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Investment scam vulnerability among university students: the role of personality traits and risk tolerance

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ABSTRACT

This study demonstrates that personality traits affect investment scam vulnerability, either directly or indirectly, through risk tolerance. This study uses the Big Five personality traits, specifically openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. This study collected data by randomly distributing surveys to students from A-accredited universities in Java and Bali, Indonesia, areas known for their economic growth. The study analysed 421 respondents aged 18–24 years old at undergraduate and graduate levels using the partial least squares method. Our findings reveal a negative correlation between the conscientiousness trait and scam vulnerability. The ability of conscientiousness-type respondents to obtain quality and relevant information prevents them from making impulsive investments. This study also finds that students with high openness to experience, extraversion, and neuroticism traits increase their vulnerability to scams through risk tolerance. These types of personality traits cause the individual to tolerate more risky investments, thereby increasing their susceptibility to investment fraud. There is still limited research that connects personality traits, risk tolerance, and scam vulnerability. In addition, this study is able to expand the boundaries of the Big Five personality theory.

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1. Introduction

The fraud causes victims to experience financial and other losses (Wilson et al., 2024). One of the reasons why people fall victim to investment fraud is financial dissatisfaction (Kadoya et al., 2020). Klapper and Lusardi (2020) study on financial literacy found discrepancies between developed and developing countries. The average financial knowledge score in advanced nations is 55%, whereas in developing nations it is 28%. The authors noted that gender differences exist in both established and developing countries, with younger individuals having more knowledge than earlier generations, particularly in emerging countries (Goulart et al., 2023; Klapper & Lusardi, 2020). Previous studies have investigated the relationship between personality traits and socio-economic factors (Kadoya et al., 2020), victimisation and lifestyle routines (Akdemir & Lawless, 2020; Drew, 2020), financial literacy (Sirohi & Misra, 2024), and financial management education (Mohd Padil et al., 2022).

Investment scams frequently offer huge profits and violate legal restrictions. This lures investors, particularly those who are more materialistic (Deliema et al., 2020), into investing. As technology advances, people's financial habits have also evolved, leading them to favour investing through mobile devices (Fan, 2022). Indonesia has struggled with investment fraud for years. Organised criminals perpetrate numerous schemes, leading thousands of Indonesians to become victims annually (Prabowo, 2024). From 2017 to 2022, Indonesians lost a total of IDR137.84 trillion due to investment fraud (Soehandoko, 2023). There are many cases of crypto-related fraud (Mehta & Chawla, 2024) using schemes such as Ponzi schemes and Get-rich-quick, which offer unrealistic returns for small investment amounts (A. Rahman et al., 2020). Using the Prospect Theory, this study examines an investor's response and

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susceptibility to risky investments influenced by personality traits. Investors can fall victim to fraud from risky investments with or without an understanding of the consequences that will occur (Ma & McKinnon, 2022). Investors should have an understanding of the rules that apply and be able to assess them carefully before making an investment decision (Hossain, 2023).

Individual personality traits known as the Big Five Personality Traits—openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism—have a relationship with a person's level of financial satisfaction, which in turn influences their investment decisions (Sachdeva & Lehal, 2023). An individual's level of tolerance for investment risk is also associated with their personality traits (Rodrigues & Gopalakrishna, 2024). In making decisions, investors who lack confidence will listen to the advice of others, such as advisors and friends (Ahmad, 2020). Conversely, investors who are confident and like to seek new experiences, or who are open to experiencing trait characteristics, dare to invest in initial public offerings or high-risk assets (Akhtar & Malik, 2023; Jain et al., 2023).

Previous studies on the relationship between personality traits, investment risk, and investment decisions (Akhtar & Das, 2020; Akhtar & Malik, 2023; Jiang et al., 2024) explain how individual psychology can shape their investment patterns and financial decisions. However, more research is required to comprehend how a student acting as an investor, guards against investment scams while taking risk tolerance and personality traits into account. The previous studies link personality traits to risk tolerance as a direct influence, while our study examines the influence of personality traits on scam vulnerability through risk tolerance as an indirect influence. Furthermore, several studies investigate how personality traits affect investors' risk tolerance levels (De Bortoli et al., 2019; Verma & Kanna, 2024). They find that individuals with higher risk tolerance are more likely to engage in diverse investment strategies than safer investment options (Verma & Kanna, 2024).

In the digital economy, it is important to understand and address the existence of various fraud risks. When making investments, students have varying attitudes towards the risk of investment fraud. Understanding personality traits allows an investor to prioritise long-term financial goals over short-term ones in order to maintain a disciplined investment plan and avoid making emotional decisions (Baker et al., 2021).

Our study aims to investigate university students' level of vigilance in committing and dealing with investment fraud, based on five personality traits. This study posits that risk tolerance influences students' personality traits and their susceptibility to scams. Our study contributes to the literature in three ways. First, there is a lack of research linking personality traits, risk tolerance, and scam vulnerability. Prior research has investigated the correlation between personality traits and risk attitudes in university students (Ahmad, 2020), although it has not connected these factors to self-protection against investment fraud. Secondly, Indonesia, with its large population of young adults, attracts investment research in the ASEAN region. Third, our study connects two theories, specifically the Big Five Personality Theory and the Prospect Theory. It is easier for young people to change their behaviour because they are still developing their decision-making characteristics. By acknowledging that students make risk-related decisions based on unpredictable events and scrutinising their information processing, this approach enhances economic theory (Goulart et al., 2023).

This study divides the subsequent discussion into five sections. The second section provides an overview of the literature review. The third section presents hypothesis development, the research methodology used, and data collection. The fourth section discusses respondent demographics, test results, the ensuing discussion, and implications. Finally, the fifth section formulates conclusions about the overall results of this study, including its limitations and future research directions.

2. Literature review and hypotheses development

2.1. The Big Five personality theory

This study bases its discussion of individual personality on the Big Five Personality, first proposed by Lewis Goldberg and developed by McCrae and Costa (1997). The theory is currently the most widely accepted model (Goulart et al., 2023). Based on the Big Five Personalities, there are five personality types consisting of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism (Rodrigues &

Gopalakrishna, 2024). People can use personality traits to analyse their decisions in an economic context (Goulart et al., 2023) and influence the behaviour of investors in financial markets (Sachdeva & Lehal, 2023). This theory can describe a person's personal characteristics that exist genetically in humans (Akhtar & Malik, 2023). Furthermore, the Big Five personality traits can explain how investors' personality attributes may contribute to their irrational behaviour (Akhtar & Malik, 2023). Investors often make irrational decisions when investing (Tjondro et al., 2024a), making them vulnerable to fraud.

2.2. The prospect theory

The prospect theory best describes the phenomenon of decision-making in the face of risk and uncertainty. Investors exhibit risk-averse behaviour when purchasing insurance policies and become risk-takers when purchasing lottery tickets (Akhtar & Malik, 2023). According to the Prospect Theory, individuals tend to be risk-averse, but when faced with losses, they tend to increase their investment risks (Hidajat et al., 2020). They do this to prevent losses or financial losses. Investors base their decisions on available information, which may be inaccurate or insufficient. Even so, the accessible information has an impact on the investor's ability to grasp and analyse (Akhtar & Malik, 2023). Based on the Prospect Theory by Kahneman and Tversky (1988), when investors realise that there is little chance of getting their money back, they will irrationally reinvest in the same fraudulent scheme (Hidajat et al., 2020).

2.3. Hypotheses development

Uncertain conditions often confront investors, potentially leading to either loss or gain (Ahmad, 2020). Personality traits have a strong contribution to how an investor takes risks through emotions and psychology (Akhtar & Malik, 2023; Rodrigues & Gopalakrishna, 2024). However, emotions and psychology can cause an investor to make poor financial decisions (Akhtar & Malik, 2023). This then increases the likelihood of becoming a victim of investment fraud. As a result, this study focuses on how personality traits contribute to investment risk and vulnerability to investment scams.

The openness to experience trait indicates that people will not hesitate to try new things (Jiang et al., 2024; Rodrigues & Gopalakrishna, 2024), including new investments. They have a friendly personality, are active and energetic, and enjoy socialising (Jain et al., 2023). In addition to being open to new experiences, they are also open and easily accepting of new ideas or concepts that exist (Akhtar & Malik, 2023; Rodrigues & Gopalakrishna, 2024). This personality type will also seek information (Ahmad, 2020) and opportunities (Akhtar & Malik, 2023). Due to their openness and curiosity, they will dare to invest in risky and hyper fluctuating investments (Akhtar & Das, 2020; Akhtar & Malik, 2023; Rodrigues & Gopalakrishna, 2024), such as cryptocurrencies (Nyhus et al., 2024), in the hope of gaining greater understanding (Rodrigues & Gopalakrishna, 2024). The more open an investor is, the more willing they will be to accept the risks they will face (Jiang et al., 2024). Bias investors attempt to mimic the investing success of peers by depending on others' choices for investing (Tjondro et al., 2024a).

Risk tolerance acts as an intermediary between an individual's negligent behaviour and their willingness to engage in risky investments (Tjondro et al., 2024b). When individuals engage in negligent conduct, their tolerance for risk increases, resulting in irrational decisions regarding risky investments. Based on the previous explanation, hypotheses are

H1a: The openness to experience trait is positively associated with scam vulnerability.

H1b: The openness to experience trait is positively associated with risk tolerance.

H1c: Risk tolerance mediates the relationship between openness to experience and scam vulnerability.

People with conscientiousness traits are careful in their decisions, including those related to investments (Jain et al., 2023). They are responsible, disciplined, hardworking, and more organised (Jiang et al., 2024). Because of their cautious nature, they tend not to take risks (Akhtar & Das, 2020; Aren et al., 2021; Aumeboonsuke & Caplanova, 2023). Investors with the conscientiousness trait have confidence in their abilities, so they pay less attention to the advice of others and rely more on their abilities

in making an investment decision (Ahmad, 2020). They have good self-control so that, through the quality financial information they obtain, they will make a good long-term investment decision (Akhtar & Malik, 2023). If they have not obtained relevant and valid information, then they will not act impulsively to buy an existing investment. Their ability to obtain quality and relevant information makes them avoid making impulsive investments and have a small amount of risky assets in their portfolio (Akhtar & Malik, 2023; Rodrigues & Gopalakrishna). Based on the previous explanation, hypotheses are

H2a: The conscientiousness trait is negatively associated with scam vulnerability.

H2b: The conscientiousness trait is negatively associated with risk tolerance.

H2c: Risk tolerance mediates the relationship between conscientiousness and scam vulnerability.

Extraversion traits include people who are optimistic, talkative (Ahmad, 2020), enthusiastic, and eager to interact with others (Jiang et al., 2024; Rodrigues & Gopalakrishna, 2024). Their extroverted nature allows them to easily gather various types of information from their various acquaintances. Through this information, they will look for opportunities (Akhtar & Malik, 2023) and tend to overreact to market information. This, in turn, results in biased decision-making (Ahmad, 2020). Extraverted individuals tend to purchase financial assets at high prices (Rodrigues & Gopalakrishna, 2024), indicating that they are not typically risk-averse (Akhtar & Das, 2020; Akhtar & Malik, 2023; Aumeboonsuke & Caplanova, 2023; Rodrigues & Gopalakrishna, 2024). This can lead an individual with the extraversion trait to develop a high-risk tolerance, particularly when managing existing investment risks. The more extraversion a person has, the higher their risk tolerance due to their outgoing nature (Rodrigues & Gopalakrishna) and the higher the risk level of their investments (Akhtar & Malik, 2023). Based on the previous explanation, hypotheses are

H3a: The extraversion trait is positively associated with scam vulnerability.

H3b: The extraversion trait is positively associated with risk tolerance.

H3c: Risk tolerance mediates the relationship between extraversion and scam vulnerability.

An agreeable trait is a person who is considerate, unselfish, cooperative, and often shows sympathy for others (Ahmad, 2020; Jain et al., 2023). The nature of a person who is always in a state of agreeableness and harmony with others. Characteristics of a trustworthy person include honesty, benevolence, obedience, modesty, and tendermindedness (Goulart et al., 2023). In making investment decisions, they will rely on the latest market information (Ahmad, 2020) to avoid risky investments (Akhtar & Das, 2020; Aumeboonsuke & Caplanova, 2023). Another factor is that a person with an agreeable personality wants to establish good relationships with others. The tendency to maintain relationships with others makes them choose to avoid conflict and take risks to please them. When making investment decisions, they tend to use other people's decisions in the hope of maintaining relationships with them (Akhtar & Malik, 2023). On the other hand, their positive nature makes them not easily suspicious of fraud, so individuals with agreeableness become easy targets for fraud. Based on the previous explanation, hypotheses 4 are

H4a: The agreeableness trait is positively associated with scam vulnerability.

H4b: The agreeableness trait is positively associated with risk tolerance.

H4c: Risk tolerance mediates the relationship between agreeableness and scam vulnerability.

Neuroticism is when someone is less able to control their reactions to emotions and unfavourable situations (Rodrigues & Gopalakrishna, 2024). They will show fear and anxiety (Ahmad, 2020), stress about their financial condition, and worry about their monthly expenses and personal finances (Fachrudin & Latifah, 2022). People with a neurotic personality are risk-averse due to a lack of confidence in their decision-making ability for risky investments (Akhtar & Das, 2020; Aren et al., 2021; Fachrudin & Latifah, 2022; Fenton-O'Creevy & Furnham, 2023). They are uncertainty-averse (Fachrudin et al., 2022). Neuroticism will invest less in risky assets (Akhtar & Malik, 2023; Fenton-O'Creevy & Furnham, 2023) as it

considers more threats and losses from investments rather than taking opportunities (Akhtar & Malik, 2023). Their tendency to avoid risky investments makes them more aware of fraud scenarios, making them less likely to fall victim to fraud (Akhtar & Malik, 2023). Based on the previous explanation, hypotheses are

H5a: The neuroticism trait is negatively associated with scam vulnerability.

H5b: The neuroticism trait is negatively associated with risk tolerance.

H5c: Risk tolerance mediates the relationship between neuroticism and scam vulnerability.

3. Methodologies

3.1. Sample selection and questionnaire study

This study's sample consists of 421 active undergraduate and graduate students aged 18–24 years old. Students aged 18 and up should have strong financial understanding because they are starting to live independently, particularly financially (Rapina et al., 2023). University students' financial decisions appear to impact their future, implying that those with insufficient financial literacy would face financial issues in the future (Rapina et al., 2023). The students came from excellent or A-accredited universities in Jakarta, West Java, East Java, Central Java, Yogyakarta, and Bali. The questionnaires were distributed for one month, from the beginning to the end of April 2024. Questionnaires are only provided to registered and authenticated users in a centralised database managed by a reliable survey service institution. The institution has officially joined the ESOMAR organisation. This study ensures that all respondents in the database have an equal chance of inclusion in the sample through random probability sampling.

This study uses several demographic criteria to avoid sample selection bias. First, the respondents are equal male and female students to minimise result bias because of a gender dominance. Second, this study restricted the sample to active undergraduate and postgraduate students between the ages of 18 and 24. Third, since Java and Bali islands are the centre of economic growth, we limited the respondents to students studying in Jakarta, West Java, East Java, Central Java, Yogyakarta, and Bali provinces. The areas belong to Tier 1, a group of densely populated cities with significant economic, cultural, and political influence (Alpha JWC Ventures & Kearney, 2021). Fourth, we restricted only students to excellent or A-accredited universities. If the respondents did not meet the four criteria above, they could not continue filling out the questionnaire because they had not completed the initial screening.

This study included a validation question in the form of a simple mathematical question to ensure that respondents took the survey seriously. If the respondent answered this question incorrectly, we would exclude them from the sample. There are four sections in the questionnaire. The first section is the respondent's demographic information. The second section contains questions about scam vulnerabilities. This section inquired about the respondents' potential reactions to a tricky investment offer. The third section aims to find out the personality traits of the respondents. The fourth section contains questions that can determine the respondent's risk tolerance.

There are several stages to preparing the questions. First, we derived the questionnaire questions from previous references, modified them, and translated them into Bahasa for research purposes. Second, we conducted a pilot project with 41 individuals. The questions that fail the validity and reliability tests in the survey are not to be used in the survey. Furthermore, this study translates the questions back to English for publication purposes.

3.2. Definition of variables and model analysis

3.2.1. Dependent variable

This study modifies measurements from James et al. (2014) and Kubilay et al. (2023) to examine scam vulnerability as a dependent variable. The measurement is modified to fit the purpose of this study, which is to find out whether or how often a person is faced with an investment scam or even becomes a victim of an investment scam. Table 1 presents the dependent, independent, and mediated variables and their indicators. The type of measurement used is a five-points Likert scale.

Table 1. Variables and indicators.

Constructs	Indicators	Code
Dependent variables		
Scam vulnerability	How frequently have you received an offer for a risky investment in the past year?	SCV
	How often have you been a victim of investment fraud?	
	How many people do you know who have fallen victim to investment scams?	
	How often have you received tricky offers related to investments from people you know (friends, relatives, or family) in the past year?	
	How often have you received tricky investment offers from people on behalf of financial institutions over the past year?	
	When an investment looks very attractive and too good to be true, it is probably profitable.	
Independent variables		
Personality traits - Openness to experience	I have an active imagination about new things.	PTOP
	I have many new ideas.	
	I am an innovative person who enjoys creating new things due to my inventiveness.	
	I like to explore and play with new ideas.	
Personality traits - Conscientiousness	I do my work efficiently.	PTC
	I persevere (keep trying) until I complete the task.	
	I am known as a hard-working person.	
	I am a reliable person.	
Personality traits - Extraversion	I am a sociable person who likes to socialise.	PTE
	I am a talkative person.	
	I am a person full of energy.	
	I am a very enthusiastic person.	
Personality traits – Neuroticism	I consider myself to be an individual who enjoys collaborating with others.	PTN
	I am helpful and unselfish.	
	I am a caring and kind person.	
	I like to cooperate with others.	
Personality traits – Agreeableness	I get nervous easily.	PTA
	I am always moody and easily depressed.	
	I am a very worried person.	
	I easily become tense.	
Mediator variable		
Risk tolerance	Having a high-return investment, despite the risk, is more important than a lower-return investment.	RT
	I always consider investing in highly volatile instruments because they offer high returns.	
	If I believe an investment will be profitable, I am willing to borrow money to make it happen.	
	Safe investments are not my choice.	
	I believe that in order to improve my financial position, I must take high financial risks.	
	I am prepared to accept risks, such as losing money, when there is also an opportunity to earn money.	

3.2.2. Independent and mediator variables

There are five independent variables that make up personality traits. Questions for personality traits variables are modified from research belonging to Gosling et al. (2003), Rammstedt and John (2007), and Ngcamu et al. (2023), while risk tolerance is a modification of research belonging to Bucciol and Miniaci (2018). The measurement scale uses a five-point Likert scale with a total of four questions for each personality trait and six questions related to risk tolerance. The questions are based on the following definitions. Personality traits are the distinctive characteristics that shape an individual's personality.

The mediator variable is risk tolerance. Risk tolerance refers to the level of risk that an individual is willing to accept when making a risky investment. Table 1 presents the dependent, independent, and mediator variables and their indicators.

3.2.3. Demographic variables

Demographic variables in this study consist of gender, age, domicile, education, university origin, faculty, family income, and employment status. Gender is categorised into male and female, with equal proportions to prevent biased results. This study uses a binary question to exclude respondents outside the 18–24 age range from the sample. Then this study divides the domicile into Jakarta, West Java, East Java, Central Java, Yogyakarta, and Bali.

4. Empirical results

4.1. Demographic and descriptive statistics

Table 2 presents the demographics of the participants, encompassing their experience with investment scams, gender, study location, educational attainment, and faculty affiliation. A total of 88.6% (373 out of 421) of students have received investment offers with irrationally high interest rates. A total of 50.1% (211 out of 421) of students have been victims of investment fraud. Out of 50.1%, 61.14% were male. Therefore, we can conclude that men exhibit a higher vulnerability to investment fraud. According to Bernaola et al. (2021), men are more likely to take investment risks than women due to their lower risk tolerance. Jakarta and West Java comprise 51% of the locations. A total of 33% of respondents are fourth-year students. The discipline of business and economics dominates the study category, accounting for 28.5% of the total.

Table 3 shows descriptive statistics for SCV-dependent variables, independent variables (PTOP to PTA), and RT mediation variables using a five-point Likert scale.

Table 3 above reveals that, out of the five personality traits, the majority of respondents have the conscientiousness trait with the highest average, 4.07. This shows that students tend to be more careful

Table 2. Demographic respondent.

	N	%
Potential investment scam		
Have you ever received a dubious offer attempting to deceive you into investing?		
Yes	373	88.6%
No	48	11.4%
Have you ever fallen prey to a deceptive investment fraud?		
Yes	211	50.1%
No	210	49.9%
Gender		
Male	217	51.5
Female	204	48.5
Currently studying in:		
Jakarta	100	23.7
West Java	115	27.3
East Java	96	22.8
Central Java	66	15.7
Yogyakarta	39	9.3
Bali	5	1.2
Education		
First-year undergraduate	83	19.7
Second-year undergraduate	80	19
Third-year undergraduate	97	23
Fourth-year undergraduate	139	33
Graduate	22	5.2
Field of study		
Business and Economics	120	28.5
Engineering	58	13.8
Computer Science	44	10.5
Medical School	19	4.5
Humanities and creative industries	37	8.8
Mathematics and natural sciences	35	8.3
Others	108	25.7
Family income (Monthly)		
<10.000.000 IDR	267	63.4
10.000.000– 20.000.000 IDR	80	19
20.000.000–30.000.000 IDR	55	13.1
>30.000.000 IDR	19	4.5

Source: processed data.

Table 3. Descriptive statistics.

	N	Mean	STD	Min	Max
SCV	421	2.97	0.90	1.00	5.00
PTOP	421	3.91	0.78	1.25	5.00
PTC	421	4.07	0.66	1.75	5.00
PTE	421	3.76	0.84	1.00	5.00
PTN	421	3.22	0.97	1.00	5.00
PTA	421	4.00	0.69	1.75	5.00
RT	421	3.23	0.86	1.00	5.00

Source: processed data.

and do not want to take excessive risks. They gather a large amount of knowledge and trust it more than other sources. The second-highest trait is agreeableness, with an average of 4.00. These people are attentive and helpful to others. The trait that ranks third is openness to experience, with an average score of 3.91. Because they are still young and may not have many dependents, students will tend to explore new things around them to increase their experience and relationships. The fourth trait is the extraversion trait. Similar to openness to experience, some students tend to exhibit extroverted traits and enjoy socialising with others, which they can leverage to broaden their relationships. Finally, the fifth trait is neuroticism. These are people who are prone to nervousness, depression, and fear.

4.2. Hypotheses result

This study examined the research data using Partial Least Squares (PLS). The first step involved checking the convergent validity, discriminant validity, and consistency reliability of each indicator. This study examines the loading factor value to determine convergent validity. A loading value greater than 0.5 indicates that the measurements on each construct have a strong relationship because they can explain 50% of an indicator (Hair et al., 2019). Based on Table 4, the loading value has met all the criteria, specifically in the range of 0.603–0.883.

Furthermore, this study uses the average variance extracted (AVE) value to determine the extent to which a construct can explain its indicators. For acceptance, the AVE limit value must be 0.5, so the AVE value of more than 0.5 means that the construct is able to explain more than 50%. In Table 4, the AVE value is entirely acceptable because it meets the criteria of being more than the 0.5 limit, which is between 0.531 and 0.715.

Testing consistency composite reliability (CR), also known as Dillon-Goldstein's rho, determines reliability, with a higher CR value indicating a higher level of reliability. 0.7 is the minimum limit criteria for being considered reliable. Table 4 shows that the CR value is more than 0.7 for each construct, indicating that it has fulfilled the reliability requirements. Cronbach's is another type of measurement that can test reliability. A value greater than 0.6 indicates a high level of reliability and is an acceptable index, so the results in Table 4 have met the reliability requirements based on Cronbach's α.

Table 4. Measures of consistency reliability and convergent validity.

Construct	Items	Loading	Cronbach's α	CR	AVE
Scam vulnerability (SCV)	SCV3	0.779	0.850	0.890	0.577
	SCV4	0.781			
	SCV5	0.744			
	SCV6	0.831			
	SCV7	0.798			
	SCV8	0.603			
Personality traits - Openness to experience (PTOP)	PTOP1	0.819	0.867	0.909	0.715
	PTOP2	0.870			
	PTOP3	0.858			
	PTOP4	0.835			
Personality traits - Conscientiousness (PTC)	PTC1	0.792	0.788	0.863	0.612
	PTC2	0.777			
	PTC3	0.816			
	PTC4	0.742			
Personality traits - Extravert (PTE)	PTE1	0.788	0.855	0.903	0.700
	PTE2	0.821			
	PTE3	0.883			
	PTE4	0.851			
Personality traits - Agreeableness (PTA)	PTA1	0.759	0.779	0.859	0.604
	PTA2	0.788			
	PTA3	0.779			
	PTA4	0.783			
Personality traits - Neuroticism (PTN)	PTN1	0.788	0.848	0.898	0.688
	PTN2	0.796			
	PTN3	0.854			
	PTN4	0.876			
Risk tolerance	RT1	0.817	0.816	0.871	0.531
	RT2	0.678			
	RT3	0.714			
	RT4	0.631			
	RT5	0.753			
	RT6	0.764			

Discriminant validity is a test to determine whether a construct differs from other constructs. Table 5 displays the analysis by comparing a construct's AVE square root value to the correlation value between the construct and other constructs (Fornell & Larcker, 1981). If the square roots of AVEs in each build (bold letters) outperform those in the horizontal and vertical row constructs, then the results fulfil the discriminant validity criteria.

This study examines the p-value to determine the direct effect of each variable. This study expects the p-value to be smaller than 0.05, indicating a significant influence between the independent and dependent variables. This study uses the coefficient value to determine the extent and direction of influence on the described variable. When looking at the relationship between PT and RT, the results show that PTOP, PTE, and PTN have a significant influence on RT, with p-values of 0.01, 0.01, and 0.02. Furthermore, RT itself has the potential to influence SCV, with a p-value of 0.01. Then, for the influence of other PTs such as PTC and PTA with RT, as well as PTOP, PTE, PTA, and PTN with SCV, there is no significant relationship because the p-value is greater than 0.05.

This study uses the indirect effect to evaluate risk tolerance's role as a mediator in the relationship between personality traits (PT) and scam vulnerability (SCV). The analysis results indicate that risk tolerance (RT) can only mediate the relationship between PTOP and SCV ($\beta = 0.07$, p-value < 0.016), PTE and SCV ($\beta = 0.09$, p-value < 0.004), as well as PTN and SCV ($\beta = 0.05$, *p*-value < 0.089). However, this study did not demonstrate the influence of PTN on SCV through RT, as the test results showed a positive correlation between neuroticism and risk tolerance, which in turn led to an increase in scam vulnerability. Therefore, this study concludes that RT cannot mediate the relationship between PTC and SCV, nor PTA and SCV. Figure 1 and Table 6 present the results of the analysis of the relationship between variables, while Table 7 displays the indirect effect.

Table 5. Fornell-Larcker criterion analysis.

	Correlation matrix						
Construct	SCV	PTOP	PTC	PTE	PTA	PTN	RT
SCV	**0.760**						
PTOP	0.124	**0.846**					
PTC	0.130	0.642	**0.782**				
PTE	0.233	0.570	0.561	**0.837**			
PTA	0.168	0.579	0.586	0.697	**0.777**		
PTN	−0.027	−0.038	−0.035	−0.190	−0.060	**0.830**	
RT	0.493	0.269	0.238	0.315	0.259	0.004	**0.729**

Source: processed data.

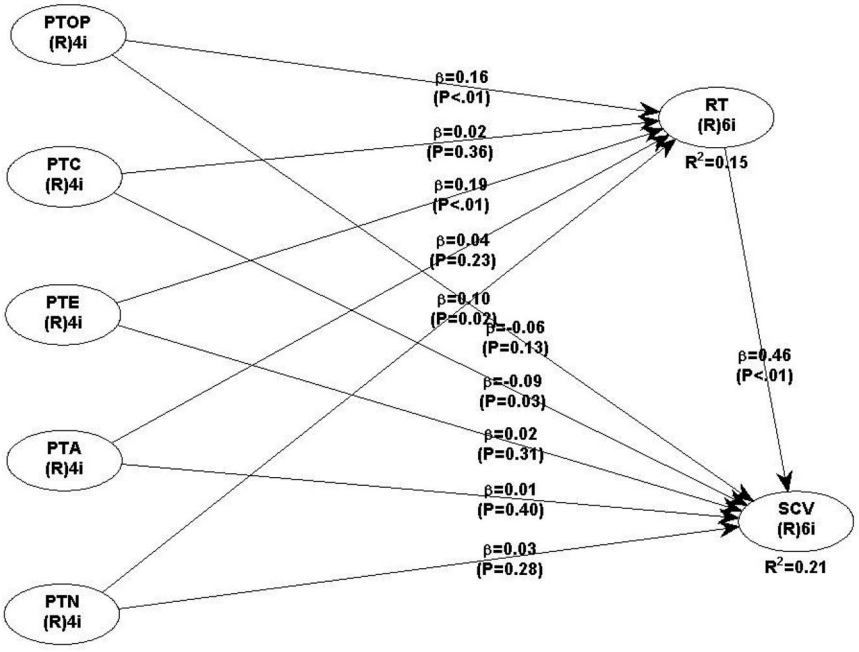

Figure 1. Model.

Table 6. Hypotheses testing – direct effect.

Hypotheses	Paths	Direct effect	VIF	Remarks
H1a	PTOP → SCV	−0.06 ($p < 0.13$)	1.475	H1a rejected
H2a	PTC → SCV	−0.09 ($p < 0.03^{**}$)	1.457	H2a accepted
H3a	PTE → SCV	0.02 ($p < 0.31$)	1.710	H3a rejected
H4a	PTA → SCV	0.01 ($p < 0.40$)	1.605	H4a rejected
H5a	PTN → SCV	0.03 ($p < 0.28$)	1.093	H5a rejected
H1b	PTOP → RT	0.16 ($p < 0.01^{***}$)	1.857	H1b accepted
H2b	PTC → RT	0.02 ($p < 0.36$)	1.946	H2b rejected
H3b	PTE → RT	0.19 ($p < 0.01^{***}$)	1.929	H3b accepted
H4b	PTA → RT	0.04 ($p < 0.23$)	1.846	H4b rejected
H5b	PTN → RT	0.10 ($p < 0.02^{**}$)	1.144	H5b accepted

$^{*}p < 0.10$.
$^{**}p < 0.05$.
$^{***}p < 0.01$.
PTOP = Openness to experience, PTC = Conscientiousness, PTE = Extraversion, PTA = Agreeableness, PTN = Neuroticism, RT = Risk tolerance, SCV = Scam vulnerability.

Table 7. Hypotheses testing - indirect effect and total effect.

Hypotheses	Paths	Indirect effect	Remarks	Coefficient (β) - Total effect
H1c	PTOP → RT → SCV	0.07 ($p < 0.016^{**}$)	Supported	0.01
H2c	PTC → RT → SCV	0.01 ($p < 0.406$)	Not supported	−0.08
H3c	PTE → RT → SCV	0.09 ($p < 0.004^{***}$)	Supported	0.11
H4c	PTA → RT → SCV	0.02 ($p < 0.312$)	Not supported	0.03
H5c	PTN → RT → SCV	0.05 ($p < 0.089^{*}$)	Not supported	0.08

$^{*}p < 0.10$.
$^{**}p < 0.05$.
$^{***}p < 0.01$.
PTOP: openness to experience; PTC: conscientiousness; PTE: extraversion; PTA = agreeableness; PTN: neuroticism; RT: risk tolerance; SCV: scam vulnerability.

4.3. Discussions and implications

The vulnerability to investment scams among university students in Indonesia is very high. Table 3's demographic data reveals that 88.6% of respondents have encountered deceptive investment offers that promise unrealistically high returns. 50.1% of respondents have fallen victim to investment scams. Research by Grable et al. (2020) also classifies young people as 'loss risk' and 'risk seeker' decision-makers with a medium to high level of risk tolerance. According to Pinho and Gomes (2024), individuals of this type tend to take less preventive action and are more tolerant of potential investment risks. This lack of preventive action makes them vulnerable to investment fraud. This research also supports Whitty (2020), who proves that individuals who are impulsive and risk-takers will be more susceptible to fraud. According to the prospect theory, individuals who are optimistic about a profitable investment may prioritise pursuing profits over potential losses. Another finding from the respondent survey indicates a mean scam vulnerability value of 2.97, which falls into the low category at the time of the survey. This is likely due to students' tendency to become more cautious after experiencing investment fraud.

The test results demonstrate that personality traits, both directly and indirectly, influence a person's vulnerability to fraud through risk tolerance. De Bortoli et al. (2019) show that people with a higher risk tolerance according to investor profile analysis, who violate the Prospect Theory, and who are open to new experiences are more likely to take on more risk in their investment decisions. Studieshave shown that risk tolerance partially mediates the relationship between personality traits and investment decisions (Sadiq & Amna, 2019). Examining the direct impact of personality traits on scam vulnerability reveals that solely conscientiousness influences students' susceptibility to scams. Highly conscientious people make careful decisions. Because of its prudence, the conscientiousness trait causes a decrease in students' scam vulnerability. The higher a person's level of conscientiousness, the more careful they are in making decisions and not acting impulsively, so their vulnerability to investment fraud is also lower. This result is consistent with previous research that proves a negative relationship between the two (Rodrigues & Gopalakrishna, 2024).

The results of testing the direct effect of personality traits on risk tolerance show that extraversion, neuroticism, and openness to experience all increase individual risk tolerance; however, openness to experience,

extraversion, and neuroticism are the traits that ultimately increase scam vulnerability. Individuals with the openness to experience trait will tend to have a higher risk tolerance, making them more vulnerable to investment fraud. This is in line with previous studies (Pinho & Gomes, 2024; Rodrigues & Gopalakrishna, 2024; Whitty, 2020). Individuals with the openness to experience trait will always try new things. They will continue to seek new experiences and tend to be impulsive (Pinho & Gomes, 2024). Extraverted individuals typically exhibit a low tolerance for risky investments due to their friendly and sociable nature. This result is consistent with the studies of Rodrigues & Gopalakrishna (2024) and Brooks and Williams (2021). Due to their energetic nature, extraverted individuals tend to exhibit high enthusiasm for investments that are popular in their social circles (Jiang et al., 2024), and they tend to make less rational decisions about these investments (El Othman et al., 2020). They are confident and positive about their own decisions, even though they have consulted with experts in financial matters (Sadiq & Amna, 2019). The findings conducted by Aren and Nayman Hamamci (2020) state that neuroticism is not a trait that is consistently a factor in choosing an investment. This implies that the degree of neuroticism does not dictate the level of tolerance individuals are willing to accept when making investment decisions, particularly those involving risk. This is due to the trait of neuroticism, which causes individuals to become easily nervous, worried, and emotionally unstable (Brooks & Williams, 2021; Jiang et al., 2024). Consequently, they struggle to make decisions, and their investment choices can fluctuate based on their mood. These findings shed light on the importance of understanding the various social factors that can influence a person's financial behaviour in relation to their propensity to engage in fraudulent schemes.

Agreeableness traits do not directly or indirectly affect scam vulnerability. People with agreeable traits enjoy working and collaborating with others. Their involvement with others prompts them to seek advice first when investing (Brooks & Williams, 2021). Due to their fear of rejection in their social environment, they tend to agree with the given advice without further evaluating the potential risks. Therefore, they base their investment decisions on compliance, not the influence of their personal traits (Tauni et al., 2020). This finding supports the herding theory, in which a person will carry out activities or make decisions based on the information from others around him. This study also found that this trait does not directly have a significant effect on fraud susceptibility. Thus, agreeableness is more suitable for social decision-making than financial or investment (Rodrigues & Gopalakrishna, 2024).

This research holds several implications for investors and potential investors, particularly for students seeking a deeper understanding of investment. First, this research focuses on the response of each personality trait to risky investments so that it can provide an understanding of the mindset and investment decision-making of students with their respective personality traits. Secondly, this research can assist universities in identifying the appropriate educational and training programmes for students, tailored to their individual personality traits, to enhance their skills. That way, students can have the capability to make wise and profitable investment decisions. Thirdly, this research can assist novice investors in enhancing and managing their investment portfolios by understanding the factors that shape their decisions based on their personality traits. This knowledge can enhance their ability to assess investment risks and profit opportunities, enabling them to select options that align better with their financial goals and profile. For novice investors, it is important to realise that each individual has different investment needs depending on their own goals and strategies. Therefore, we hope that this research can serve as a basis for considering wiser and more profitable investment choices.

Conclusion and limitations

This study investigates whether the Big Five personality traits influence a person's susceptibility to investment fraud through risk tolerance. The Big Five personality traits consist of openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism. The study's findings explain that openness to experience, extraversion, and neuroticism indirectly influence an individual's susceptibility to fraud through risk tolerance. This influence is positive, in the sense that the stronger the personality type, the more tolerant the person is of investment risk and the higher the susceptibility to fraud. The other finding is that the conscientiousness trait directly affects a decrease in scam vulnerability. Researchers have not proven that agreeableness traits, either directly or indirectly through risk tolerance, affect a person's level of scam vulnerability.

This study has several limitations. Firstly, this study sampled students from superior or A-accredited universities on the islands of Java and Bali. Therefore, due to potential demographic differences such as economic level and family income, risk profile, and social environment, it is not possible to generalise the results of this study to students from other levels of universities. Secondly, the study's shortcomings include the possibility of response omission and sample selection bias, as students participated voluntarily.

For future research, we recommend expanding the research sample to include cities throughout Indonesia, as investment fraud is on the rise and has targeted many students outside the islands of Java and Bali, where internet usage is becoming increasingly widespread throughout the country. Future research could also explore the differences in scam vulnerability between students residing in the business and government hub of Java and those in other cities. In addition, research using a qualitative approach can be considered to deepen understanding and analysis of future topics.

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