 1992). This phenomenon is frequently observed among young investors with low financial literacy, who tend to imitate decisions without properly considering risk factors (Shefrin, 2007). From the perspective of prospect theory, herding is understood as a risk-avoidance behavior, where individuals follow the majority to minimize potential regret (Tversky & Kahneman, 1974). Additionally, heuristic theory suggests that herding reflects an attempt to simplify decision-making under conditions of uncertainty and complexity (Gigerenzer & Gaissmaier, 2011).

An inconsistency exist in the results regarding herding bias in investment decision-making. Wibowo et al. (2023) reported that herding bias had a negative effect on investment decisions among Generation Z investors. Therefore, the higher the tendency to follow the majority, the lower the quality of investment decisions. These results suggest that herding behavior tends to trigger impulsive and less rational decisions. Ahmed et al. (2022) also confirmed the negative influence of herding bias, stating that the tendency to follow the majority led to suboptimal investment decisions. However, Kaban & Linata (2024) reported that herding bias did not have a direct effect on investment decisions. Kaur et al. (2024) found that herding bias had a positive influence on investment decisions since investors' confidence to invest was strengthened by following the majority in certain contexts. Similar results were presented by Denura & Soekarno (2023), who suggested a positive effect of herding bias on investment decisions. The influence of online communities and social media plays an important role in enhancing the collective confidence of young investors to engage in more aggressive investment. The following hypothesis has been proposed based on the theories and results.

H1: Herding bias has a positive effect on cryptocurrency investment decisions

Overconfidence bias is a cognitive bias that occurs when individuals overestimate the abilities and the accuracy of judgments in making investment decisions (Shefrin, 2007). This bias often drives investors to engage in speculative decisions without objectively considering the associated risk. In the context of behavioral finance, overconfidence represents a deviation from the assumption of investor rationality (Shiller, 2003). According to prospect theory, individuals are more sensitive to potential losses than to equivalent gains (Kahneman & Tversky, 1979). However, this sensitivity to loss tends to decrease when experiencing overconfidence bias. The belief in the ability to control risk or anticipate losses leads individuals to persist in making speculative decisions. Heuristic theory explains that overconfidence is reinforced by past experiences or intuition, causing investors to simplify the decision-making process without adequately accounting for risk (Gigerenzer & Gaissmaier, 2011).

Kumar et al. (2024) found that overconfidence had a positive effect on investment decisions among salaried investors, but was insignificant among self-employed individuals. Denura & Soekarno (2023), Kartini & Nahda (2021), and Kaur et al. (2024) consistently reported positive effect, stating that overconfident cryptocurrency investors make fast and aggressive investment decisions. Wibowo et al. (2023) found a negative effect, particularly among young investors, where excessive confidence reduced the quality of decision-making. The following hypothesis has been proposed based on the theories and results.

H2: Overconfidence bias has a positive effect on cryptocurrency investment decisions.

Gambler's fallacy is a cognitive bias in which individuals believe that the pattern of a random event will "reverse" due to the frequent manifestation in previous occurrences. In an investment context, this bias predisposes investors to assume that an asset experiencing decline will rebound in the absence of any logical basis or supporting fundamental data. The phenomenon is consistent with heuristic theory, where investors frequently rely on simplified patterns or intuition in conditions of uncertainty Tversky & Kahneman (1974). The belief in a "market reversal" often drives speculative decisions without rational evaluation. Prospect theory explains that investors tend to avoid losses by holding onto or increasing investment in declining assets, hoping for a recovery (Kahneman & Tversky, 1979).

Research results on gambler's fallacy have shown varying results. Dewi et al. (2020), Hans et al. (2024), and Saleem et al. (2023) found that gambler's fallacy had a positive effect on investment decisions, where investors believed the market would reverse. However, Denura & Soekarno (2023) reported no significant effect since the bias was not dominant in the context of cryptocurrency. Panggabean & Adib (2025) suggested that the bias led to harmful decisions due to false assumptions about market movements. These differing results show that the influence of gambler's fallacy is contextual, depending on investor profiles and market characteristics. In the speculative and inefficient cryptocurrency market, this bias has the potential to reinforce irrational investment behavior. The following hypothesis has been proposed based on the theories and results.

H3: Gambler's fallacy has a positive effect on cryptocurrency investment decisions

Risk perception refers to investors' subjective assessment of loss and the degree of uncertainty in investment activities Weber et al. (2002). In the context of the highly volatile and speculative cryptocurrency market, this variable is often shaped in a biased manner due to the influence of emotions, personal experiences, and intensive exposure to social media and online communities (Thaler, 1999). An increased risk perception can lead investors to act more cautiously and consider decisions more rationally. In some cases, this leads to decision paralysis or reluctance to invest due to excessive fear (Slovic, 1987).

Overconfident investors may recognize high uncertainty but still have excessive trust in abilities or private information, resulting in higher risk tolerance and willingness to speculate (Weber et al., 2002). Therefore, overconfidence can drive risky behavior without necessarily suppressing the awareness of potential losses.

For investors with low levels of overconfidence, risk perception remains an important determinant of investment decisions. An increased risk perception often promotes cautious and deliberate evaluation of potential outcomes before committing to a speculative investment. Risk perception acts as a protective factor, reducing impulsive behavior and supporting rational decision-making processes.

Ahmad & Shah (2022) and Almansour et al. (2023, 2024) reported that risk perception had a positive effect since the variable supported caution and more measured decision-making. Ahmed et al. (2022) found no significant effect, while Hossain & Siddiqua (2024) suggested a negative effect on investment decisions since excessive caution affected optimal decision-making. The following hypothesis has been proposed based on the theories and results.

H4: Risk perception has a positive effect on cryptocurrency investment decisions

Herding bias reflects the tendency of investors to follow the decisions of the majority without conducting independent analysis. In the context of behavioral finance, this behavior is driven by information limitations, social pressure, and cognitive bias, which can influence risk perception (Thaler, 1999). According to prospect theory, investors are more sensitive to losses than to gains (Kahneman & Tversky, 1979). However, a false sense of security may be developed when others are taking the same actions, leading to biased risk perception, either increasing due to social dependence or decreasing due to collective reassurance.

Almansour et al. (2023, 2024), Kaban & Linata (2024), and Purwidianti et al. (2023) found that herding increased risk perception, particularly in uncertain market conditions. Investors who recognized the lack of knowledge became more cautious when following the majority. Conversely, Wibowo et al. (2023) stated that herding reduced risk perception among young investors, who were comfortable conforming to group behavior. The following hypothesis has been proposed based on the theories and results.

H5: Herding bias has a positive effect on risk perception

Overconfidence bias refers to the tendency of individuals to overestimate the accuracy of judgments, predictions, and personal abilities in managing investment decisions. According to behavioral finance, this bias reflects a cognitive distortion that leads investors to disregard contradictory information, resulting in a risk perception bias. Based on prospect theory, overconfident investors underestimate potential risk due to the belief of controlling investment outcomes, even though individuals are more sensitive to losses than to gains (Kahneman & Tversky, 1979). In the framework of heuristic theory, this behavior is reinforced by the use of availability and representativeness heuristics, which lead to risk assessment bias by relying on limited information or past successful experiences.

Almansour et al. (2023) and Purwidianti et al. (2023) found that overconfidence bias did not have a significant effect on risk perception. Conversely, Almansour et al. (2024) showed that overconfidence bias decreased risk perception since investors became excessively confident in abilities and underestimated potential losses. Similar results were reported by Wibowo et al. (2023), where overconfidence bias contributed to lower risk perception, supporting more aggressive investment behavior. Kaban & Linata (2024) reported different results since overconfidence bias increased risk perception, particularly among Generation Z investors in

Indonesia. This occurred because young investors began to recognize the limitations of analytical abilities when faced with complex market expectations.

Overconfidence bias significantly affects risk perception, considering the differences in cultural, demographic, and psychological contexts. The direction of the effect may vary depending on market conditions and individual characteristics. Therefore, understanding the effect of excessive confidence on risk perception is important in investment decision-making. The following hypothesis has been proposed based on the theories and results.

H6: Overconfidence bias has a negative effect on risk perception

Gambler's fallacy denotes the conviction that random events possess a self-correcting mechanism after a discernible pattern. This is visible in the presumption that a series of unfavorable outcomes necessitates subsequent favorable results. In the framework of behavioral finance, the bias represents the failure to understand the statistical independence of price movements. Future probabilities are evaluated based on unrelated past outcomes Tversky & Kahneman (1974). According to heuristic theory, gambler's fallacy is a cognitive bias primarily attributable to the representativeness heuristic. This includes a tendency for individuals to judge the probability of an event based on a typical or expected pattern, leading to the erroneous conviction that deviations are corrected to achieve a perceived balance. Investors can make irrational risk predictions, such as holding onto declining assests or selling (Shefrin & Statman, 1994).

From the perspective of risk perception theory, gambler's fallacy shapes subjective risk assessments since investors tend to perceive false patterns as indicators. Investors may become overly cautious after a series of gains, or excessively optimistic following repeated losses, leading to biased and non-objective evaluations of risk. Deka et al. (2023) found that gambler's fallacy positively influenced risk perception. Investors tend to be more cautious or hesitant in making investment decisions since the market will soon reverse. The research showed that gambler's fallacy significantly increased risk perception, particularly when investors attempted to balance assumptions based on prior market events.

Deka et al. (2023) strengthened the view that gambler's fallacy played a significant role in shaping risk perception even though research on the variable was limited. This effect becomes more relevant in volatile markets, where historical patterns are mistakenly believed to influence future outcomes. The following hypothesis has been proposed based on the theories and results.

H7: Gambler's fallacy has a positive effect on risk perception

In the framework of behavioral finance, investment decisions are determined by objective information, as well as cognitive and emotional bias shaping the analysis of risk and opportunity. Risk perception functions as a psychological representation of the challenges faced and serves as an important mediator for bridging the influence of behavior bias on investment decisions Ahmed et al. (2022) and Almansour et al. (2023). Heuristic theory also explains that bias such as herding, overconfidence, and gambler's fallacy arise from the use of mental shortcuts to process information quickly (Tversky & Kahneman, 1974). Risk perception influences the assessment and decision-making process regarding high-risk instruments such as cryptocurrency.

Herding bias reflects the tendency of investors to follow the actions of the majority, specifically in uncertain markets such as cryptocurrency. In these conditions, risk perception is formed through social pressure, causing investors to evaluate risk. According to the theory, collective behavior may increase or reduce risk perception depending on the dominant

market direction. Investors tend to feel safer when "moving with the crowd," even though actual market risk remains high. Almansour et al. (2023, 2024) and Kaban & Linata (2024) found that herding bias increased risk perception, which positively influenced investment decisions. Wibowo et al. (2023) reported a negative direction of effect, while Purwidianti et al. (2023) found no significant influence. These differences show the complexity of the mediating effect in the context of high-risk assets such as cryptocurrency.

Overconfidence bias reflects the tendency of investors to overestimate predictive abilities and understanding of the market. In behavioral finance theory, this bias causes investors to underestimate risk and disregard external information. From a heuristic perspective, overconfidence arises from the self-attribution heuristic, in which past successes are attributed to personal ability rather than luck. This leads to a lower risk perception, prompting impulsive, high-risk decisions. Almansour et al. (2023, 2024) and Kaban & Linata (2024) also found that overconfidence increased risk perception and supported investment decisions. However, Wibowo et al. (2023) showed that overconfidence lowered risk perception and negatively influenced investment decisions. Purwidianti et al. (2023) suggested no significant mediating effect. This is because the mediating role of risk perception is strongly influenced by investor profiles.

Gambler's fallacy is a cognitive bias in which individuals believe a random event will become corrected after a certain pattern. In heuristic theory framework, this bias is rooted in the representativeness heuristic, where individuals tend to believe that random patterns must balance out in the short term (Tversky & Kahneman, 1974). This perception distorts objective risk assessments since investors may become overly optimistic after a streak of losses, or overly pessimistic after continuous gains.

Jain et al. (2023) reported that gambler's fallacy significantly increased risk perception, primarily because investors felt the need to anticipate a potential "trend reversal" believed to be imminent. This increased risk perception can lead to two divergent consequences, namely 1) supporting more cautious decision-making, and 2) making speculative decisions based on the belief that a reversal is about to occur. The effect of gambler's fallacy on risk perception is contextual and strongly influenced by an investor's level of financial literacy and experience.

The following hypothesis has been proposed based on the theories and results.

H8: Risk perception mediates the effect of herding bias on cryptocurrency investment decisions
H9: Risk perception mediates the effect of overconfidence bias on cryptocurrency investment decisions

H10: Risk perception mediates the effect of gambler's fallacy on cryptocurrency investment decisions

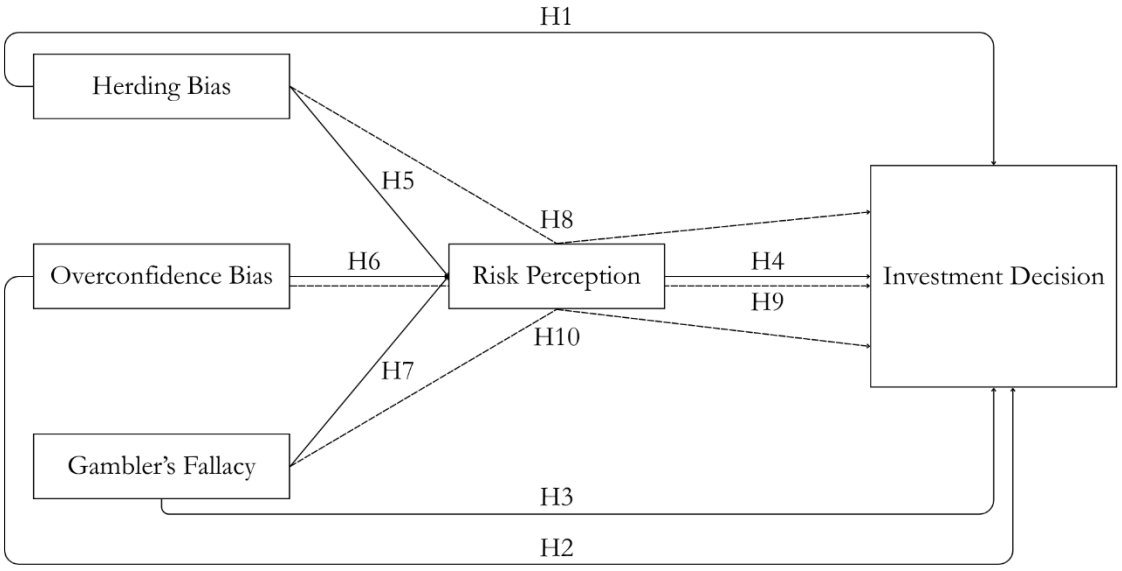

Figure 1. Conceptual Framework

METHOD

This research adopted a quantitative method using primary data as the main source of information. Data collection was carried out through the distribution of questionnaires to respondents selected based on specific criteria. The population consisted of Generation Z investors in cryptocurrency residing in Malang City. Respondents were reached, and the questionnaires were distributed online using digital platforms and social media channels to effectively gather data from the target population.

Purposive sampling method was used to select samples based on specific considerations or criteria relevant to the research objectives (Sugiyono, 2016). The inclusion criteria to ascertain respondent participation comprised the following.

1. Generation Z, born between 1997 and 2012
2. Residing in Malang City
3. Currently investing in cryptocurrency

The questionnaire included preliminary screening questions to validate respondent eligibility, namely "Do you currently invest in cryptocurrency?", "How long have you been investing in cryptocurrency?", "How much capital have you invested in cryptocurrency assets?", "What is your age?" and "Do you currently reside in Malang City?" These items were used to confirm behavioral inclusion, investment continuity, demographic suitability, and geographic relevance. Responses that did not meet the criteria of active investment, belonging to Generation Z, and residence in Malang City were excluded from the dataset.

The determination of the sample size referred to the Lemeshow formula, which was widely used in survey research of large populations (Lemeshow et al., 1991). The application of the formula was informed by scientific considerations since conventional probabilistic methods, which depended on an accurately known population size, were limited in research contexts, including partially undocumented populations, such as Generation Z cryptocurrency investors in Malang City. Furthermore, the Lemeshow formula provided an estimate of the minimum required sample size capable of producing an acceptable level of precision. The results maintained strong validity in representing the target population, and the following formula was used.

$$n = \frac{Za^2 \text{ x } P \text{ x } Q}{d^2}$$

Description:

N : Minimum sample size

Zα : Standard value

P : Maximum Estimation

Q : 1-P

d : Alpha or sampling error (10%)

$$n = \frac{1{,}96^2 \text{ x } 0{,}5 \text{ x } 0{,}5}{0{,}1^2} = \frac{3{,}8416 \text{ x } 0{,}25}{0{,}01} = 96{,}04 \approx 96 \text{ Respondent}$$

The minimum number of respondents required in this research was 96. The sample size was used according to the calculation results after meeting the representation criteria based on the formula and considering efficiency and time constraints in data collection.

The limited geographical scope confined to Malang City affected the generalizability of the results. Therefore, the results were interpreted in the local context, and future research across different regions was recommended to strengthen external validity in the framework of Generation Z cryptocurrency investment behavior in Indonesia.

This research measured five main variables, namely herding bias, overconfidence bias, gambler's fallacy, risk perception, and investment decisions. Investment decision-making was not conducted rationally. In Behavioral Finance, various cognitive bias were identified as factors influencing investor behavior. Herding bias refers to the tendency of individuals to follow the decisions of the majority without conducting independent analysis of market information (Bikhchandani et al., 1992). This bias typically occurred under conditions of uncertainty, where investors assumed that collective actions represented accurate information. Herding bias was increasingly relevant in the context of Generation Z, who relied on social signals from online communities when making investment decisions. The indicators of the construct were adapted from Kaur et al. (2024) and Metawa et al. (2019).

Overconfidence bias refers to the tendency of individuals to overestimate abilities, the accuracy of information, or the precision of predictive judgments, often resulting in excessive trading activity and the underestimation of potential risk (Barber & Odean, 2001). This construct was measured using indicators adapted from Kaur et al. (2024), Kumar et al. (2024), Metawa et al. (2019), as well as Nur Aini & Lutfi (2019). Meanwhile, gambler's fallacy describes the mistaken belief that past random events influence future outcomes (Tversky & Kahneman, 1974). This bias frequently occurred when investors assumed that asset prices would "reverse direction" after showing a particular trend. The indicators for the construct were adapted from the instrument developed by Hans et al. (2024).

These three cognitive bias collectively shaped risk perception, which referred to the subjective assessment of risk inherent in decisions. According to the Risk Perception Theory, risk perception is a psychological construct influenced by intuition, emotion, personal

experience, and social context, rather than by objective probabilities (Slovic, 1987). Investors evaluated risk through two main dimensions, namely dread (the fear associated with potentially severe consequences) and unknown risk (uncertainty or lack of understanding). In the highly volatile cryptocurrency market, risk perception functioned as a key psychological mechanism linking cognitive inputs with behavioral outputs. Generation Z investors exposed to social media and informal investment communities formed risk perception based on online narratives and social signals rather than fundamental analysis. The indicators for the construct were adapted from Ahmed et al. (2022) and Khan (2017).

The outcome of this cognitive and affective process was reflected in the investment decisions regarding the selection of instruments, the amount, timing, and strategies (Markowitz, 1952). From a behavioral perspective, these decisions were shaped by previous perception and bias (Ricciardi & Simon, 2000). For Generation Z investors, investment decisions were often driven by a combination of subjective perception, intuition, and social pressures in cryptocurrency ecosystem. This research positioned herding bias, overconfidence bias, and gambler's fallacy as indirect determinants of investment decisions, with risk perception serving a mediating function. The measurement of the investment decisions construct referred to Kaur et al. (2024) and Nizar & Daljono (2024).

Construct	Measurement Items
Herding Bias (HB)	HB1: My investment decisions are influenced by other investors' cryptocurrency choices HB2: My investment decisions are influenced by the actions of other investors, particularly concerning the quantity of cryptocurrency they hold HB3: Other investors' decisions to buy and sell cryptocurrency are influencing my decisions to invest HB4: I am confident in making decisions that are different from the majority of investors in the market
Overconfidence Bias (OB)	OB1: I am aware of the optimal times to enter and exit my investment positions in cryptocurrency market OB2: I trade frequently in cryptocurrency than other people OB3: I possess adequate knowledge of cryptocurrency market OB4: I have the necessary knowledge and skills to be an investor in cryptocurrency market OB5: I am sure that my ability is better than other people in choosing cryptocurrency investment assets OB6: Because of my unique expertise, I have been able to invest successfully in the past OB7: I am in a position to have full control over the results of my investment decision
Gambler's Fallacy (GF)	GF1: The profits I gained from cryptocurrency in the past influence my decisions to buy, sell, or hold it GF2: I tend to assume that cryptocurrency prices will reverse after reaching a certain high or low

Table 1. Measurement Model Assessment

Risk Perception (RP)	RP1: I am often not afraid to invest in cryptocurrency with positive past trading performance RP2: I am looking for a higher-income business or job
Investment Decisions (ID)	ID1: The choices I make regarding cryptocurrency investment contribute to reaching my investment objectives ID2: I am confident in my ability to make accurate decisions regarding cryptocurrency investment ID3: I typically earn higher returns than the average performance of cryptocurrency market ID4: I trust my inner heart before deciding to buy cryptocurrency

The questionnaire items were formulated as closed-ended questions using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). This method was selected due to the clarity for respondents, the inclusion of a balanced neutral option, and the capacity to facilitate consistent quantitative measurement of attitudes and perceptions (Joshi et al., 2015). The collected data were confidential and used solely for academic purposes.

This research adopted Partial Least Squares Structural Equation Modeling (PLS-SEM) method using SmartPLS software version 3.2.9. PLS-SEM is a variance-based estimation method that allows simultaneous assessment of the measurement and structural models (Hair et al., 2021). This method was appropriate for research including complex models with multiple latent constructs and indicators, as well as relatively small sample sizes.

PLS-SEM was advantageous in analyzing data that were not fully distributed in behavioral finance research of subjective perception and cognitive bias (Rigdon, 2016). Moreover, this method was suitable for quantitative and applied research focused on testing conceptual models with complex latent constructs.

RESULTS AND DISCUSSION

Description	Category	Frecuency	Percentage
Gender	Male	44	45,8%
	Female	52	54,2%
Age	13-16	0	0%
	17-20	30	31,3%
	21-24	46	47,9%
	25-28	20	20,8%
Employment Status	Student	53	55,2%
	Private Employee	26	27,1%
	Self-Employed	10	10,4%
	Not Yet Working	6	6,3%
	Other	1	1%
Investment Period	< 6 Months	42	43,8%
	6-12 Months	31	32,3%
	> 1 Year	23	23,9%
Capital	< 2 Million	64	66,7%
	2-4 Million	20	20,8%
	4-6 Million	6	6,25%

Table 2. Description of Respondents

> 6 Million	6	6,25%

Source: Primary data (2025)

Table 2 shows that this research comprises a total of 96 respondents selected based on specific criteria. In terms of gender, the distribution of respondents was relatively balanced, with 52 females (54.2%) and 44 males (45.8%). This composition reflected a diversity of gender perspectives in participation related to the activity. Based on age groups, the majority of respondents were in the productive age range. The largest proportion was from the 21–24 age group, comprising 46 individuals (47.9%). This was followed by 17–20 and 25–28 age groups with 30 (31.3%) and 20 (20.8%) individuals, respectively. There were no 13–16 age groups since respondents were predominantly individuals with a relatively mature capacity for making economic and investment decisions.

The employment status of respondents showed variation. The majority of respondents were students, accounting for 53 individuals (55.2%). This was followed by 26 private-sector employees (27.1%), 10 entrepreneurs (10.4%), and 6 respondents who were unemployed (6.3%) but only 1 respondent (1%) selected the other category. Respondents had diverse occupational backgrounds, with a predominance of individuals from academic settings. In terms of investment experience, the largest group invested for less than 6 months, totaling 42 individuals (43.8%). This was followed by 31 (32.3%) and 23 (23.9%) with 6–12 months and more than 1 year of experience, respectively. These data suggested that most respondents were novice investors who started investment activities in the past year.

The amount of capital used in investment activities was relatively modest. A total of 64 respondents, or 66.7% reported investing less than IDR 2 million. Meanwhile, 20 (20.8%) and 6 (6.25%) invested between IDR 2–4 million and IDR 4–6 million, respectively. These results showed that most investments were conducted on a small to medium scale, reflecting a preference for caution and limited capital, particularly among students.

Descriptive Statistics

Variable	Theoretic Range	Actual Range	Mean	Standard Deviation
Gambler's Fallacy (GF)	1-5	1-5	3,990	0,745
Herding Bias (HB)	1-5	1-5	3,862	0,830
Investment Decisions (ID)	1-5	1-5	3,917	0,835
Overconfidence Bias (OB)	1-5	1-5	3,809	0,838
Risk Perception (RP)	1-5	1-5	4,026	0,732

Table 3. Descriptive Statistics

Source: Primary data, processed (2025)

The mean scores and standard deviations of each variable show that respondents agreed with the statements presented in the questionnaire. This is evidenced by the mean values for the variables above 3.8 on a 1–5 Likert scale. The standard deviation values ranging from 0.732 to 0.838 suggested that there were no extreme deviations in respondents' answers.

Table 4. Discriminant Validity Test Results

Variable	GF	HB	ID	OB	RP
GF	0,892				
HB	0,373	0,843			
ID	0,318	0,349	0,842		
OB	0,307	0,399	0,697	0,782	
RP	0,557	0,627	0,378	0,346	0,855

Source: Primary data, processed (2025)

The measurement model shows the representation of latent variables. The evaluation includes testing for validity and reliability. Validity testing evaluates the extent to which a research instrument accurately measures the concept to be assessed. This variable consists of convergent and discriminant validity. Convergent validity indicates the extent to which the indicators truly represent the underlying construct. Convergent validity is achieved when the factor loading of each indicator exceeds 0.7 and Average Variance Extracted (AVE) is greater than 0.5 (Hair et al., 2021). In this research, all constructs have AVE values greater than 0.5 and factor loadings above the required threshold, since the convergent validity is met.

Discriminant validity relates to the principle that indicators measuring different constructs should not show high correlations with each other. According to Hair et al. (2021), Heterotrait-Monotrait (HTMT) Ratio provides an accurate assessment of discriminant validity. This variable is considered established when HTMT values fall below 0.90. In Table 4, all HTMT values between variables are below the 0.90 threshold, confirming that each construct is distinct from the others.

Table 5. Reliability Test Results

Variable	Cronbach's Alpha	Composite Reliability
GF	0,745	0,887
HB	0,864	0,908
ID	0,863	0,907
OB	0,894	0,917
RP	0,636	0,844

Source: Primary data, processed (2025)

Construct reliability is assessed based on Cronbach's Alpha and Composite Reliability (CR) values. A construct is considered reliable when both values exceed 0.7 (Hair et al., 2021). Table 5 shows that all constructs have Cronbach's Alpha and CR values above 0.7, except for the Risk Perception construct with an alpha of 0.636. Since CR value remains above 0.7, the overall reliability of the construct is considered acceptable.

Table 6. Direct Hypothesis Test Results

Hypothesis	Hypothesis Direction	Path Coefficient	t-statistics	p-values	Conclusion
H1: HB → ID	+	-0,009	0,074	0,944	Not Supported
H2: OB → ID	+	0,639	11,397	0,000	Supported
H3: GF → ID	+	0,050	0,593	0,570	Not Supported
H4: RP → ID	+	0,135	1,198	0,279	Not Supported
H5: HB → RP	+	0,472	5,580	0,000	Supported

H6: OB → RP	-	0,044	0,556	0,536	Not Supported
H7: GF → RP	+	0,368	3,929	0,000	Supported

Source: Primary data, processed (2025)

Table 7. Mediation Effect Test Results

Hypothesis	Hypothesis Direction	Path Coefficient	t-statistics	p-values	Conclusion
H8: HB → RP → ID	Mediated	0,064	1,147	0,295	Not Supported
H9: OB → RP → ID	Mediated	0,006	0,357	0,706	Not Supported
H10: GF → RP → ID	Mediated	0,050	1,188	0,310	Not Supported

Source: Primary data, processed (2025)

Hypothesis testing was conducted at a 5% significance level, with the decision criterion that a hypothesis was supported when the t-statistic value was greater than 1.65 and the p-value was less than 0.05. Table 6 shows that only three were supported by the data out of the seven direct hypotheses.

- H2 (Overconfidence Bias → Investment Decision) reported a positive and significant effect, with a t-statistic value of 11.397 and a p-value < 0.001. Therefore, there was a direct relationship between investors' level of confidence and the tendency to make investment decisions.
- H5 (Herding Bias → Risk Perception) showed a positive and significant effect, with a t-statistic of 5.580. This suggested that there was a direct relationship between the intention of investors to follow the majority and the level of risk perception.
- H7 (Gambler's Fallacy → Risk Perception) was significant, with a t-statistic of 3.929. This showed that misperception of random patterns contributed to risk perception.

Hypotheses H1, H3, H4, and H6 did not show significant effect since the t-statistic values were below the 1.65 threshold and p-values were above 0.05. Therefore, the direct relationships between the variables were not supported by the data.

Mediation analysis was conducted to assess the mediating effect of Risk Perception between behavioral bias (Herding, Overconfidence, and Gambler's Fallacy) and investment decision-making. The results showed that all mediation paths were not statistically significant, with p-values above 0.05 and t-statistics below 1.65. Even though Risk Perception was significantly related to some bias, the variable did not function as a mediating variable in influencing investment decisions indirectly.

Overconfidence Bias and Cryptocurrency Investment Decision

The main results reported a positive influence of overconfidence bias on investment decisions. This confirmed that excessive self-confidence was a dominant factor in shaping investor behavior, particularly in cryptocurrency market. The results were consistent with the behavioral finance framework (Shiller, 2003). Concerning the characteristics of respondents, the predominant age group was 21–24 years (47.9%), with students constituting the largest occupational segment (55.2%). Respondents' investment experience was primarily short-term, since 43.8% and 32.3% invested for less than 6 months and between 6 to 12 months,

respectively. The profile showed that most investors were young and relatively inexperienced. These traits increased the likelihood of overconfidence bias, as reported by Denura & Soekarno (2023). The results were consistent with the tendency of young investors to overestimate the capacity to interpret market dynamics and assess the accuracy of investment decisions.

The results reflected a deviation from the core principle of prospect theory, where individuals were more sensitive to losses than to equivalent gains. However, overconfident investors downplayed loss sensitivity due to inflated self-belief, focusing more on potential gains and engaging in more speculative decision-making (Kahneman & Tversky, 1979). According to heuristic theory, investors often simplify decision-making through intuition or experience, leading to disproportionate confidence relative to actual market conditions (Gigerenzer & Gaissmaier, 2011). The results strengthened the literature that identified overconfidence as a significant psychological bias in investment decisions, as reported by Kaur et al. (2024) and Kumar et al. (2024).

A contrasting perspective was offered by Wibowo et al. (2023), where overconfidence reduced the quality of decision-making among young investors. Even though the majority of respondents were relatively young, overconfidence bias had a positive effect on investment decisions. This suggested that the positive influence of overconfidence did not necessarily reflect sound decision quality but reported a tendency toward quick and speculative actions, especially in the dynamic cryptocurrency investment environment. Therefore, overconfidence bias affected psychological dimensions as well as promoted impulsive and less-analytical investment behavior. This showed the critical importance of risk education and enhanced financial literacy, particularly for young investors entering cryptocurrency market.

Herding Bias, Gambler's Fallacy, and Risk Perception in Investment Decisions

In contrast to overconfidence bias significantly influencing investment decisions, herding bias and gambler's fallacy do not exert a direct influence on cryptocurrency investment behavior. This suggests a dissonance between cognitive perception and actual behavior in financial decision-making. In the framework of behavioral finance, the results were unexpected since cognitive bias function heuristically and were not directly translated into financial actions.

Prospect theory showed that individuals were more sensitive to potential losses than to equivalent gains since decision-making was influenced by loss aversion and reference points (Kahneman & Tversky, 1979). However, not all bias carry equal weight in shaping final decisions. Herding and gambler's fallacy, from the perspective of heuristic theory, served as mental shortcuts to cope with complexity and uncertainty (Gigerenzer & Gaissmaier, 2011). The empirical results suggested that shortcuts did not necessarily act as determinants of final decisions. This supported the arguments of Kaban & Linata (2024), where herding bias did not have a direct influence on investment decisions.

Gambler's fallacy, characterized by the search for patterns in random events, showed no significant effect. Even though Dewi et al. (2020) and Hans et al. (2024) reported a positive influence of this bias on investment behavior, the present results were in line with Denura & Soekarno (2023). This research showed that the effect of gambler's fallacy was contextual and not consistently dominant in the highly volatile and speculative cryptocurrency market. Gambler's fallacy existed at the perceptual level and did not influence actual decision-making, suggesting the presence of self-regulation or active risk calibration among investors.

Risk perception did not significantly affect investment decisions. Thaler (1999) and Weber et al. (2002) argued that risk perception was based on objective information, emotions, past experiences, and social context. Among Generation Z, known for sensation-seeking behavior, risk was perceived as a challenge rather than a deterrent. Therefore, the acknowledged risk did not influence final decisions and was internally negotiated with a relatively high-risk tolerance (Hossain & Siddiqua, 2024).

Ahmed et al. (2022) showed that risk perception did not have a significant association with investment behavior. These results reinforced the research that the construction was relative and subordinated to more dominant psychological factors, such as overconfidence or herd-following disposition. The classical assumption that risk perception served as a rational barrier to investment decisions appeared insufficient to explain the behavior of the new generation of investors. This perspective called for a more holistic method to modeling investment decision-making. The method considered objective risk calculations and social-emotional dynamics inherent to investors.

In cryptocurrency investment, empirical confirmation and theoretical reinforcement were offered, where behavioral bias and risk perceptions did not universally show a linear relationship in influencing decision-making. These results reflected the complex and multidimensional nature of financial decisions, which comprised the interaction of cognition, emotion, and social context. Therefore, behavioral finance methods must acknowledge the non-deterministic nature of bias and consider the reflective capacity of investors in navigating market uncertainty.

The Influence of Bias on Risk Perception

Herding bias had a significant influence on risk perception. The stronger an investor's tendency to follow the majority, the greater the perceived investment risk in cryptocurrency assets. These results were consistent with Almansour et al. (2023, 2024), Kaban & Linata (2024), and Purwidianti et al. (2023), where cognitive bias such as herding and gambler's fallacy enhanced vigilance and risk perception in uncertain market conditions. Therefore, cognitive bias influenced the final investment decisions and shaped the framework for interpreting risk.

Behavioral Finance framework showed that investors processed information through psychological bias (Shefrin, 2002). In the context of herding, investors followed the majority due to informational limitations and experienced social pressure to shape risk perception. The phenomenon is termed informational herding, where individuals perceive the actions of a group as indicative of superior information and greater credibility (Baddeley, 2010). Furthermore, Wibowo et al. (2023) found that young investors might experience a decrease in risk perception when engaging in herding. This showed the contextual nature of the influence, which depended on factors such as age, experience, and market expectations. Prospect theory explains the mechanism by which individuals may experience either an illusion of safety or collective fear, contingent upon the interpretation of social cues (Kahneman & Tversky, 1979).

Gambler's fallacy had a positive and significant influence on risk perception. Therefore, the stronger the investor's belief in patterned behavior in random market movements, the higher the perceived investment risk. These results were consistent with heuristic theory, where investors relied on illusory patterns to predict market trends (Tversky & Kahneman, 1974). Deka et al. (2023) observed that the bias significantly increased risk perception, particularly under volatile market conditions where investors became excessively cautious or doubtful.

The risk perception theory showed that perceived risk was heavily influenced by affective factors such as fear and uncertainty, amplified by perceptual bias (Slovic, 1987).

Overconfidence bias did not show a significant influence on risk perception. This was consistent with Almansour et al. (2023) and Purwidianti et al. (2023), where overconfident investors underestimated risk following the capability to control outcomes. Overconfident individuals reduce sensitivity to risk and lose internal mechanisms of self-regulation. Therefore, the bias might be more hazardous than herding or gambler's fallacy. Investors operated in a state of denial regarding risk, often making aggressive and speculative decisions.

This research reported a critical distinction between bias concerning risk perception. Herding and gambler's fallacy significantly raised risk awareness through biased perception, while overconfidence showed no effect. This difference was crucial for designing financial literacy and education strategies. Bias with increased risk perception could be used to promote caution, while overconfidence, decreasing risk sensitivity, required more urgent intervention.

Risk Perception as a Mediator

Risk perception did not serve as a significant mediator in the relationship between herding bias, overconfidence bias, and gambler's fallacy, and investment decisions in cryptocurrency assets. Statistically, there was no significant indirect effect of the bias on investment decisions through risk perception. Even though some behavioral bias directly influenced perceived risk, the perception did not mediate the influence on actual investment decisions in the context of cryptocurrency assets.

The results challenged the framework of behavioral finance and heuristic theory, which reported risk perception as an affective and cognitive bridge mediating the influence of bias on financial decisions. In herding bias, risk perception increased when individuals followed the majority in uncertain markets. However, the absence of a mediating effect suggested that Generation Z investors did not consistently internalize social pressures into risk assessments before making investment decisions. Purwidianti et al. (2023) also found no significant effect, but contrasted with Almansour et al. (2023, 2024) and Kaban & Linata (2024), where herding bias increased risk perception and investment behavior.

Regarding overconfidence bias, the lack of a mediating effect showed that investors with excessive confidence did not realistically assess risk. This was consistent with the self-attribution heuristic, where investors attributed past success to personal skill rather than luck. Purwidianti et al. (2023) found no mediating effect of risk perception in the relationship between overconfidence bias and investment decisions. The results were explained by the phenomenon of the self-attribution heuristic. Investors interpreted previous investment successes as evidence of abilities rather than external factors or luck. Therefore, excessive confidence was maintained without perceiving risk as lower or higher.

Jain et al. (2023) and Wibowo et al. (2023) stated that overconfidence bias could reduce risk perception. The development of investor overconfidence led to an underestimation of actual risk levels, stimulating more aggressive investment behavior. This interpretation was consistent with the illusion of control theory, which described the overestimation of ability to control investment outcomes.

Almansour et al. (2023, 2024) and Kaban & Linata (2024) found that overconfidence bias increased risk perception. This tendency was particularly observed among young investors who recognized the limitations of analytical abilities when confronted with complex markets. In these situations, high confidence was no longer accompanied by excessive optimism but

balanced by greater caution toward risk. The influence of overconfidence bias on risk perception was contextual and not necessarily linear. Factors such as investment experience, financial literacy, investor age, and market characteristics moderated the relationship. In this research, the absence of a mediating effect showed that risk perception was not the primary mechanism linking overconfidence bias to investment decisions. Therefore, interventions intended to moderate the influence of overconfidence bias considered other variables, such as financial literacy or market experience, rather than focusing on risk perception.

Risk perception did not affect investment decisions, even though investors believed in a "market correction" following a streak of losses or gains. According to heuristic theory, this bias influenced risk perception through the representativeness heuristic. Jain et al. (2023) found that gambler's fallacy increased risk perception and indirectly influenced decision-making. The inconsistency was a consequence of insufficient investment experience or demographic attributes of investors. For instance, Generation Z respondents did not possess the cognitive maturity or practical exposure to investment downturns required to cultivate strong risk perception. The results challenged the prevailing assumption that risk perception played a mediating role in biased decision-making processes. In the context of young investors and cryptocurrency assets, behavioral bias exerted direct effect on decisions, minimizing the reflective function of risk perception. This reinforced the research indicating that financial education interventions should extend beyond promoting risk awareness and prioritize the cultivation of literacy regarding subconscious behavioral bias.

CONCLUSION

In conclusion, overconfidence bias influenced investment decisions positively in the context of cryptocurrency investment among Generation Z in Malang City. This showed that speculative investment decisions by young investors were primarily fueled by overconfidence, often lacking a comprehensive assessment of the associated risk. Herding bias and gambler's fallacy did not show a direct influence on investment decisions, but had a significant impact on shaping risk perception. Risk perception did not act as a significant mediator in investment decision-making. This was because investors followed intuition or bias-driven impulses without a conscious risk evaluation process. The results reinforced the relevance of behavioral finance theory in understanding the dynamics of investment decisions in the highly volatile cryptocurrency market. This research has several limitations, namely 1) the relatively small number of respondents and the geographical confinement to the Malang area limit the generalizability of the results to the broader Generation Z population in Indonesia, and 2) the self-report questionnaire-based measurement instrument opens the possibility of social bias or less than objective responses from respondents.

Based on the limitations, further research is recommended to expand the research area and increase the sample size to strengthen the external validity of the results. The role of other variables, such as financial literacy and the influence of social media, should also be explored in moderating or mediating the relationship between cognitive bias and investment decisions.

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