Original Research

Risk Tolerance: Heuristic Bias Towards Investment Decision Making

*Wahyu Febri Ramadhan Sudirman[1] **Mohd Winario**[2]**, Arif Mudi Priyatno**[3]**,
Zubaidah Assyifa**[2]

[1]Islamic Banking Program, Faculty of Islamic Studies, Universitas Pahlawan Tuanku Tambusai. Kampar, Indonesia
[2]Islamic Economics Program, Faculty of Islamic Studies, Universitas Pahlawan Tuanku Tambusai. Kampar, Indonesia
[3]Digital Business Program, Faculty of Islamic Studies, Universitas Pahlawan Tuanku Tambusai. Kampar, Indonesia
Correspondence*:
Address: Jl Tuanku Tambusai No 23 Bangkinang Kota, Kampar, Riau, Indonesia 28412 | e-mail: wahyu.febri.id@universitaspahlawan.ac.id

Abstract

Objective: This study aims to examine how risk tolerance influences the role of overconfidence bias and availability bias in investment decision-making. Because of the complexities of the investment decision-making process, this study attempts to investigate psychological variables in the investment decision-making process.
Design/Methods/Approach: This study used the Structural Equation Modeling Partial Least Squares (SEM-PLS) analytic approach using the SmartPLS 3 program and survey data provided online to stock investors, with a total of 303 samples obtained. The study applied CMB preventive techniques to decrease common method bias (CMB).
Findings: The results indicate a positive and significant mediating role of risk tolerance on the effect of overconfidence bias and availability bias toward investment decision-making.
Originality/Value: This research seeks to explore the process of making investment decisions by taking into account the psychological aspects of investors by using a more comprehensive Bounded rationality theory point of view. This study tested the mediation mechanism of risk tolerance in bridging the influence of heuristic bias on investment decision-making, which has not been explored much by previous studies.
Practical/Policy implication: The findings can guide investors to consider how they make biased investment decisions and help investment managers assess the appropriate level of investment risk.

Keywords: Overconfidence bias, Availability bias, Risk tolerance, Investment decision, Bounded rationality

1. Introduction

The financial theory is based on the idea that buyers in financial markets make rational judgments, think critically when making choices, and use all available information in their investment decision-making process. Traders forecast stock expenses through an expansion of monetary methodologies (Ross, 1977; Stulz, 1995). Following Markowitz's (1952) theory, individual traders choose low-risk investments over high-risk ones for a given rate of return because they are rational and risk-averse. Due to the fact that traders may not always act rationally, the behavior finance principle undermines conventional financial theory (Simon, 1955). The conventional financial principle is not yet able to explain why investors opt to maintain losers longer and sell winners quicker (Odean, 1999; Tversky & Kahneman, 1974), tend to comply with the glide of facts (Tan et al., 2008), and are not varied (Goetzmann & Kumar, 2008). Cohen and Kudryavtsev (2012) display that records, previous overall performance, past experiences, and expectations all impact investment decisions.

Psychologists have observed that people do now not act in the way that economics projected. In line with the incidence of inventory market anomalies and empirical research studies undertaken by (Babajide & Adetiloye, 2012; Skavantzos, 1998), traders are irrational, as noted. A heuristic is one of the biases that would have an impact on buyers' investing choices. Tversky and Kahneman (1974) outline heuristics as "policies of thumb" that people utilize in unsure situations to make easy and green judgments. Choice-making approaches that forget some facts are quicker, inexpensive, and more accurate than state-of-the-art methods (Gigerenzer & Gaissmaier, 2011). Heuristics observe the ideas of regulations of thumb, or simplifying selection-making processes, which assist traders in making choices without completing sophisticated possibility critiques, after which estimate the values associated with positive choices. This heuristic leads investors to commit significant and systematic mistakes in their decision-making, compelling them to behave irrationally (Tversky & Kahneman, 1974). These systematic mistakes are known as cognitive biases, and they are classified into three sorts: availability heuristics, anchoring and adjustment heuristics, and representational heuristics. We consciousness of the availability and overconfidence heuristics in this study due to the fact that these heuristic biases do not arise in ordinary investors; however, professional and skilled traders are vulnerable to these heuristic biases (Rasheed et al., 2018; Tversky & Kahneman, 1974).

Previous research has examined the impact of heuristic bias on investment decision-making for both individual and institutional investors. Research focuses on the direct relationship between heuristic bias and investment decisions (Raheja & Dhiman, 2020; Rasheed et al., 2018; Rasool & Ullah, 2020; Waweru et al., 2008; Shah et al., 2018). Several studies support the positive influence of heuristics on making irrational investment decisions (Kasoga, 2021; Rasheed et al., 2018); investors who are affected by heuristic bias will make irrational investment decisions so that the investments made will have a negative impact on the performance of the investment portfolio. This is also reinforced by Shah et al. (2018) and Waweru et al. (2008), who found a negative effect of heuristic bias on investment decisions and performance. Investors affected by heuristic bias make more risky and excessive investments (Odean, 1999). Previous research did not consider mediation mechanisms that affect heuristic bias and investment decisions, so it is necessary to consider a further study to fill this gap. Investors make judgments about certain probabilities based on norms, beliefs, and values jointly measured in their preference constructs with risky choices. Risk-taking is common among investors, and in making decisions, risk considerations will always appear in the decision-making process so that heuristic bias does not directly affect investors' decisions. Therefore, investors' risk perceptions must be considered because they can influence investment decision-making (Ishfaq et al., 2020; Khan et al., 2017). This study proposes risk tolerance as a mediating factor in bridging the heuristic relationship to investment decision-making.

This research has several very essential contributions. First, this study provides a broader picture of previous studies that focused on the direct effect of heuristic bias on investment decisions (Khan et al., 2017; Shah et al., 2018; Waweru et al., 2008) because this heuristic bias can have an impact on investors' profits and losses. For example, representation bias can result in overpriced stock purchases due to the tendency to associate new events with known events (Waweru et al., 2008). Second, this research provides a new perspective for investors in understanding the influence of the investment decisions they make based on heuristic bias, attitudes towards risk, and financial literacy in the socio-cultural context in Indonesia because available information will change an investor's preference for certain investment patterns, and sometimes even irrelevant information influences investment decisions (Kirchlers et al., 2005). Third, the findings of this study assist investors in understanding behavior patterns in making better and more rational investment decisions so that they are not affected by heuristic bias in making investment decisions. Lastly, this research assists policymakers in taking appropriate steps to train future investors to manage the emerging stock market.

The remainder of this article is organized as follows: The next section discusses the literature review and the formation of research hypotheses. The methods section discusses the sample, measurements of variables and the analytical methods. The results and discussion section explain hypothesis testing and analysis. Finally, the conclusions section summarizes the findings, implications, and direction for future research.

2. Literature Review and Hypotheses Development

Bounded Rationality

Bounded rationality theory is a concept developed by Herbert Simon, a social scientist and economist, to explain that humans often do not act completely rationally in their decision-making due to limited information, time, and mental resources. This theory contrasts with traditional economic theory assumptions that regard human beings as fully rational decision-makers and able to maximize their utility or profits. The theory of rationality is limited by the assumption that humans make rational decisions with limited knowledge and cognitive capacities. Bound rationality relates to how final decisions are formed by the decision-making process itself (Pompian, 2011). In the context of limited rationality, humans are assumed to have limited cognitive abilities that limit their problem-solving abilities. Second, limited willpower illustrates that people sometimes make choices that are not in their long-term interests. Finally, attached personal interests show that humans are often willing to sacrifice their interests to help others (Sent, 2018).

According to Simon, three assumptions underlie limited rationality. Information Limitations: Humans do not always have access to or sufficient time to gather all relevant information before making decisions. Therefore, they tend to choose an alternative that is good enough or sufficient, even though it is not optimal. Cognitive Limitations: Human mental limitations limit their ability to process information simultaneously and complexly. This can lead to errors in assessing and understanding the situation, ultimately affecting decision-making quality. Time Limitation: Limited time in decision-making encourages humans to take shortcuts or rely on established rules of thumb and conventions rather than carry out in-depth analysis to choose the best option (Pompian, 2011; Simon, 1955).

Heuristic

Heuristics were first introduced by Tversky & Kahneman (1974), who define heuristics as mental shortcuts that make people make decisions by ignoring complex information in confronting situations. Initially, Tversky & Kahneman (1974) introduced three heuristics that investors can use in their decision-making: anchoring, availability, and representativeness. Then Waweru et al. (2008) added one heuristic, namely Overconfidence bias. This study focuses on the two most commonly used heuristic biases in decision-making: availability and overconfidence heuristics due to the potential for novice and experienced investors (Rasheed et al., 2018; Tversky & Kahneman, 1974). Overconfidence is an unwarranted belief in one's intuitive reasoning, judgment, and cognitive ability (Pompian, 2011). Asri (2013) says that excessive behavior in psychology can occur when a person has "psychological problems" such as overestimating the information he gets or the judgment he makes of that information. Two conditions cause people to be overconfident; first, when someone has experience that has been tested many times. Second, caused by the opposite, namely, they do not really understand the problems they face or do not have good capabilities in dealing with them, but they are unaware of their limitations. The availability heuristic is the tendency to make decisions relying solely on already available information (Tversky & Kahneman, 1974). Decisions are made only based on what a person can remember, what he has just done, and even what he has just heard or seen (Asri, 2013).

According to Gigerenzer & Gaissmaier (2011), heuristics is an approach that ignores some information to make decisions quickly, efficiently, or accurately compared to more complicated methods. Heuristics can have better accuracy than more complex strategies, even though they process only a small amount of information (more limited impact). Heuristics can be helpful in many situations, but they often lead to biased decisions (Tversky & Kahneman, 1974). Over time, heuristic decision-making has been developed in organizational strategy and management, focusing on simple rules in complex situations and environments (Bingham & Eisenhardt, 2011). Heuristic decision-making makes people only use available information in making decisions in uncertain situations because it is faster and simpler (Artinger et al., 2015), including in making investment decisions (Ahmad & Shah, 2022; Shah et al., 2018). Investors who use heuristics in investment decisions tend to make decisions with limited information, especially in complex situations and high uncertainty, so investors will tend to make irrational decisions, which leads to worse portfolio performance. Previous research has also found that heuristics worsens investment performance (Waweru et al., 2008). Investors also tend to make riskier investment decisions (Shah et al., 2018), resulting in lower investment performance than market performance. Heuristics have also been shown to undermine the decision-making process for entrepreneurs (Ahmad et al., 2020) and capital market investors (Cao et al., 2021).

Risk Tolerance

Risk tolerance involves a balance between the potential rewards or gains that may be obtained from taking risks and the potential losses or negative consequences. For example, in the investment context, an investor with a high-risk tolerance may be willing to take greater risks to get greater rewards or returns. On the other hand, individuals who have a low-risk tolerance may prefer to invest in more stable financial instruments even though the rewards are low. According to Raheja & Dhiman (2019), the risk is the capability loss attributable to a specific motion or activity. Monetary risk tolerance is someone's willingness to comply with making economic choices in the event of uncertainty (Prabhakaran & Karthika, 2011). According to (Pak & Mahmood, 2015), monetary chance tolerance is a person's willingness to interact in positive investment behaviors.

Risk tolerance refers to the extent to which individuals or organizations are willing to accept or face risks in making decisions. It reflects the level of uncertainty that an individual or entity can accept or tolerate in achieving certain objectives or taking certain actions. Risk tolerance can vary significantly between individuals, organizations, industrial sectors, and social contexts. Investor preferences for risk can be divided into three: risk seeker investors, which means investors who tend to invest in high-risk assets. Risk neutral; means investors who do not always avoid risk or seek risk, and risk-averse, means the tendency of investors to take assets with a more predictable outcome but a lower probability of return than agreeing to a situation with an uncertain outcome.

Mediating Effect of Risk Tolerance, Heuristic, and Investment Decision

Risk tolerance is vital in investment studies and portfolio management (Mahat et al., 2010). Investors make a change-off amongst threat degree and income margin even as making funding alternatives about securities, even though they regularly comply with a threat aversion technique (Tversky & Kahneman, 1974), so the level of risk influences funding picks (Menkhoff et al., 2006), and on occasion adverse to investment approach (Nguyen et al., 2019). Individuals with excessive-chance tolerance capability can spend money on riskier shares and obtain extra returns (Grable, 2016). Risk tolerance is one of the characteristics that most investors require in order to succeed (Grable & Roszkowski, 2008). Further (Roszkowski & Davey, 2010) states that economic risk tolerance reduces investor frustration and will increase self-perception in making higher monetary decisions. Customers who have got a low chance tolerance usually tend to keep away from making funding due to the reality that it is a far risky technique (Nguyen et al., 2019), invest a whole lot much less in shares, and lose the opportunity to get massive returns (Grable, 2016), the investor who is geared up to take several risks are geared up to buy shares (Zheng, 2013). In making selections, investors make an exchange-off among the stage of risk and income margins, notwithstanding the reality that customers tend to have a risk-averse mindset (Kahneman & Tversky, 1979). Risk tolerance affects investment choice-making in numerous financial markets (Ishfaq et al., 2020).

A preceding look at finished through (Mahat et al., 2010) found that risk tolerance acts as a mediating between the development of character financial managers and overall economic performance. Investors with an immoderate-risk tolerance tend to rely on heuristic-primarily based choices in investment selections (Pak & Mahmood, 2015), and investors with an overconfidence heuristic underestimate funding risk. The overconfidence heuristic also can make a person pay less interest to or overlook approximately vital chance elements, together with marketplace volatility or uncertainty inside the financial machine (Odean, 1998). this may purpose them to a great deal much less able to become aware of the real risks and take suitable actions to govern the risks. Overconfidence also makes investors make irrational investment choices (Sudirman & Pratiwi, 2022). The overconfidence heuristic can affect someone's threat tolerance by creating confidence in their ability to triumph over risks, so they take higher risks than they want to. Based on the relevant literature, this study argues that investors with overconfidence bias can have a large chance tolerance due to overestimation in their potential to expect marketplace movements that generally tend to make excessive trading for decisions. Moreover, Investors generally tend to underestimate the reviews of financial analysts, ignoring statistics and applicable information that reasons investment selections to be made to be unfounded and tends to be irrational. Therefore, the following hypothesis is posited:

H1: The effect of overconfidence towards investment decision-making is mediated by risk tolerance.

The availability bias is decision-making based only on the available information (Tversky & Kahneman, 1974). Decision-making is based only on available knowledge and not on other alternative studies (Javed et al., 2017). The availability heuristic can affect a person's risk perception and ultimately affect their level of risk tolerance. Investors who use the availability heuristic in making decisions tend to have a high-risk tolerance. The availability heuristic prevents investors from choosing the right and wrong investments in making an assessment (Shah et al., 2018), and high-risk tolerance also increases investor intensity in making investments. Mubaraq et al. (2021) and Nguyen et al. (2016) found that risk tolerance has a positive effect on investment decisions. Investors who have high-risk tolerance tend to invest in riskier assets. Based on the literature review above, this study argues that the supply of facts held by investors will impact the conduct patterns so that it will be displayed, which includes investor tolerance for funding risk. Investors affected by availability bias tend to have high chance tolerance, leading to irrational investment decisions. Therefore, this study posits the following hypothesis:

H2: The effect of availability towards investment decision-making is mediated by risk tolerance.
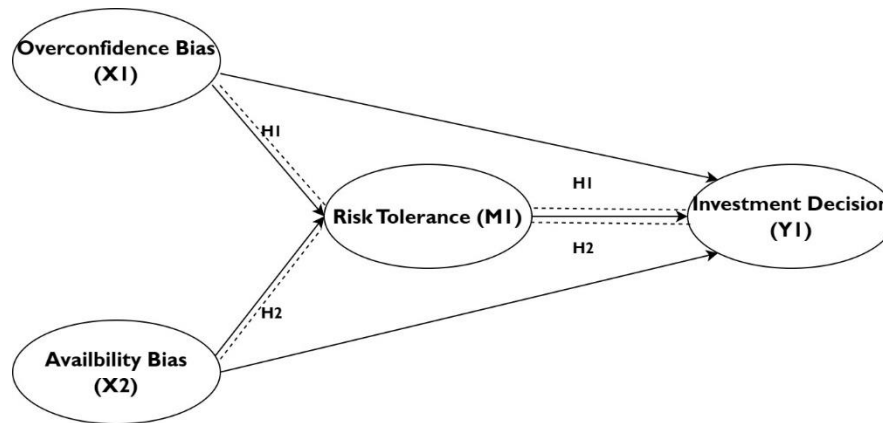
Figure 1. Research Model

3. Method

This research was conducted on individual investors who invest in the Indonesian Stock Exchange (IDX). Data collection was conducted by distributing questionnaires online through investor groups. The distribution of online questionnaires was used in this study because the Covid-19 situation was still not under control, so direct distribution was less effective, and the interview method consumed much time for respondents. Hence, the online questionnaire was the best option. Data collection has gone through the common method bias mitigation procedure suggested by (Malhotra et al., 2006; Podsakoff et al., 2003). The method includes paying attention to the anonymity of respondents, avoiding statements that have multiple meanings, avoiding ambiguous statements, separating questions based on constructs, and prioritizing construct criteria so that it will reduce social disability bias in research.

This research adopts a purposive technique in determining the sample. The following are the sample criteria: 1) Have a Single Investor Identification (SID) in stocks, 2) have invested in financial instruments in the form of stocks, 3) are individual investors, 4) have invested in the last three months. In total, 349 respondents filled out the research questionnaire, and 303 respondents met the sample criteria that could be used in the study. The respondents' characteristics are: 76.8% were male and 23.2% female. About 60% of the respondents had investment experience of more than 1 year, and 40% of respondents had investment experience of less than one year.

In measuring the overconfidence heuristic, this study uses three items developed by Nada & Moa'mer (2013). This study added two more items from Abdin et al. (2017). The availability heuristic is measured using eight indicators with six measurement items from Nada & Moa'mer (2013) and two questionnaire items from Abdin et al. (2017). Risk tolerance is measured based on three indicators developed by Khan et al. (2017) and four indicators used by Pinjisakikool (2018). The investment decision is measured by five items developed by (Scott & Bruce, 1995). All indicators used in the study used a Likert scale of 1-5, 1 indicates strongly disagree, and 5 reflects strongly agree. Furthermore, testing the research instrument, Cronbach alpha, composite reliability, average variance extracted (AVE), and factor-loading for each indicator are presented in Table 1.

Table 1. Operational Definition and Variable Measurement

Variables	Definition	Label	Items	Source
Investment Decision Making	Response patterns that form a habit shown by individuals in intuitively making an investment decision (by relying on hunches and feelings) (Scott & Bruce, 1995)	IDM1	I trust my feelings when making investments.	(Rasheed et al., 2018; Scott & Bruce, 1995)
		IDM2	Usually, I make investments that feel right to me.	
		IDM3	I rely on my instincts when investing.	
		IDM4	Feeling the rightness of an investment holds greater importance to me than having a logical justification for it.	
		IDM5	I tend to rely on my intuition when I make investments.	
Risk Tolerance	Willingness to agree to make financial decisions in the event of maximum uncertainty (Prabhakaran & Karthika, 2011)	RT1	I think it is better to have a safe investment with a low but guaranteed return than to take risks to have a chance of a high return.	(Khan et al., 2017; Pinjisakikool, 2018)
		RT2	I am ready to borrow money to make a profitable investment, in my opinion.	
		RT3	I do not invest in stocks because it is too risky.	
		RT4	I want to make sure that my investment is safe.	

Variables	Definition	Label	Items	Source
Overconfidence Bias	Unreasonable belief in one's intuitive reasoning, judgment, and cognitive ability (Pompian, 2011)	RT5	I am ready to take the risk of losing money when there is an opportunity to earn money.	(Abdin et al., 2017; Nada & Moa'mer, 2013)
		RT6	If I want to improve my financial position, then I have to take financial risks.	
		OB1	I am an experienced investor.	
		OB2	I can predict future stock price movements in various analyses.	
		OB3	I am a smart investor in the stock market.	
		OB4	I believe my ability to choose stocks is better than others.	
		OB5	I believe my knowledge can help me outperform the market.	
Availability Bias	The degree to which a person relies on readily available information in making decisions (Tversky & Kahneman, 1974)	AB1	I use my ability to predict the right investment time so that the performance of my stock portfolio can outperform the market performance.	(Abdin et al., 2017; Nada & Moa'mer, 2013)
		AB2	I feel more confident in my investment choices than my colleagues or friends.	
		AB3	I own several shares of different companies on the Indonesia Stock Exchange (IDX).	
		AB4	I have better investment performance compared to other people.	
		AB5	I get more returns compared to other people.	
		AB6	I use my ability to predict the right investment time so that the performance of my stock portfolio can outperform the market performance.	
		AB7	I feel more confident in my investment choices than my colleagues or friends.	
		AB8	I own several shares of different companies on the Indonesia Stock Exchange (IDX).	

4. Result and Discussion

4.1 Descriptive statistics

The survey on stock investors obtained 303 respondents with the following characteristics: 233 respondents, or 77 percent of the total respondents, are male, while 70, or 23 percent, are female. In terms of age, this survey shows variations in respondents from various age ranges. The majority of respondents are between 20 and 30 years old (56.4%) and are most likely the millennial generation. Respondents aged more than 30 to 40 years are 23.1%, followed by those aged more than 40 to 50 years (10.2%) and those aged more than 50 years (4.3%).

Regarding investment experience, most respondents had less than 1 year (39.9%), while 51.5% said they had been investing for 1 to 5 years. Only 8.6% of respondents have investment experience of more than 5 years. In terms of investment timeframe, this survey shows that the number of respondents who choose the long-term term (50.2%) is almost the same as those who choose the short-term term (49.8%). The data indicate that respondents have balanced preferences between long-term and short-term investments, which may be adjusted to their respective investment objectives.

4.2 Data Analysis

The Structural Equation Modeling Partial Least Square (PLS-SEM) approach is used in this study to test the hypotheses. Confirmatory Factor Analysis (CFA) employs to examine and assess the quality credibility of the research instrument, including convergent validity, discriminant validity, and the research constructs. In addition, structural model testing is performed to investigate the direct influence of representativeness and availability bias on investment decision-making. Finally, this study assesses the mediating role of risk tolerance on investment decision-making to determine the indirect effect of overconfidence bias and availability bias.

Table 2. Descriptive Statistics

Profile	Total	Percentage
Gender		
Male	233	77%
Female	70	23%
Age		
<20 year	18	5.9%
20-30 year	171	56.4%
>30-40 year	70	23.1%
>40-50 year	31	10.2%
>50 year	13	4.3%
Investment experience		
<1th	121	39.9%
1-5th	156	51.5%
>5th	26	8.6%
Period		
Long-term	152	50.2%
Short-term	151	49.8%

Hair et al. (2019) proposed methodologies and measurement criteria were utilized to assess the study's validity and reliability. The amount of precision of a measurement capable of representing the thing being measured is called validity. It is legitimate in measuring research when both the convergence and discriminant features are fulfilled. Construct validity, according to Hair et al. (2019), is divided into two parts: convergent validity and discriminant validity. Convergent validity was tested to examine how well the indicators employed in the study explained the construct by looking at the average variance extracted (AVE) value, which was considered valid when it was more than 0.5. The study's convergent validity test yielded different AVE values; the three components' convergent validity was not initially fulfilled. Therefore, indicators with a factor-loading value of 0.7 were evaluated for deletion. Based on the instrument testing results presented in Table 2, seven indicators must be removed to increase the AVE value of each construct, namely the second and fourth indicators from the risk tolerance construct, the seventh indicator from the availability construct, and the first and second indicators from the overconfidence construct. The average variance extracted (AVE) for all constructs is thus greater than 0.5, indicating that convergent validity is fulfilled.

Table 2 Testing Research Instruments

Construct	Measurement Item	Factor Loading	AVE	Cronbach alfa	Composite Reliability
Investment Decision Making	IDM1	0.832	0.619	0.847	0.890
	IDM2	0.814			
	IDM3	0.828			
	IDM4	0.744			
	IDM5	0.709			
Risk Tolerance	RT1	0.685b	0.526	0.698	0.815
	RT2	*0.514b			
	RT3	0.702			
	RT4	*0.582b			
	RT5	0.757			
	RT6	0.629b			
Availability Bias	AB1	0.745	0.548	0.861	0.894
	AB2	0.786			
	AB3	0.712			
	AB4	0.636b			
	AB5	0.756			
	AB6	0.783			
	AB7	*0.326a			
	AB8	0.701			

Construct	Measurement Item	Factor Loading	AVE	Cronbach alfa	Composite Reliability
Overconfidence bias	OB1	*0.683b	0.527	0.554	0.768
	OB2	*0.244b			
	OB3	0.583b			
	OB4	0.717			
	OB5	0.683b			

Note: b= factor loading value < 0,7, a= factor loading value < 0,5, *item deleted.

Discriminant validity testing is carried out to assess indicators that measure a construct differently from other constructs. According to Hair et al. (2019), an indicator of a construct is valid if the Root AVE value of each construct is higher when measuring that construct than other constructs using the Fornell-Larcker criteria. Based on Table 3, the results of the Fornell-Larcker criteria test show that the AVE root value of each construct is higher than the AVE root value of the other constructs so that the discriminant validity of each construct is fulfilled.

Table 3. Discriminant Validity Testing

Construct	Availability Bias	Representativeness Bias	Investment Decision	Risk Tolerance
Availability Bias	**0.77**			
Representativeness Bias	0.21	**0.73**		
Investment Decision	0.46	0.31	**0.79**	
Risk Tolerance	0.32	0.34	0.42	**0.73**

Construct reliability test using the composite reliability value obtained a value of 0.894 for the Availability bias construct, 0.768 for the overconfidence bias construct, 0.815 for the Risk Tolerance construct, and 0.890 for the Investment Decision Making construct so that all the constructs used in the study are reliable. Furthermore, testing for general method bias is one of the biases found when using quantitative studies involving survey techniques in data collection. General method bias testing is required to meet the requirements for instrument validity. Procedural design and statistical testing are ways that can be used to reduce the chances of common method bias (Podsakoff et al., 2003). Harman's single factor test was used in this study to test general method bias and obtained a variance value of 31.67% <50%. Based on the results of the CMB test, it can be concluded that the model designed in this study is free from general method bias (Malhotra et al., 2006; Podsakoff et al., 2003).

Table 3. Common Method Bias Testing

Total Variance Explained					
Initial Eigenvalues			Extraction Sums of Squared Loadings		
Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
6.017	31.670	31.670	6.017	31.670	31.670

4.3 Structural Models

This study uses Baron & Kenny's (1986) approach to test the structural model. Within the Baron and Kenny approach, this study examined the direct relationship of the independent variables to the dependent variable. Followed by examining the oblique relationship of each pathway, the impartial variables to the mediating variables, and the mediating variables to the established variable. The mediating impact of each research route is presented in Table 4.

Testing the impact of availability bias on funding selections has a probability value (p-value) of 0.000 < 0.05 with a coefficient of 0.372. The impact of overconfidence bias on investment decisions obtained a probability value of 0.008 < 0.05 with a coefficient cost of 0.170. Moreover, the effect of risk tolerance on funding selections has a probability value of 0.023 < 0.05 with a coefficient value of 0.148. Hence, availability bias, overconfidence bias, and chance tolerance positively and significantly affect investment choices. Furthermore, the effect of availability bias on threat tolerance has a probability value of 0.000 < 0.05 with a coefficient of 0.249. The effect of overconfidence bias on investment decisions has a probability value of 0.000 < 0.05 with a coefficient price of 0.370. Hence, supply bias and overconfidence bias significantly impact choices investment. Testing the mediating effect of availability bias on investment decisions through risk tolerance obtained a significance value of 0.047 <0.05 with a coefficient of 0.037. Estimation of the indirect effect indicates that risk tolerance partially mediates the effect of availability bias on investment decision-making. Estimation

results of the effect of overconfidence bias on investment decisions through risk tolerance obtained a significance value of 0.028 <0.05 with a coefficient of 0.055. Furthermore, by weighing the resulting indirect effect starting from the influence of overconfidence bias on significant risk tolerance and risk tolerance on significant investment decisions and testing the influence is also significant. It can be concluded that risk tolerance partially mediates the effect of overconfidence bias on investment decision-making.

Table 4. Hypothesis Testing

Independent Variable	Dependent Variable			VIF	Decision
	Direct Effect		Indirect Effect		
	Risk Tolerance	Investment Decision	Via Risk Tolerance		
Availability	0.249**	0.372**	0.037*	1.125	Supported
Overconfidence	0.370**	0.170**	0.055*	1.235	Supported
Risk Tolerance	-	0.148*	-	1.314	
R^2	0.239	0.28			

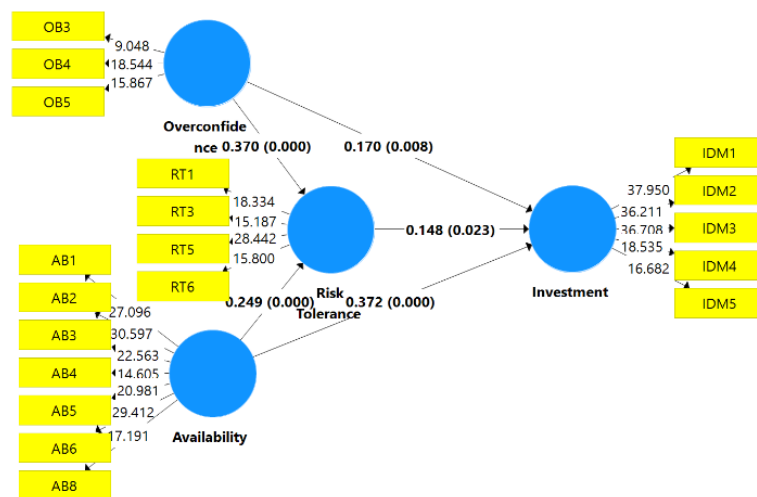Notes: **$P < 0.01$, *$P < 0.05$, n= 303.

Figure 1. Research Model Testing

4.4 Discussion

This research confirms the theory of bounded rationality. Bounded rationality states that humans have limited information, time, and cognitive abilities in making decisions, and humans often use simpler and easier methods than finding optimal solutions (Pompian, 2011; Simon, 1955). So according to bounded rationality, people tend to make decisions that are not fully rational because they only consider certain factors in the process, which can lead to misjudgments and ignore essential aspects that should be considered. Irrational investment decisions can also be influenced by cognitive biases, such as availability bias or overconfidence bias, which lead to judgments and decisions that are not objective. This study finds the indirect effect of overconfidence and availability bias on investment decisions through risk tolerance using the mediation test approach introduced by Baron & Kenny (1986). This study only tested the indirect effect of overconfidence bias and availability bias on investment decision-making because previous studies had focused on testing direct effects, for example (Khan et al., 2017; Raheja & Dhiman, 2019; Rasool & Ullah, 2020; Shah et al., 2018) so that this study focus on testing mediation effects only.

This study finds the mediating effects of risk tolerance on the impact of overconfidence bias on irrational investment selections. The results imply that risk tolerance determines the level to which overconfidence bias influences funding selections. Investors with high-risk tolerance have a greater tendency to take better risks, regardless of the extent of overconfidence they have. Moreover, investors with high overconfidence bias tend to have excessive risks tolerance because investors' tolerance for unsure situations will also be excessive, affecting irrational decision-making. Investors with a low-risk tolerance can be extra careful about taking risks and are more likely to assess records objectively. They will be better capable of apprehending and conquering overconfidence biases that may stand up for their investment choice-making. The evidence provides a new understanding of behavior finance, which thus far has

been concerned with direct testing such as (Ahmad & Shah, 2022; Khan et al., 2017; Khan et al., 2020; Shah et al., 2018). The results also support Nguyen et al. (2019), which observed that risk tolerance leads to riskier investments.

The availability bias refers to the inclination to make decisions based on information that is readily available or that is fresh in minds. Investors place a higher value on material easily remembered or recalled quickly. The impact of availability bias on investment decisions might be hazardous since we are sensitive to picking solutions not completely supported by logical reasoning or extensive facts, resulting in higher risk tolerance. Risk tolerance is the degree to which a person is ready to accept risk in financial decisions. The findings of the second hypothesis test demonstrated that risk tolerance can mitigate the influence of availability bias on investment decisions. These findings support the research conducted by (Mubaraq et al., 2021; Nguyen et al., 2016). This research also shows that investors with a high-risk tolerance tend to consider information that is easily accessible or recalled, even if it is not sensible. Investors assume more risks in their financial selections. When a person has a low-risk tolerance, they may be more cautious about taking risks and are more likely to do in-depth study and gather more full facts before making an investment choice. In this instance, investors can better overcome availability bias and are less swayed by easily remembered information. As a result, risk tolerance serves as a bridge between availability bias and investing preferences.

5. Conclusion

This study provides insights into the role of mental elements in investment decisions, which cannot always be based on rational analysis proposed by traditional financial theory. It also includes emotional and perceptual components to explain psychological phenomena using bounded rationality theory. This research fills a gap by exploring the mediating and moderating consequences of investor psychological phenomena in investment decisions, specifically the mediating role of risk tolerance. The study shows that investors with overconfidence bias often take excessive risks and disregard contradictory data, which can harm their investment returns. The results also show that individual risk tolerance mediates the relationship between overconfidence bias and investment decisions. Individuals with a high-risk tolerance tend to be more risk-acceptance, regardless of their level of overconfidence.

Furthermore, Availability bias also influences investment decisions. Individuals tend to give extra weight to facts that are simple to remember without thoroughly thinking about the records and more comprehensive evaluation. In addition, risk tolerance mediates the impact of availability bias on funding decisions. Individuals with risk tolerance can be more objective, sensible, and cautious in taking risks in their investments.

For investors, this research provides a deeper understanding of how overconfidence and availability bias can affect their decision-making process. By being aware of these tendencies, they can identify situations where heuristic biases can arise and work to reduce their negative impact. This research can also encourage the development of more rational and evidence-based decision-making strategies. Investors can take steps to overcome overconfidence and availability bias in their investment decisions. For example, they may adopt a more cautious approach to evaluating information and avoid making decisions based on more accessible information (availability bias). Investors can better assess risk tolerance by understanding how heuristic bias influences risk perception.

This research focuses on heuristic bias in making investment decisions, even though many other factors, such as financial knowledge and previous investment experience, can influence investment decision-making. Moreover, this study only focuses on one type of cognitive bias, even though many cognitive biases cause errors in making investment decisions: conservative bias, illusory control bias, self-control bias, confirmation bias, and accounting mental bias. Furthermore, this study uses a survey method which is prone to general method bias, so a comparison method is needed to improve the accuracy of the research results. While this research provides insight into the impact of heuristic bias and risk tolerance, applying these findings in practice may involve overcoming established habits and thought patterns.

Future research is expected to examine other cognitive biases to increase the accuracy of the results and reveal factors that influence investors' investment decision-making, such as conservative bias, illusory control bias, self-control bias, confirmation bias, and mental accounting bias. Future studies may also test elements of demographics along with; gender, investment experience, income, and monetary literacy as moderating variables to make certain contextual factors from heuristic bias toward funding decision-making. Finally, future studies may also employ other methodologies to compare methods, such as experimental design.

Author Contribution
Wahyu Febri Ramadhan Sudirman: conceptualization, writing original draft, data curation, formal analysis, investigation, methodology, writing review, and editing.
Mohd Winario: data curation, formal analysis, investigation, review and editing, validation, visualization.
Arif Mudi Priyatno: data curation, formal analysis, investigation, review and editing, validation, visualization.
Zubaidah Assyifa: data curation, formal analysis, investigation, review and editing, validation, visualization.

Financial Disclosure
This article does not have a source of funding from anywhere or any funding agency.

Conflict of Interest
The authors declare no conflict of interest in the article that the author made because there was no funding from any party that would intervene in the results of this research.

References

Abdin, S. Z. ul, Farooq, O., Sultana, N., & Farooq, M. (2017). The impact of heuristics on investment decision and performance: Exploring multiple mediation mechanisms. *Research in International Business and Finance*, *42*, 674–688. https://doi.org/10.1016/j.ribaf.2017.07.010

Ahmad, M., & Shah, S. Z. A. (2022). Overconfidence heuristic-driven bias in investment decision-making and performance: mediating effects of risk perception and moderating effects of financial literacy. *Journal of Economic and Administrative Sciences*, *38*(1), 60–90. https://doi.org/10.1108/jeas-07-2020-0116

Ahmad, M., Shah, S. Z. A., & Abbass, Y. (2020). The role of heuristic-driven biases in entrepreneurial strategic decision-making: evidence from an emerging economy. *Management Decision*, *59*(3), 669–691. https://doi.org/10.1108/MD-09-2019-1231

Artinger, F., Petersen, M., Gigerenzer, G., & Weibler, J. (2015). Predicting Marital Happiness and Stability from Newlywed Interactions Published by : National Council on Family Relations Predicting Marital Happiness and Stability from Newlywed Interactions. *Journal of Organizational Behavior*, *36*(S1), S33–S52. https://doi.org/10.1002/job

Asri, M. (2013). *Keuangan Keprilakuan.* (fist). BPFE.

Babajide, A. A., & Adetiloye, K. A. (2012). Investors' Behavioural Biases and the Security Market: An Empirical Study of the Nigerian Security Market. *Accounting and Finance Research*, *1*(1), 219–229. https://doi.org/10.5430/afr.v1n1p219

Baron, R. M., & Kenny, D. A. (1986). The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182. https://doi.org/10.1037//0022-3514.51.6.1173

Bingham, C. B., & Eisenhardt, K. M. (2011). The Effect of Firm Compensation Structures on the Mobility and Entrepreneurship of Extreme Performers. *Strategic Management Journal*, *32*, 1437–1464. https://doi.org/10.1002/smj

Cao, M. M., Nguyen, N. T., & Tran, T. T. (2021). Behavioral Factors on Individual Investors' Decision Making and Investment Performance: A Survey from the Vietnam Stock Market. *Journal of Asian Finance, Economics and Business*, *8*(3), 845–853. https://doi.org/10.13106/jafeb.2021.vol8.no3.0845

Cohen, G., & Kudryavtsev, A. (2012). Investor rationality and financial decisions. *Journal of Behavioral Finance*, *13*(1), 11–16. https://doi.org/10.1080/15427560.2012.653020

Gigerenzer, G., & Gaissmaier, W. (2011). Heuristic decision making. *Annual Review of Psychology*, *62*(1), 451–482. https://doi.org/10.1146/annurev-psych-120709-145346

Goetzmann, W. N., & Kumar, A. (2008). Equity portfolio diversification. *Review of Finance*, *12*(3), 433–463. https://doi.org/10.1093/rof/rfn005

Grable, J. E. (2016). Handbook of Consumer Finance Research. In *Handbook of Consumer Finance Research* (pp. 19–31). Springer International Publishing. https://doi.org/10.1007/978-3-319-28887-1

Grable, J. E., & Roszkowski, M. J. (2008). The influence of mood on the willingness to take financial risks. *Journal of Risk*

Research, *11*(7), 905–923. https://doi.org/10.1080/13669870802090390

Hair, J. F. J., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate Data Analysis* (Eighth). Pearson Education, Inc. https://doi.org/10.1002/9781119409137.ch4

Ishfaq, M., Nazir, M. S., Qamar, M. A. J., & Usman, M. (2020). Cognitive Bias and the Extraversion Personality Shaping the Behavior of Investors. *Frontiers in Psychology*, *11*(October). https://doi.org/10.3389/fpsyg.2020.556506

Javed, H., Bagh, T., & Razzaq, S. (2017). Herding Effects, Over Confidence, Availability Bias and Representativeness as Behavioral Determinants of Perceived Investment Performance: An Empirical Evidence from Pakistan Stock Exchange (PSX). *Journal of Global Economics*, *6*(1), 1–13. https://doi.org/10.4172/2375-389.1000275

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 263–292. https://doi.org/10.2307/1914185

Kasoga, P. S. (2021). Heuristic biases and investment decisions: multiple mediation mechanisms of risk tolerance and financial literacy—a survey at the Tanzania stock market. *Journal of Money and Business*, *1*(2), 102–116. https://doi.org/10.1108/jmb-10-2021-0037

Khan, A. R., Azeem, M., & Sarwar, S. (2017). Impact of Overconfidence and Loss Aversion Biases on Investment Decision : Moderating Role of Risk Perception. *International Journal of Transformation in Accounting, Auditing & Taxation*, *1*(1), 23–35. http://management.eurekajournals.com/index.php/IJTAAT/article/view/93/225

Khan, H. H., Naz, I., Qureshi, F., & Ghafoor, A. (2017). Heuristics and stock buying decision: Evidence from Malaysian and Pakistani stock markets. *Borsa Istanbul Review*, *17*(2), 97–110. https://doi.org/10.1016/j.bir.2016.12.002

Khan, I., Afeef, M., Jan, S., & Ihsan, A. (2020). The impact of heuristic biases on investors' investment decision in Pakistan stock market: moderating role of long term orientation. *Qualitative Research in Financial Markets*, *13*(2), 252–274. https://doi.org/10.1108/QRFM-03-2020-0028

Kirchler, E., Maciejovsky, B., & Weber, M. (2005). Framing Effects, Selective Information, and Market Behavior: An Experimental Analysis. *Journal of Behavioral Finance*, *6*(2), 90–100. https://doi.org/10.1207/s15427579jpfm0602

Mahat, F., Nasir, A. M., & Ali, N. A. (2010). The Mediating Effects of Risk Tolerance on Fund Performance. *International Journal of Business and Social Science*, *1*(2), 89–102. https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.454.3705&rep=rep1&type=pdf

Malhotra, N. K., Kim, S. S., & Patil, A. (2006). Common method variance in IS research: A comparison of alternative approaches and a reanalysis of past research. *Management Science*, *52*(12), 1865–1883. https://doi.org/10.1287/mnsc.1060.0597

Markowitz, H. (1952). Portfolio Selection. *The Journal of Finance*, *7*(1), 77–91. https://doi.org/10.1111/j.1540-6261.1952.tb01525.x

Menkhoff, L., Schmidt, U., & Brozynski, T. (2006). The impact of experience on risk taking, overconfidence, and herding of fund managers: Complementary survey evidence. *European Economic Review*, *50*(7), 1753–1766. https://doi.org/10.1016/j.euroecorev.2005.08.001

Mubaraq, M. R., Anshori, M., & Trihatmoko, H. (2021). the Influence of Financial Knowledge and Risk Tolerance on Investment Decision Making. *Jurnal Ekonomi Bisnis Dan Kewirausahaan*, *10*(2), 140. https://doi.org/10.26418/jebik.v10i2.47089

Nada, S. M. A., & Moa'mer, F. A. (2013). *Behavioural Factors Influencing Investment Decision Making: An Empirical Study of Palestine Stock Exchange*. The Islamic University – Gaza.

Nguyen, A. D., Pham, C. H., & Pham, L. (2016). Total Quality Management and Financial Performance of Construction Companies in Ha Noi. *International Journal of Financial Research*, *7*(3), 41–53. https://doi.org/10.5430/ijfr.v7n3p41

Nguyen, L., Gallery, G., & Newton, C. (2019). The joint influence of financial risk perception and risk tolerance on individual investment decision-making. *Accounting and Finance*, *59*(S1), 747–771. https://doi.org/10.1111/acfi.12295

Nguyen, L. T. M., Gallery, G., & Newton, C. (2016). The influence of financial risk tolerance on investment decision-making in a financial advice context1. *Australasian Accounting, Business and Finance Journal*, *10*(3), 3–22. https://doi.org/10.14453/aabfj.v10i3.2

Odean, T. (1998). Volume, volatility, price, and profit when all traders are above average. *Journal of Finance*, *53*(6), 1887–

1934. https://doi.org/10.1111/0022-1082.00078

Odean, T. (1999). Do investors trade too much? *American Economic Review*, *89*(5), 1279–1298. https://doi.org/10.2307/j.ctvcm4j8j.28

Pak, O., & Mahmood, M. (2015). Impact of personality on risk tolerance and investment decisions: A study on potential investors of Kazakhstan. *International Journal of Commerce and Management*, *25*(4), 370–384. https://doi.org/10.1108/IJCoMA-01-2013-0002

Pinjisakikool, T. (2018). The Influence of Personality Traits on Households' Financial Risk Tolerance and Financial Behaviour. *Journal of Interdisciplinary Economics*, *30*(1), 32–54. https://doi.org/10.1177/0260107917731034

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Pompian, M. M. (2011). *Behavioral Finance and Wealth Management: How to Build Investment* (Second (ed.); Second). Wiley.

Prabhakaran, K., & Karthika, P. (2011). A study on risk perception and portfolio management of equity investors in coimbatore city. *Journal of Management and Science*, *1*(2), 65–77. https://doi.org/10.26524/jms.2011.9

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

Raheja, S., & Dhiman, B. (2020). How do emotional intelligence and behavioral biases of investors determine their investment decisions? *Rajagiri Management Journal*, *14*(1), 35–47. https://doi.org/10.1108/ramj-12-2019-0027

Rasheed, M. H., Rafique, A., Zahid, T., & Akhtar, M. W. (2018). Factors influencing investor's decision making in Pakistan: Moderating the role of locus of control. *Review of Behavioral Finance*, *10*(1), 70–87. https://doi.org/10.1108/RBF-05-2016-0028

Rasool, N., & Ullah, S. (2020). Financial literacy and behavioural biases of individual investors: empirical evidence of Pakistan stock exchange. *Journal of Economics, Finance and Administrative Science*, *25*(50), 261–278. https://doi.org/10.1108/JEFAS-03-2019-0031

Ross, S. A. (1977). Determination of Financial Structure: the Incentive-Signalling Approach. *Bell J Econ*, *8*(1), 23–40. https://doi.org/10.2307/3003485

Roszkowski, M. J., & Davey, G. (2010). Risk Perception and Risk Tolerance Changes Attributable to the 2008 Economic Crisis : A Subtle but Critical Difference. *Journal of Financial Service Professionals*, *64*(4), 42–53.

Scott, S. G., & Bruce, R. A. (1995). Decision-Making Style: The Development and Assessment of a New Measure. *Educational and Psychological Measurement*, *55*(5), 818–831. https://doi.org/10.1177/0013164495055005017

Sent, E. M. (2018). Rationality and bounded rationality: you can't have one without the other. *European Journal of the History of Economic Thought*, *25*(6), 1370–1386. https://doi.org/10.1080/09672567.2018.1523206

Shah, S. Z. A., Ahmad, M., & Mahmood, F. (2018). Heuristic biases in investment decision-making and perceived market efficiency: A survey at the Pakistan stock exchange. *Qualitative Research in Financial Markets*, *10*(1), 85–110. https://doi.org/10.1108/QRFM-04-2017-0033

Simon, H. A. (1955). A behavioral model of rational choice. *Quarterly Journal of Economics*, *69*(1), 99–118. https://doi.org/10.2307/1884852

Skavantzos, A. (1998). Efficient residue to weighted converter for a new Residue Number System. *Proceedings of the IEEE Great Lakes Symposium on VLSI*, *9*(28), 185–191. https://doi.org/10.1109/GLSV.1998.665223

Stulz, R. M. (1995). American Finance Association, Report of the Managing Editor of the Journal of Finance for the Year 1994. *The Journal of Finance*, *50*(3), 1013. https://doi.org/10.2307/2329297

Sudirman, W. F. R., & Pratiwi, A. (2022). Overconfidence Bias Dalam Pengembilan Keputusan Investasi: Peran Perbedaan Gender. *Muhammadiyah Riau Accounting and Business Journal*, *3*(2), 081–092. http://ejurnal.umri.ac.id/index.php/MRABJ

Tan, L., Chiang, T. C., Mason, J. R., & Nelling, E. (2008). Herding behavior in Chinese stock markets: An examination of A and B shares. *Pacific Basin Finance Journal*, *16*(1–2), 61–77. https://doi.org/10.1016/j.pacfin.2007.04.004

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, New Series*, *185*(4157), 1124–1131. https://doi.org/10.4324/9781912282562

Waweru, N. M., Munyoki, E., & Uliana, E. (2008). The effects of behavioural factors in investment decision-making : a survey of institutional investors operating at the Nairobi Stock Exchange. *Int. J. Business and Emerging Markets*, *1*(1), 24–41. https://doi.org/10.1504/IJBEM.2008.019243

Zheng, Y. (2013). *The Development of the Risky Financial Behavior Scale: A Measure of Financial Risk Tolerance* [Electronic Theses and Dissertations University of Denver]. https://digitalcommons.du.edu/etd/734