The Behavioral Finance of the Digital Gold Market: Heuristics, Overconfidence Bias, and Market Sentiment

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ABSTRACT

This study aims to analyze the effect of heuristic and overconfidence bias on investment decision-making in the digital gold market, with market sentiment as a mediating variable. The population of this study consists of 5,628 investors in the digital gold market at JFX, with a sample of 200 respondents obtained using the convenience sampling technique. The data analysis method employed is Structural Equation Modeling (SEM) using the Smart PLS application. The results of this study show that heuristic has no effect on investment decision-making, either directly or through market sentiment. Conversely, overconfidence bias has a significant positive effect on investment decision-making, both directly and indirectly through market sentiment. Although investors often utilize heuristics, this does not directly contribute to investment decision-making. Overconfidence bias, which reflects excessive confidence in one's abilities, plays an important role in investment decisions. This study contributes to understanding how overconfidence bias affects investment behavior and emphasizes the importance of market sentiment in mediating this effect.

ABSTRAK

Penelitian ini bertujuan untuk menganalisis pengaruh heuristik dan bias overconfidence terhadap pengambilan keputusan investasi di pasar emas digital, dengan sentimen pasar sebagai variabel pemediasi. Populasi penelitian ini terdiri dari 5.628 investor di pasar emas digital di JFX, dengan sampel 200 responden yang diperoleh menggunakan teknik convenience sampling. Metode analisis data yang digunakan adalah Structural Equation Modeling (SEM) dengan aplikasi Smart PLS. Hasil penelitian menunjukkan bahwa heuristik tidak memengaruhi pengambilan keputusan investasi, baik secara langsung maupun melalui sentimen pasar. Sebaliknya, bias overconfidence memberikan dampak positif signifikan terhadap pengambilan keputusan investasi, baik secara langsung maupun tidak langsung melalui sentimen pasar. Meskipun investor sering menggunakan heuristik, hal tersebut tidak secara langsung berkontribusi pada pengambilan keputusan investasi. Bias overconfidence, yang mencerminkan rasa percaya diri yang berlebihan terhadap kemampuan diri, berperan penting dalam keputusan investasi. Penelitian ini memberikan kontribusi dalam memahami bagaimana bias memengaruhi perilaku investasi dan menekankan pentingnya sentimen pasar dalam memediasi pengaruh tersebut.

1. INTRODUCTION

Gold is a versatile instrument and has various functions, such as an investment instrument, hedge, payment instrument, safe-haven asset, commodity, and jewelry. Gold, as an investment instrument, comes in various product forms, ranging from physical forms, such as bars or jewelry, to gold derivatives and other gold-based investment products (Risman et al., 2024).

Currently, gold investment is increasingly in demand because it offers convenient technology-based transactions. Technology allows for seamless digital transactions through online applications (Yulianto et al., 2024; Risman et al., 2021). By utilizing advances in information technology and the internet, the Jakarta Futures Exchange (JFX) launched a digital platform for physical gold trading in 2021, known as the digital gold market.

The transaction mechanism and characteristics of the digital gold market are similar to stock trading in the capital market, such as involving many sellers and buyers, implementing queues based on price and time priorities, offering various types of orders, and providing physical goods that are traded before

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transactions occur. Due to the similarity of these mechanisms and characteristics, market phenomena that commonly occur in the capital market also occur in this digital gold market. In addition, various investment theories that apply in the capital market can also be applied to the digital gold market.

According to standard financial theories, one of which is the Efficient Market Hypothesis (Fama, 1970), investment decisions are basically always based on rationality and linking the return and risk of the investment. Smith (2020) found that the capital market in Indonesia is not always efficient, as well as the findings of research conducted by Chen and Zhang (2019), Fang et al. (2020), William (2021), Gupta and Karim (2022), Johnson and Lee (2023), that the capital market is not always efficient. Although studies on the Efficient Market Hypothesis (EMH) have not been conducted in the physical-digital gold market due to its status as a relatively new investment instrument, the behavior of investors and speculators tends to align with that observed in stock and commodity markets, where the primary goal is to profit from price fluctuations (Doan et al., 2016; Fang et al., 2020; Shiller, 2000).

In the digital gold market, public information such as inflation data releases, changes in gold supply & demand, interest rates, monetary policy, and macroeconomic indicators can directly affect gold prices. According to the Efficient Market Hypothesis (EMH) theory, gold prices will immediately reflect this new information. Likewise, according to the Arbitrage Pricing Theory (Ross, 1976), gold is an investment instrument for capital market investors who switch and arbitrage due to inflation, in addition to the increasing need for safe haven assets in conditions of uncertainty with increasing inflation indicators.

The inefficient market conditions are caused by irrational investment decisions of investors and are influenced by psychological factors. Behavioral Finance is an approach that explains how humans make investments or relate to financial decisions that are influenced by psychological factors (Risman et al., 2021). Based on the financial behavior of investors, there are many psychological factors that influence investment decisions. The three most dominant factors influencing investors in the digital gold market are heuristic bias, overconfidence bias, and market sentiment.

This study attempts to explore how these three factors influence investment decision making, although research on the influence of heuristic bias and overconfidence bias on investment decisions has been widely studied (Jain et al., 2023; Ahmad et al., 2022; Sihombing & Prameswary, 2023; Qasim et al., 2019; Soraya et al., 2023; Johnson & Tversky, 2019; Li

& Zhang, 2020), but this study is different from previous studies because we use market sentiment as a mediating variable, and this study was conducted on the digital gold market where no previous research. Several previous studies have found that heuristics do not affect investment decisions (Johnson & Tversky, 2019; Li & Zhang, 2020), and overconfidence bias does not affect investment decisions (Gervais & Odean, 2019; Barberis & Huang, 2020), therefore heuristics and overconfidence bias may have an indirect effect on investment decisions through mediating variables.

2. THEORETICAL FRAMEWORK AND HYPOTHESES

Digital Gold Market

The digital gold market on the Jakarta Futures Exchange (JFX) consists of two mechanisms: on-exchange and off-exchange. This study focuses on the on-exchange mechanism because it is order-driven, similar to stock trading in the capital market. Prices in this system are determined by supply and demand, reflecting the psychological factors of investors, making it more suitable for studies on financial behavior. In contrast, the conventional gold market and the off-exchange mechanism use a quote-driven approach, where prices are determined by a single party, namely the gold trader.

The digital gold market on the Jakarta Futures Exchange (JFX) involves physical gold trading facilitated through a digital-based platform, enabling investors to transact gold online. This concept aims to provide convenience, efficiency, and security in gold investment through a transparent system supervised by regulators. The system is supported by a digital recording mechanism directly connected to gold storage facilities and clearing and guarantee institutions. Investors own the physical gold but do not need to worry about its security, as it is directly stored in dedicated gold vaults provided by JFX. This system minimizes risks and provides flexibility for transactions anytime and anywhere.

Behavioral Finance and Investment Decisions (ID)

Based on behavioral finance, investors are not always rational in making investment decisions. This is because investors do not always process information correctly, leading to errors in calculating the probability distribution of future profits. As a result, investors often make decisions that are inconsistent and suboptimal, even when they have access to the probability distribution of profits (Bodie et al., 2017). Additionally, the market is not fully efficient (Shiller, 1981; Tversky & Kahneman, 1973), and factors such as Fear of Missing Out (FOMO) also play a role (Ritter, 1991). All of this indicates that

psychological factors influence investment decisions.

Therefore, this study uses psychological indicators to build latent variables (constructs) of investment decisions, which are then linked to exogenous variables. Psychology, the study of behavior and thought, encompasses all aspects of human experience, including mental processes and behavior, as well as the emotional and behavioral characteristics of individuals, groups, or activities. The most influential psychological factors include excessive self-confidence, excessive optimism, excessive pessimism, and risk tolerance (Shrestha, 2020).

Market Sentiment (MS)

The term market sentiment, also known as investor sentiment, is a concept used to describe the feelings, thoughts, and perceptions of investors and traders regarding financial market conditions (Baker & Wurgler, 2006). Market sentiment, as part of behavioral finance, can be explained as an investor's positive tendency towards certain stocks, allowing for arbitrage across price variations in the securities market.

In general, market sentiment is divided into four types:
1. Bullish Sentiment: The accumulation of traders' optimistic views on the market.
2. Bearish Sentiment: The accumulation of traders' pessimistic views on the market.
3. High-Risk Appetite: The accumulation of traders' views who are willing to take risks in uncertain market conditions.
4. Low-Risk Appetite: The accumulation of traders' views who avoid risks due to uncertain market conditions.

This study adopts the dimensions and indicators of market sentiment from Khan & Rizvi (2023). The dimensions include news analysis, sentiment indicators, expert opinions, trading volume, and price fluctuations; and the indicators include news and social media analysis, market sentiment indicators, expert opinions, stock price fluctuations, and stock trading volume.

In making decisions, investors are influenced not only by cognitive factors but also by emotional factors that psychologically affect investment decisions. Emotional factors are influenced by investors' perspectives, both optimistic and pessimistic, on the market (market sentiment), thus having a significant impact on price movements. Before making investment decisions, investors need to understand market sentiment by observing market events and trading volumes, including using indicators such as the

Volatility Index (VIX). Therefore, the presence of market sentiment makes it easier for investors to make investment decisions.

The first hypothesis put forward in this study is follows:
H1: Market sentiment has a positive effect on investment decisions.

Heuristic Behavior (HE)

Heuristics are mental strategies or cognitive shortcuts that humans use to solve problems quickly, especially in complex or uncertain situations. This strategy was first introduced by cognitive psychologists Tversky and Kahneman (1973). The effectiveness of decisions is closely related to human cognitive limitations in processing information and to the time devoted to the decision-making process (Galavotti et al., 2021), so that decisions can be made in a limited time (Singla et al., 2023). Heuristics allow individuals to process information efficiently and make quick judgments based on past experiences or familiar patterns, without having to analyze every detail of the situation in depth.

Heuristics are often used by individuals to ignore complex information when speed and timeliness are needed in decision making. Investors only look at data and rely on their intuition, while other information they obtain is only a complement to what investors already have. Thus, they have actually lost useful and important data and information to support important decision making (Risman et al., 2021). Heuristics can help investors identify emerging market trends more quickly, making it easier for them to make decisions. This is because investors tend to assess probability based on memorable examples (Tversky & Kahneman, 1973.

The second hypothesis put forward in this study is follows:
H2: Heuristic has a positive effect on investment decisions.

Investors who use practical methods will accumulate in the general investor perspective on market prices (market sentiment), therefore the higher the heuristic behavior, the greater the market sentiment will be.

Therefore, the third hypothesis put forward in this study is as follows:
H3: Heuristic has a positive effect on market sentiment.

Theoretically and logically, heuristics have a direct influence on investment decision making. However, the results of several previous studies show that heuristics do not have a direct influence on investment decision making (Johnson & Tversky,

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2019). Therefore, heuristics may have an indirect influence on investment decision making through mediating variables, such as market sentiment.

Investors who use practical methods will generate market sentiment as an accumulation of investor decisions in aggregate. The emergence of market sentiment will help investors in making investment decisions. Therefore, the higher the heuristic behavior, the greater the market sentiment will be. Furthermore, the greater the market sentiment, the greater its influence on investment decisions.

The fourth hypothesis put forward in this study is as follows:

H4: Heuristic has a positive effect on investment decisions through market sentiment.

Overconfidence Bias (OB)

Overconfidence bias is a type of emotional bias that makes investment decisions because investors are overly confident in their predictions and information. After obtaining information and facts, investors base their decisions on cognitive and emotional factors. Emotional bias emphasizes feelings and spontaneity more than facts. Overconfidence bias is a type of decision-making influenced by emotions, leading individuals to take bolder risks (Kahneman & Tversky, 1979). Overconfidence Bias will encourage someone to have no doubts and not many considerations so that the individual can quickly and timely make decisions. The less doubt, the faster, and the right time to make decisions, the better it will be for investors to make investment decisions. Therefore, the more overconfident a person is, the quicker and easier it becomes to make investment decisions.

Bias has a positive meaning in studying behavioral finance because it can provide several benefits. First, bias allows for quick decision making. This is very important in trading because market prices move quickly. Second, bias can help make practical decisions, allowing investment decisions to be made effectively and efficiently. Third, bias encourages investors to be less anxious or easily frightened, helping them overcome major challenges that come from within themselves, such as fear and greed. Fourth, bias can create a sense of confidence, which is very important in decision making that requires speed and accuracy (Shiller, 2000).

Therefore, the fifth hypothesis put forward in this study is as follows:

H5: Overconfidence bias has a positive effect on investment decisions.

Investors tend to overestimate new information. This accumulates in the decisions made by investors in general towards market prices (market sentiment), so that overconfidence bias can cause market sentiment.

Therefore, the sixth hypothesis put forward in this study is as follows:

H6: Overconfidence bias has a positive effect on market sentiment.

Theoretically and logically, overconfidence bias affects investment decision-making. However, the results of several previous studies show that overconfidence bias does not have a direct effect on investment decision-making (Barber & Odean, 2001; De Bondt & Thaler, 1995). Therefore, overconfidence bias may have an indirect effect on investment decision making through mediating variable. Investors who have an overconfidence bias in making investment decisions will accumulate in the general perspective of investors towards market prices (market sentiment), and the emergence of market sentiment will help investors in making investment decisions. The higher the overconfidence bias, the greater the market sentiment will be. The greater the market sentiment, the greater its influence on investment decisions will be.

Therefore, the seventh hypothesis put forward is as follows:

H7: Overconfidence bias has a positive effect on investment decisions through market sentiment.

3. RESEARCH METHOD

This study uses a quantitative method. Data collection was conducted through Google Forms from August to September 2024. This study uses dimensions and indicators developed in the research conducted by (Khan & Rizvi, 2023). The measurement of variables in this study uses a five-point Likert scale. The population of this study consists of 5,628 investors in the gold market traded physically on the Jakarta Futures Exchange (JFX). Based on nonprobability sampling techniques, especially convenience sampling, and the application of the Slovin formula, there is a minimum sample of 100. However, this study uses 200 samples. Structural Equation Modeling (SEM) is applied using the Smart PLS application for data processing and analysis. SEM-PLS was chosen because it provides deeper insights into how psychological factors affect investor behavior and contribute to market inefficiency, and can effectively handle multicollinearity among independent variables.

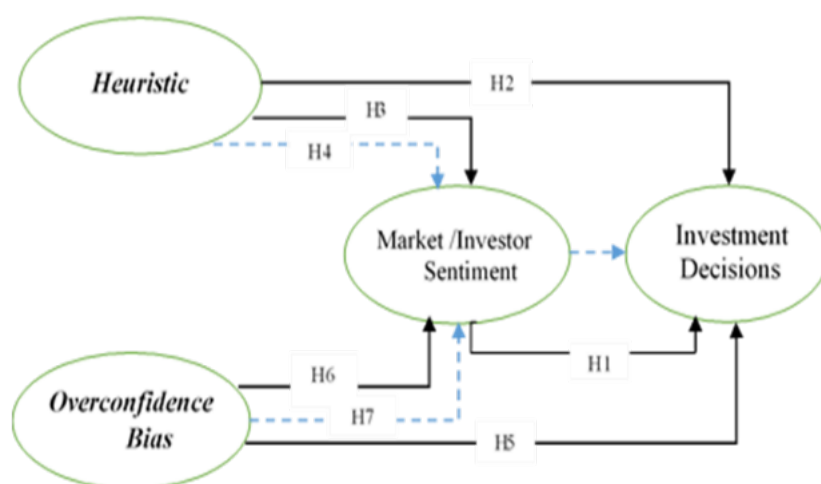The conceptual model is shown in the following figure:

Figure 1
Conceptual Model

4. DATA ANALYSIS AND DISCUSSION
Convergent Validity Test
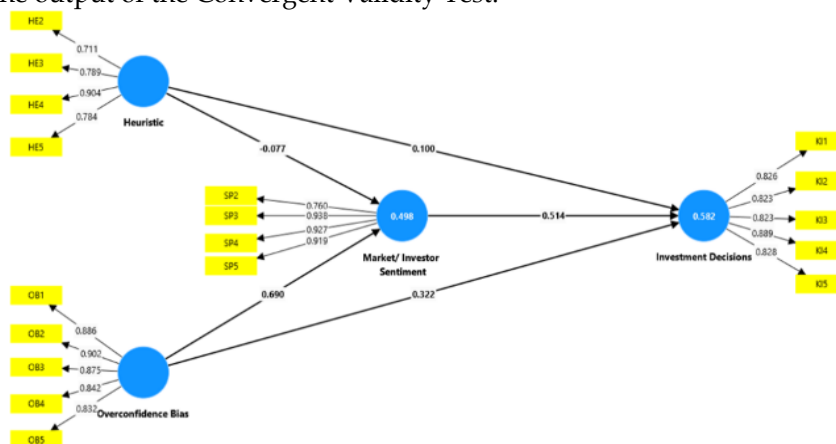The following is the output of the Convergent Validity Test:

Figure 2
The Convergent Validity Test
Source: Data Processed

Based on Picture 2, a resume can be made as follows:

Table 1
The Convergent Validity Test

Variable	Indicators	*Outer Loading*	Conclusions
Heuristic	HE2	0.711	Valid
	HE3	0.789	Valid
	HE4	0.904	Valid
	HE5	0.784	Valid
Overconfidence Bias	OB1	0.826	Valid
	OB2	0.823	Valid
	OB3	0.823	Valid
	OB4	0.889	Valid

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	OB5	0.828	Valid
Investment Decisions	ID1	0.886	Valid
	ID2	0.902	Valid
	ID3	0.875	Valid
	ID4	0.842	Valid
	ID5	0.832	Valid
Market/ Investor Sentiment	MS1	0.760	Valid
	MS2	0.938	Valid
	MS3	0.927	Valid
	MS4	0.919	Valid
	MS5	0.760	Valid

Source: Data Processed

Convergent Validity is the value of loading factors on latent variables with their indicators. The results of the analysis show that the Heuristic indicator "frequency of use of practical rules" (HE1) has an outer loading value of less than 0.7, so it is removed from the model. Based on Figure 2 and Table 1, all indicators have met convergent validity because they have loading factor values above 0.70.

This indicates that a variable has explained 50% or more of the variance of its indicators.

Discriminant Validity

Table 2
Discriminant Validity Test

Cross Loadings	Heuristic	Investment Decisions	Overconfidence Bias	Market Sentiment
HE2	0.711	0.027	-0.074	-0.069
HE3	0.789	-0.105	-0.155	-0.152
HE4	0.904	-0.015	-0.123	-0.18
HE5	0.784	0.011	-0.096	-0.13
ID1	0.002	0.826	0.594	0.531
ID2	-0.04	0.823	0.53	0.676
ID3	-0.012	0.823	0.542	0.511
ID4	-0.065	0.889	0.594	0.612
ID5	-0.049	0.828	0.54	0.673
OB1	-0.158	0.48	0.886	0.531
OB2	-0.132	0.505	0.902	0.562
OB3	-0.117	0.476	0.875	0.498
OB4	-0.104	0.735	0.842	0.632
OB5	-0.135	0.618	0.832	0.748
MS2	-0.139	0.72	0.561	0.76
MS3	-0.157	0.602	0.671	0.938
MS4	-0.197	0.582	0.622	0.927
MS5	-0.145	0.649	0.632	0.919

Source: Data Processed

Based on Table 2, the MS1 indicator is removed from the model because the largest cross loading value of each indicator does not correspond to its latent variable.

Reliability Testing

Table 3
Reliability Testing

Variables	Cronbach's Alpha	Reliability

Heuristic (HE)	0.820	0.876
Overconfidence Bias (OB)	0.839	0.922
Investment Decisions (ID)	0.917	0.938
Market Sentiment (MS)	0.860	0.937

Source: Data Processed

Based on Table 3, all constructs have composite reliability values above 0.70 and Cronbach's Alpha values above 0.70.

Therefore, it can be concluded that the constructs show good reliability.

Adjusted R-Squared

Table 4
Adjusted R-Squared

	R^2	Adjusted R^2
Investment Decisions	0.582	0.576

Source: Data Processed

Based on Table 4, the adjusted R^2 value of 0.576 shows that every change in the dependent variable of investment decision can be explained by the independent variables (heuristic and overconfidence bias), mediating variable (market sentiment) and their interactions of 57.6 percent. There are still other factors outside the model that explain the investment decision variable of 42.4 percent.

Goodness of Fit

In this study, the Goodness of Fit test is conducted using the predictive relevance value or Q-Square (Q^2) because the measurement of endogenous latent variables was carried out using reflective indicators. The Q-Square (Q^2) value indicates how well the observed data is reproduced by the model and its parameters. The formula for calculating Q-Square is as follows:

$Q^2 = 1 - (1 - R_1^2)(1 - R_2^2) \cdots (1 - R_P^2)$
$Q^2 = 1 - (1 - 0.498)(1 - 0.582) = 0.790.$

Based on the calculation, the value of Q^2 is 0.790, which is greater than 0 (zero). This indicates that 79 percent of the variation in investment decisions can be predicted by heuristics, overconfidence bias, and market sentiment, while the remaining 21 percent is explained by other variables outside the model. This demonstrates that the model has good predictive relevance or that the model is fit.

Hypotheses Test

Table 5
Hypotheses Test

Variable	Original Sample	T-Statistics	P Values	Conclusion
HE -> ID	0.100	1.703	0.089	Not Significant
OB -> ID	0.322	4.050	0.000	Positive Significant
MS -> ID	0.514	6.194	0.000	Positive Significant
HE -> MS	-0.077	1.620	0.105	Not Significant
OB -> MS	0.690	14.528	0.000	Positive, Significant
HE -> MS ->ID	-0.040	1.590	0.112	Not Significant
OB -> MS ->ID	0.355	5.316	0.000	Positive Significant

Source: Data Processed

The results of the first hypothesis (H1) test in Table 5 show that market sentiment has a significant positive effect on investment decisions with a T-statistic value of 6.194 and a P value of 0.000. So H1 is

accepted. This empirical evidence indicates that optimistic market sentiment drives investor confidence in economic and market prospects, thereby increasing investor interest and confidence in investing. Financial markets are very responsive to changes in sentiment. Important news or events can quickly change market sentiment and influence investment decisions.

The results of the second hypothesis (H2) test in Table 5 show that heuristic has no effect on investment decisions with a T-statistic value of 1.703 and a P value of 0.089. So H2 is rejected.. Although heuristic is often used by investors, it has no significant influence on investors' investment decisions. This finding shows that heuristic does not provide significant benefits in improving the quality of investment decisions. This is because heuristic behavior often cannot capture the complexity of information in the digital gold market.

The results of the third hypothesis (H3) test in Table 5 show that heuristic has no effect on market sentiment with a T-statistic value of 1.620 and a P value of 0.105. So H3 is rejected.

The results of the fourth hypothesis (H4) test in Table 5 show that market sentiment does not mediate the effect of heuristic on investment decisions with a T-statistic value of 1.590 and a P value of 0.112. So H4 is rejected. This empirical evidence suggests that individual effects cannot change the broader market perception, and therefore are insufficient to contribute to general investment decision-making. Market sentiment is more dominantly influenced by macroeconomic factors and major events. It is not always in line with how investors practically make investment decisions, as market sentiment can have both positive and negative impacts.

The results of the fifth hypothesis (H5) test in Table 5 show that overconfidence bias has a significant positive effect on investment decisions with a T-statistic value of 4.050 and a P value of 0.000. So H5 is accepted. This finding shows that overconfidence bias can encourage investors to not hesitate, not consider much, and not worry, so that they can quickly and accurately make decisions. The less doubt, and the faster and more timely decision making, the better it will be for investors in making investment decisions.

The results of the sixth hypothesis (H6) test in Table 5 show that overconfidence bias has a significant positive effect on market sentiment with a T-statistic value of 14.528 and a P value of 0.000. So H6 is accepted. This finding indicates that investors will tend to overestimate new incoming information and this accumulates in decisions taken by investors in general at market prices. Therefore,

overconfidence bias can cause market sentiment.

The results of the seventh hypothesis test (H7) in Table 5 show that market sentiment is able to mediate the effect of overconfidence bias on investment decisions with a T-statistic value of 5.316 and a P value of 0.000. So H7 is accepted. This finding shows that investors with overconfidence bias tend to make transactions frequently and in large volumes. This trading activity can move market prices and create perceptions of optimism or pessimism that affect market sentiment and investors' investment decisions.

5. CONCLUSION, IMPLICATION, SUGGESTION, AND LIMITATIONS

This study aims to analyze the effect of heuristics and overconfidence bias on investment decisions, both directly and indirectly through the mediation of market sentiment. The results of this study show that market sentiment has a significant positive influence on investment decisions. Heuristic has no significant effect on market sentiment and investment decisions. Meanwhile, Overconfidence bias has a significant positive effect on market sentiment and investment decision. Market sentiment is able to mediate the effect of overconfidence bias on investment decisions, but it is unable to mediate the effect of heuristic on investment decisions.

Investors with overconfidence bias tend to engage in high trading activity (both in frequency and volume), which can affect market price movements and create sentiments of either optimism or pessimism. These sentiments, in turn, influence the investment decision-making of other investors. In other words, overconfidence bias not only has direct effect on individual decisions but also shapes the collective perception of the market, further influencing investment decisions.

The results of this study are expected to broaden the understanding of how psychological factors affect market dynamics, both at the individual and collective levels, thereby making a significant contribution to the development of behavioral finance theory.

The practical implication of this study is the need for investors, both experienced and novice, to be more aware of the influence of overconfidence bias on their decisions. Markets dominated by individual investors, such as the physical digital gold market, also require more intensive education to help investors better understand the impact of psychological factors on trading.

This study is limited to the physical digital gold market, so the findings in this study cannot be generalized to other markets. In addition, this research

model does not include other relevant variables in behavioral finance studies, such as market euphoria and herd behavior. The dimensions and indicators used to measure heuristics, overconfidence bias, and market sentiment may not fully capture the complexity of these constructs in the context of investment decision making. Therefore, further research is recommended to include additional variables, both exogenous and mediating. Furthermore, exploring other markets, such as the cryptocurrency market which is also relatively new, can help expand the generalization of these findings.

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