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Do Financial Knowledge and e-Payment Awareness Affect Saving and Spending Behavior? The Mediating Role of Financial Risk Tolerance

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Abstract: This study investigates the role of financial risk tolerance in mediating the impact of financial knowledge and e-payment awareness on saving and spending behavior. A total of 400 questionnaires were distributed, with 396 completed by respondents and used for analysis. This research employs partial least squares-based structural equation modeling (PLS-SEM) to validate and estimate the proposed research models, with SmartPLS software analyzing the data and estimating the relationships between its latent variables. Our study's estimation provides evidence of the positive and significant role of financial risk tolerance in mediating the impact of financial knowledge and e-payment awareness on spending and saving behavior. This study also reveals differences in the level of financial risk tolerance between male and female participants. Furthermore, the analysis results indicate that most younger people have a risk tolerance level (i.e., risk profile) that falls into the medium (i.e., risk-averse) category in terms of risk speculation, investment risk, and financial risk evaluation.

Keywords: financial knowledge, financial risk tolerance, e-payment, spending behavior, savings behavior
JEL Classification: G20, G41, G51, G53

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Introduction

Financial behavior is a critical issue in the welfare of individuals, and its effects are also felt by households, communities, countries, and globally. Recent developments in financial literacy suggest that financial behavior is explored as an interesting research topic and that it plays a crucial role in achieving financial well-being. Zulaihati & Widyastuti (2020) define financial behavior as behavior related to money management—that is, spending and saving behavior—that plays a crucial role in individuals' financial well-being. Moreover, Setiawan et al. (2022) state that the development of digital technology and e-commerce may change consumers' saving and spending behavior and the value of their transactions. Digital payment awareness is also important in today's increasingly cashless society. Individuals who are familiar with digital payment methods are more likely to track their expenses, make convenient and secure transactions, and take advantage of features such as automatic savings or budgeting applications (apps).

A previous study found that customer awareness of digital or e-payment also affects their financial behavior. Suraj (2017) states that electronic (e-)payment system awareness is affected by factors, such as convenience, cost, demography, processing charges, security, and risk. K. Garg et al. (2018) also find that customers' awareness of e-payment satisfies their needs for accessibility, convenience, and an alternative choice of payment system, while security and network issues are sources of dissatisfaction and act as barriers. Dewi et al. (2023) find that the three aspects of electronic payment adoption behavior rated the highest were alertness to security issues, ease of use, and ability to be readily adopted.

Another factor essential for enhancing responsible financial management behavior is financial knowledge. Gunawan et al. (2021) reveal that financial knowledge affects financial management behavior, such as saving behavior, shopping behavior, long-term planning, and short-term planning. Individuals with more financial knowledge are also more likely to engage in recommended financial behaviors (Hilgert et al., 2003). Knowing about and understanding financial products and services are important and can lead to the making of rational financial decisions. Individuals with a higher level of financial knowledge are more likely to make informed decisions about their spending and saving behavior.

Iram et al. (2023) state that financial literacy is a global issue, with poor financial behavior possibly having fatal impacts at both the individual and global economic levels. This issue needs to be understood and addressed, especially in developing countries with their comparatively low levels of financial literacy, poor digital platform security infrastructure, and significant presence of digital financial fraud (Sapulette & Dyana, 2020). Changes in consumer behavior and other related issues have created a chain reaction encouraging policymakers, especially those in the financial sector, to focus more on increasing financial literacy. Moreover, the financial literacy model proposed by the Organisation for Economic Co-operation and Development (OECD) mentions the following three comprehensive aspects of financial literacy: financial knowledge, financial attitudes, and financial behavior (N. Garg & Singh, 2018).

According to the studies cited above, financial knowledge and digital payment awareness are two factors that can greatly influence these behaviors. Moreover, risk tolerance is another factor that can mediate the relationship of financial knowledge and digital payment awareness with spending and saving behavior. Risk tolerance is frequently discussed in a financial decision context (Ali et al., 2023). Individuals with a higher risk tol-

erance may be more willing to make financial decisions that have the potential for greater returns but also come with higher risks. On the other hand, individuals with a lower risk tolerance may prefer safer and more conservative financial strategies, even if that means potentially lower returns.

Noman et al. (2023), in investigating the relationship between the financial risk-taking behavior of individual investors and their subjective and objective knowledge, reveal that individual investors' risk tolerance behavior is associated more with their subjective knowledge than their objective knowledge. Aslam et al. (2020) provide evidence that financial risk tolerance, as a mediating variable, strengthens the relationship between financial knowledge and investment decisions. Similarly, Bapat (2020) demonstrates that financial risk tolerance affects the relationship between financial knowledge and financial management behavior.

However, only a few studies investigate this topic from the perspective of an emerging economy or developing country (Aslam et al.,2020; Bapat, 2020; Dewi et al., 2023). Previous studies analyze financial knowledge as an antecedent of financial management behavior, but few studies analyze the key role of financial risk tolerance as an antecedent of financial management behavior (Goyal et al., 2021). Additionally, in discussing financial knowledge as an element of financial literacy, e-payment awareness, which has increased significantly in developing countries, must also be a central theme. Previous work is limited to the role of financial knowledge in saving and spending behavior or financial behavior. Despite this interest, to the best of our knowledge, no one has studied the issue of financial risk mediating the impact of financial knowledge and e-payment awareness on saving and spending behavior.

Therefore, the present study addresses the following questions. Firstly, does electronic payment awareness affect financial risk tolerance? Secondly, does financial knowledge affect financial risk tolerance? Thirdly, does financial risk tolerance affect saving behavior? Finally, does financial risk tolerance affect spending behavior? Our objective is to investigate the role of financial risk tolerance in mediating the impact of financial knowledge and e-payment awareness on saving and spending behavior. Subsequently, our study analyzes a comprehensive model based on existing ideas and generates a considerable opportunity to extend the theoretical implications. Accordingly, this research is essential in helping financial service providers and regulators to improve their policies to increase the utilization of digital financial services and products.

The main finding of this study is how financial risk tolerance mediates the relationships of financial knowledge and adoption of e-payments with spending and saving behavior. In practical terms, this finding contributes to financial institutions' ability to identify the type of customer risk profile before offering the financial product. An individual with an aggressive character will have a high-risk tolerance, tending to choose investment instruments with a high level of risk. In contrast, an individual with a conservative character and a low-risk tolerance will tend to choose low-risk investment instruments. Individuals can develop good saving and spending habits and behaviors with good knowledge and understanding of financial matters and products. This finding also contributes to the literature, with this study's results serving as a reference for developing a financial literacy research model.

The following section presents the literature review, along with the theory and conceptual framework. The development of hypotheses is then discussed, followed by the

study's data collection, methodology, results, discussion, limitations, conclusions, and implications.

Literature Review

Financial management behavior (FMB) is one of the dimensions of financial literacy. Most previous studies define financial literacy as multi-dimensional, with Atkinson & Messy (2012) stating that financial literacy can be explained in three dimensions: financial knowledge, financial behavior, and financial attitude. Furthermore, Morgan & Long (2020) and Morgan & Trinh (2020) define financial literacy not only as financial knowledge but also as actual behavior, skills, and attitudes. Financial management behavior in the present study is assessed through saving and spending behavior, following the study conducted by Moenjak et al. (2020). Previous studies find that individuals with higher financial literacy scores are more likely to have a good saving habit (Morgan & Long, 2020). Nguyen & Doan (2020) and Peiris (2021) provide evidence that financial literacy is a factor that influences individual saving behavior. Azmi & Ramakrishnan (2018) demonstrate that financial knowledge has a positive relationship with spending habits. As these previous studies show, individuals with less financial management knowledge tend to have poor financial behavior; thus, financial knowledge has important implications for well-being.

Financial Knowledge (*FIN*), Saving Behavior (*SVB*) and Spending Behavior (*SPB*)

Financial knowledge is a form of investment in human capital which has implications for individuals' well-being (Lusardi & Mitchell, 2014). The terms "financial knowledge" and "financial literacy" are frequently used interchangeably (Lind et al., 2020). Personal financial knowledge comprises two dimensions: (1) objective financial knowledge which refers to the individual's personal knowledge of specific financial matters, such as interest rates, effects of inflation on savings, time value of money, and benefits of diversification; and (2) subjective knowledge which comprises the individual's awareness of financial matters, pleasure in financial activities with financial matters, and confidence to make financial decisions (Robb & Woodyard, 2011; Woodyard, 2013; Woodyard et al., 2017). Lind et al. (2020); Heriyati et al. (2024) use subjective financial knowledge and objective financial knowledge to predict financial behavior. Their study employs objective financial knowledge to estimate relationships between financial literacy variables. The results of these previous studies show that financial knowledge has a significant impact on financial management behavior including saving and spending behavior. Robb & Woodyard (2011) and Woodyard et al. (2017) estimate the relationships of objective financial knowledge and subjective financial knowledge with financial behavior. They find that improving subjective and objective knowledge reinforces financial behavior. Furthermore, Nuris et al.(2023) and Khoirunnisaa & Johan (2020) state that financial behavior has various form including of saving and spending behavior. Moreover, Mahdzan & Tabiani (2013) and Peiris (2021) find that financial literacy had a positive impact on individual saving, and Azmi & Ramakrishnan (2018) find that financial knowledge has a positive relationship with spending behavior. Furthermore, Chavali (2020) reveal that the financial literacy of youth is significantly correlated with the saving and spending habits of youth. Therefore,

considering the findings of these previous studies on financial knowledge, saving behavior, and spending behavior, our study formulates the following hypothesis:

H1: Financial knowledge affects saving behavior.
H2: Financial knowledge affects spending behavior

e-Payment Awareness (*EPA*), Saving Behavior (*SVB*) and Spending Behavior (*SPB*)

The term "e-payment awareness (EPA)" refers to awareness of products and services available using online payment methods. The adoption of electronic payments (e-payments) has been growing at a significant rate with developments in financial technology. Financial technology (fintech) is not only expected to encourage financial inclusion and financial literacy, but also to promote better financial management behavior. In Indonesia, the current level of financial inclusion and financial literacy on digital financial products and services indicates that areas can be potentially improved. Previous studies, conducted by Morgan & Trinh (2020) and Moenjak et al. (2020), use the adoption and awareness of fintech to investigate the impact on consumers' financial behavior. Morgan & Trinh (2020) use e-banking services, e-payment services, and e-transfer services as elements of the adoption of fintech services and employ digital borrowing, digital lending, digital money (i.e., e-wallet), digital insurance, and digital financial advisors as elements of fintech awareness. In keeping with Nuris et al.(2023) and Khoirunnisaa & Johan (2020), this study examines saving and spending behavior as a form of financial behavior. Therefore, considering the findings of previous studies on e-payment awareness, saving behavior, and spending behavior, the present study proposes the following hypothesis:

H3: e-Payment awareness affects saving behavior.
H4: e-Payment awareness affects spending behavior.

Relationships of Financial Risk Tolerance (*FRT*) with Financial Knowledge (*FIN*), e-payment Awareness (*EPA*), and Saving and Spending Behavior (*FMB*)

Financial risk tolerance (*FRT*) is related to the level of variability of return on investment (ROI) that investors are willing to accept as a risk. Risk tolerance is defined by general definitions that focus on either the amount of volatility one can tolerate or the number of losses one is willing to bear (Holzhauer et al., 2016). Risk tolerance is the converse of risk aversion, an economic term that describes an individual's reluctance to accept a choice with an uncertain payoff when a more certain option is available (Grable, 2016). Grable (2018) further defines risk tolerance as "the willingness to engage in a risky behavior in which possible outcomes can be negative."

The three types of people, based on their risk tolerance, are the averse type, the neutral type, and the risk seeker (Abidin et al., 2023). Pompian (2018) divides types of investors by their risk tolerance level into four types. The first type is conservative investors who have a low level of risk tolerance. Conservative investors are careful not to take excessive risks. They are focused on taking care of family members and future generations, especially by funding life-enhancing experiences, such as education and homeownership. The second type is moderate investors who have a moderate level of risk tolerance. They

generally follow professional advice when they receive it, but they can experience difficulties at times as they neither enjoy nor have an aptitude for the investment process. The third type is growth investors who have a medium to high level of risk tolerance. They are the most likely to be contrarian which can sometimes work to their advantage. Some are obsessed with outperforming the market and may have concentrated portfolios. The fourth type is aggressive investors who have a high level of risk tolerance. They make quick decisions and may pursue higher-risk investments in which their friends or associates are investing. Some do not believe in basic investment principles such as diversification and asset allocation; they are frequently "hands-on" and want to be involved in investment decision making. Rahman (2020) states that risk tolerance is the key to the modern financial planning process and investment management decision-making model.

Financial behavior, which encompasses activities such as spending, saving, and borrowing, is influenced by interplay of financial knowledge and risk tolerance. By understanding these interconnections, individuals, financial educators, and policymakers can work to promote financial literacy, encourage appropriate risk-taking, and foster responsible financial behaviors, ultimately leading to improved financial well-being and security. In studies conducted by researchers to estimate the relationships of financial risk tolerance with financial knowledge and financial behavior, they employ financial behavior defined in terms of saving behavior and spending behavior. Samanez-Larkin et al. (2020) estimate that financial risk tolerance is associated with financial knowledge. In their study, Tavor & Garyn-Tal (2016) confirm that risk tolerance has a relationship with saving behavior for retirement programs, other savings programs, and real products with a high-risk tolerance preference for retirement savings and less tolerance for other financial risks and real products. People with more financial knowledge tend to be more risk-tolerant or to be risk seekers (Nguyen et al.,2022). Furthermore, the authors find that subjective financial knowledge is positively associated with risk tolerance but has no significant direct impact on saving behavior. Subjective financial knowledge is found to indirectly influence saving behavior through risk tolerance, risk perception, and saving intention (Bapat, 2020). Wang (2009) states that objective knowledge, subjective knowledge, and risk taking are highly correlated, while Noman et al. (2023) find that individual investors' risk tolerance behavior is associated more with their subjective knowledge than with their objective knowledge. Moreover, Dewi et al. (2023) reveal that financial knowledge and e-payment behavior affect financial risk tolerance. Nguyen et al. (2022); Song et al. (2023) argue that financial risk tolerance mediates the association between financial literacy and financial behavior. Finally, financial risk tolerance plays a significant role in shaping individual financial behavior (Grable, 2016; Grable, 2018). Therefore, considering findings in the previous studies, the present study formulates the following hypothesis:

H5: Risk tolerance mediates the relationship between financial knowledge, e-payment awareness, and financial saving and spending behavior.

Figure 1 presents the conceptual framework that explains the relationships between financial knowledge (FIN), e-payment awareness (EPA), financial risk tolerance (FRT), and financial management behavior (FMB). Figure 1 is constructed based on theoretical concepts and previous studies. Regarding the associations between variables, it can be hypothesized that *FIN* and *EPA* affect *FRT* which, in turn, affects spending and saving behavior, thus reflecting financial behavior.

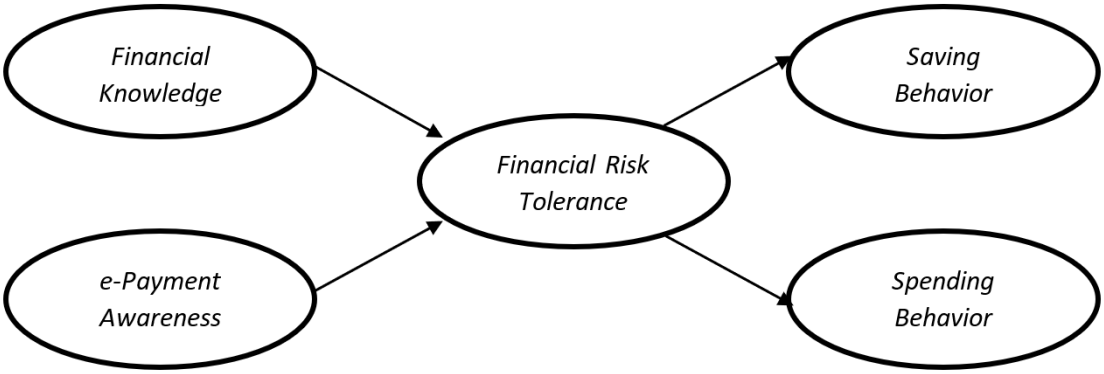

Figure 1. Conceptual Framework

Methods

The present study used partial least squares-based structural equation modeling (PLS-SEM) (Hair et al., 2021) to estimate the model of the relationships between financial knowledge, e-payment awareness, financial risk tolerance, saving behavior, and spending behavior. All variables were constructed as latent variables. Therefore, each variable was constructed using relevant indicators as shown in Table 1. To measure financial knowledge, this study used two approaches from Singh & Berwal (2021), namely, objective financial knowledge (OFK) and subjective financial knowledge (SFK). Objective financial knowledge (OFK) was measured by five indicators, comprising compounding interest (Atkinson & Messy, 2012; Singh & Berwal, 2021); inflation (Atkinson & Messy, 2012; Singh & Berwal, 2021); saving; investment risk; and mutual funds. True or false questions were used to measure objective financial knowledge (OFK). The correct answer was calculated by the mean percentage of correct scores and then grouped into a range from 1–4 (comparatively very high to comparatively very low) where 1 = very low and 4 = very high, while subjective financial knowledge (SFK) was measured through self-assessment of financial knowledge. The study proposed to measure e-payment awareness by eight indicators derived from Dewi et al. (2023) and using the forced 4-point Likert scale, where 1 = strongly disagree, 2 = disagree, 3 = agree, and 4 = strongly agree. Financial risk tolerance was measured by employing the risk-tolerance measure items derived from Dewi et al. (2023). Total risk-tolerance scores were obtained by summing (adding up) the individual scores from the four questions (Table 5). These were then scaled using a range of 1–4, with 1 being most risk-averse and 4 being most willing to take a risk (Gilliam et al., 2010)., The investor type was next divided into four: 1 = conservative investor (risk avoider) (risk tolerance level is low); 2 = moderate investor (i.e., risk-averse) (risk tolerance level is medium); 3 = growth investor (risk-tolerant) (risk tolerance level is high); and 4 = aggressive investor (risk seeker) (risk tolerance level is very high) (Pompian, 2018; Grable et al., 2020).

Saving behavior (SVB) had four indicators and spending behavior (SPB) had three indicators measured using the 4-point Likert scale, where 1 = strongly disagree and 4 = strongly agree. The indicators was derived from Dew & Xiao (2011); Zulaihati et al. (2020); and Gunawan et al. (2021). This research gathered 396 responses from a sample of young adults in Indonesia. The age of the respondents was from 18–24 (Jekielek & Brown,

2005). Respondents were found through the convenience sampling technique with data collected using an online survey. The study distributed 400 questionnaires, but only 396 respondents completed the questionnaires with valid responses. The number of responses fulfilled the minimum sample size, as suggested by Hair et al.(2021). With 30 indicators, the minimum sample size is 300; consequently, sample of 396 meets the minimum sample size requirement.

Results

In terms of gender, 36.36% of respondents were male and 63.64% were female. About 55.30% of respondents were aged 20–21. Most respondents earnt income in the following ranges: from Indonesian rupiah (IDR) 1.5–IDR 2.5 million (31.83%) and less than IDR 1.5 million (31.57%). In our study's sample, the top three financial products owned by respondents were e-money (91.67%); deposit and saving accounts (76.52%); and digital banking (61.87%) (Table 1). The adoption of e-financial products was ranked the highest, followed by digital banking. The frequency of using the e-payment method in the past month showed that most respondents used server-based e-money and rarely used SMS banking (see Table 2). The study results showed the top three choices for the first financial goal in the next five years. Most respondents had goals of saving to establish an emergency fund, buying their first house, and saving to start a business (see Table 3). The study also found that Millennials used electronic money and e-commerce platforms mostly due to their practicality and the promotion of these services. The current study revealed the promotional and practical factors that influence the adoption of electronic money and e-commerce platforms (Table 4). An interesting point was that respondents reported a high level of disagreement with the attribute that the e-payment system saves their money.

Table 1. Demographic and Socio-Economic Data

Criteria	N	%
Gender		
Male	144	36.36
Female	252	63.64
Age		
18–19	73	18.43
20–21	219	55.30
22–24	104	26.27
Income		
< Indonesian rupiah (IDR) 1,500,000	125	31.57
IDR 1,500,001–IDR 2,500,000	130	31.83
IDR 2,500,001–IDR 3,500,000	91	22.98
> IDR 3,500,000	50	12.63
Financial products holding		
e-Money/Wallet	363	91.67

Deposit and Saving Account	303	76.52
Digital Banking	245	61.87
Traditional Insurance	164	41.41
Mutual Funds	150	37.88
Insuretech	46	11.62
Gold	45	11.36
Cryptocurrency	44	11.11
P2P (Person to Person) Lending	38	9.60
Bitcoin	26	6.57

Source: Computed using Microsoft (MS) Excel

Table 2. Frequency of Using e-Payment Methods in the Past Month

	e-Money Server-Based	Cash	Mobile Banking	Debit Card	e-Money Chip-Based	Internet Banking	Credit Card	SMS Banking
Never	6%	7%	16%	20%	46%	78%	92%	93%
1–4 times	26%	37%	20%	55%	36%	12%	6%	5%
5–9 times	44%	40%	34%	17%	12%	6%	1%	1%
10–14 times	14%	5%	17%	4%	2%	2%	0%	0%
15–19 times	4%	2%	7%	2%	1%	1%	0%	0%
20–24 times	3%	1%	2%	1%	2%	1%	1%	1%
25–30 times	2%	1%	2%	1%	1%	1%	0%	0%
more than 30 times	2%	6%	2%	1%	1%	0%	0%	0%
	100%	100%	100%	100%	100%	100%	100%	100%

Source: Computed using Microsoft (MS) Excel

Table 3. Top-Ranked Financial Goals in the Next Five Years

Statement	**N**	**%**
Saving for an Emergency Fund	125	32%
Buying First Home	120	30%
Saving to Start a Business	98	25%
Vacation	19	5%
Buying First Car	19	5%
I don't have a financial goal yet	15	4%
	396	100%

Source: Computed using Microsoft (MS) Excel

Table 4. e-Payment Awareness

		1	**2**	**3**	**4**
Code	**e-Payment Adoption Behavior Statements***	**SD**	**D**	**A**	**SA**
EPA1	e-Payment systems save my time	3%	6%	40%	52%
EPA2	e-Payment systems save my money	27%	21%	8%	43%
EPA3	e-Payment systems are better than cash	3%	21%	23%	54%

EPA4	Being alert to e-payment security issues	3%	7%	32%	57%
EPA5	e-Payment offers a greater choice for consumers	3%	13%	20%	64%
EPA6	e-Payment systems can be readily adopted	3%	11%	17%	69%
EPA7	e-Payment systems can be easily used	2%	8%	25%	65%
EPA8	Aware of the potential risks of e-payment	3%	10%	25%	62%

Notes: *SD = strongly disagree; D = disagree; A = agree; SA = strongly agree. * adopted from Dewi et al. (2023).*
Source: Computed using Microsoft (MS) Excel.

As shown in Table 5, financial risk tolerance (*FRT*) covers the areas of speculative risk, investment risk, and evaluated financial risk. In all, 39.9% of respondents scored a low *FRT* level, while 25.76% had a high *FRT* level on speculative risk. This shows that most respondents were conservative (i.e., risk-avoiding investors), as opposed to aggressive investors (i.e., risk takers). In terms of investment risk and evaluated financial risk, most respondents (75% and 69.96%, respectively) had a medium *FRT* level (i.e., moderate investors). Tables 6 and 7 provide a descriptive analysis of *FRT* variables and their dimensions in relation to the four basic types of investors, gender, and level of income.

Table 5. Dimensions and Indicators of Financial Risk Tolerance (FRT)

Dimensions and Indicators	**Risk Tolerance Level and Four Basic Investor Types**			
	Conservative investors (1) Low = risk avoider	Moderate investors (2) Medium = risk-averse	Growth investors (3) High = risk-tolerant	Aggressive investors (4) Very high = risk seeker
FRT1-Speculative Risk (%)	39.90	28.28	6.06	25.76
1. Suppose that before tossing a coin (side A: Fish head, side B: Fish tail), you are asked to choose one of the following options for the prize you will receive: **A. Guess which side (A or B) will appear and, if correct, you will receive IDR 100,000** **B. Guess if side A will appear and, if correct, you will receive IDR 200,000. If side B appears, you will not receive anything.** **2. Suppose you won a quiz with a cash prize of IDR 500,000. You are given the opportunity to choose either:** **A. IDR 500,000 which you have won, but without being able to have the second quiz round opportunity.** **B. Take the second quiz round with an 80% chance of winning IDR 1 million: if you lose, you will receive nothing at all**				
FRT2-Investment Risk (%)	12.12	75.00	8.59	4.29
If you unexpectedly received IDR 100 million to invest, what would you invest in the funds? **A. 100% savings and deposits** **B. 50% savings and term deposits, 50% mutual funds** **C. 50% mutual funds and 50% stocks** **D. 100% stocks**				
FRT3-Evaluated Financial Risk (%)	6.06	69.96	20.96	3.03
How many losses can you accept in investing? **A. 0%** **B. Up to 50%** **C. Up to 75%** **D. 100%**				

Source: Computed using Microsoft (MS) Excel

Table 6. Financial Risk Tolerance (FRT) by Gender

Gender	Risk Tolerance Level and Four Basic Investor Types			
	Conservative investors (1) Low = risk avoider	Moderate investors (2) Medium = risk-averse	Growth investors (3) High = risk-tolerant	Aggressive investors (4) Very high = risk seeker
	FRT1-Speculative Risk Level (%)			
Male	9.60	9.34	1.77	15.66
Female	30.30	18.94	4.29	10.10
	FRT2-Investment Risk (%)			
Male	2.27	25.25	5.30	3.54
Female	9.85	49.75	3.28	0.76
	FRT3-Evaluated Financial Risk (%)			
Male	1.01	24.49	9.09	1.77
Female	5.05	45.45	11.87	1.26

Source: Computed using Microsoft (MS) Excel

Table 7. Financial Risk Tolerance (FRT) by Income

Income	Risk Tolerance Level and Four Basic Investor Types			
	Conservative investors (1) Low = risk avoider	Moderate investors (2) Medium = risk-averse	Growth investors (3) High = risk-tolerant	Aggressive investors (4) Very high = risk seeker
	FRT1-Speculative Risk Level (%)			
< IDR 1,500,000	10.35	11.87	2.78	6.57
IDR 1,500,001–IDR 2,500,000	15.66	8.59	1.77	6.82
IDR 2,500,001–IDR 3,500,000	10.61	5.30	0.76	6.31
> IDR 3,500,000	3.28	2.53	0.76	6.06
	FRT2-Investment Risk Level (%)			
< IDR 1,500,000	7.83	19.44	3.28	1.01
IDR 1,500,001–IDR 2,500,000	1.77	27.53	2.27	1.26
IDR 2,500,001–IDR 3,500,000	1.52	19.19	1.52	0.76
> IDR 3,500,000	1.01	8.84	1.52	1.26
	FRT3-Evaluated Financial Risk Level (%)			
< IDR 1,500,000	3.28	18.18	9.09	1.01
IDR 1,500,001–IDR 2,500,000	1.26	25.25	6.06	0.25
IDR 2,500,001–IDR 3,500,000	0.76	19.19	2.27	0.76
> IDR 3,500,000	0.76	7.32	3.54	1.01

Source: Computed using Microsoft (MS) Excel

Tables 8–10 show the results from measuring the level of financial knowledge on the objective and subjective aspects of financial knowledge. Subjective financial knowledge (*SFK*) was measured using indicators of perceived level of financial knowledge. As shown in the results, 67.93% of respondents considered that they were in the low catego-

ry of investment knowledge. Only 2.02% considered themselves to know about investment at the very high level (Table 8). Table 9 shows the percentages of correct answers to each question on objective financial knowledge (*OFK*), comprising compounding interest (76.26%), inflation (82.32%), saving (79.04%), investment risk (85.61%), and mutual funds (63.13%). Meanwhile, Table 10 shows that 40.66% of respondents were rated as having a very high level of objective financial knowledge (*OFK*), with these results indicating that young people had a good understanding of financial knowledge. Financial knowledge is one of the important factors shaping good financial management behavior, especially in saving and spending behavior. The results shown in Table 10 reveal that a high level of financial knowledge at a young age plays an important role and is a positive move towards sound financial management. This outcome shows the importance of financial knowledge dissemination to people in general, besides younger people, given that knowledge about financial aspects, irrespective of age category, is imperative for overall financial management.

Table 8. Subjective Financial Knowledge (*SFK*)

***SFK*: How would you assess your knowledge of investment (on a 4-point scale; 1 meaning very low and 4 meaning very high)?**					
Scale	1	2	3	4	Total
N	21	269	98	8	396
%	5.30	67.93	24.75	2.02	100

***Note**: Number and percentage of respondents (N = 396).*
Source: Computed using Microsoft (MS) Excel

Table 9. Objective Financial Knowledge (*OFK*)

Answer	**Compounding Interest**	**Inflation**	**Saving**	**Investment Risk**	**Mutual Funds**
Correct	76.26	82.32	79.04	85.61	63.13
Incorrect	23.74	17.68	20.96	14.39	36.87

***Note:** Number and percentage of respondents (N = 396).*
Source: Computed using Microsoft (MS) Excel

Table 10. Level of Objective Financial Knowledge (*OFK*)

OFK Index	**N**	**%**	**Male**	**Female**
1-Very Low	68	17.17	5.05	12.12
2- Low	65	16.41	6.06	10.35
3-High	102	25.76	10.35	15.40
4-Very High	161	40.66	14.89	25.76
N	396			

Source: Computed using Microsoft (MS) Excel

Tables 11, 12, 13,and 14 show the measurement model (outer model) used to evaluate validity and reliability. Tables 15 and 16 show the results of the structural model evaluation (inner model) which explains the relationship between the following variables: *FIN*, *EPA*, *FRT, SVB,* and *SPB*. The evaluation of the outer model shows the results for the

evaluation of indicator reliability (factor loading value), composite reliability (CR), and convergent validity (AVE). The evaluation of the outer model comprised the evaluation of indicator reliability (loading factor value), composite reliability (CR), collinearity statistics (VIF), Cronbach's alpha, and average variance extracted (AVE) (see Table 11 and 12). Table 12 provides the outer model estimations, showing that the model is reliable and valid, as no composite reliability (CR) values are less than 0.7 and no convergent validity (AVE) values are less than 0.5 (Hair et al., 2021; Ringle et al., 2018). As shown in Table 11, all indicators have a factor loading of more than 0.6. The present study used a latent variable indicator with a factor loading of 0.6, based on Setiawan et al. (2022). The inner model estimations show that no indicator had a collinearity problem, with the results of the collinearity test shown in Table 11. All indicators have a variance inflation factor (VIF) value of less than 5 (Hair et al., 2021), suggesting that multicollinearity is not a problem.

The results of tests for discriminant validity (using the heterotrait–monotrait [HTMT] ratio and Fornell–Larcker criterion correlation) are shown at Tables 13 and 14. In the first iteration, four heterotrait–monotrait (HTMT) ratio matrix values were more than 0.9 (between *FIN* and *FRT* [1.167]; *FIN* and *SVB* [1.236]; *FIN* and *SPB* [1.199]; and *EPA* and *FIN* [0.995]), which leads to *OFK*, the manifest variable of *FIN*, needing to be removed from the model. After *OFK*'s removal from the model, all the heterotrait–monotrait (HTMT) ratio matrix values were less than 0.9 (see Table 13), meaning that all constructs used in the model had good convergent consistency (Hair et al., 2021). Tables 15 and 16 present the results for the significance and relevance of path coefficients and effect size (f^2) in Table 15, and evaluation of the prediction model (Q^2, root mean squared error [RMSE] and mean absolute error [MAE]) in Table 16. As shown in Table 16, the Q^2 values for financial risk tolerance (*FRT*), saving behavior (*SVB*), and spending behavior (*SPB*) were 0.231, 0.104, and 0.048, respectively, with more than zero being the cut-off value. This indicates that the model has predictive relevance (Chin, 2010; Jamal et al., 2016). The mediation analysis, presented in Table 17, shows *FRT* as having a complementary partial mediation role in the relationships of e-payment awareness with both saving and spending behavior. In the relationship between financial knowledge and saving behavior, *FRT* has a full mediation role. Furthermore, in the relationship between financial knowledge and spending behavior, *FRT* has a competitive (partial mediation) role: The direct effect is negative and significant, but the indirect effect is positive and significant.

Figure 2 shows the estimation of the structural model and the relationships between the variables and their indicators, along with the factor loading for each one. The present study finds positive relationships between financial knowledge, e-payment awareness, financial risk tolerance, and saving and spending behavior. Figure 2 illustrates the path coefficient of each independent variable and the effect on its dependent variable. Meanwhile, Tables 16 and 17 explain the *t*-test of each indicator and independent variable.

Table 11. Measurement Model Evaluation – Factor Loading of the Outer Model

Variables and Indicators	Code	VIF	Factor Loading First iteration	Factor Loading Second iteration	t-test
Criteria		< 5	> 0.6	> 0.6	> 1.960
Financial Knowledge					
Objective financial knowledge (OFK)	*OFK*	1.011	0.669*	delete	-
Subjective financial knowledge (SFK)	*SFK*	1.011	0.810	1.000	N/A
e-Payment Awareness					
e-Payment systems save my time (EPA1)	*EPA1*	2.188	0.824	0.824	46.341
e-Payment systems save my money (EPA2)	*EPA2*	1.437	0.625	0.624	18.179
e-Payment systems are better than cash (EPA3)	*EPA3*	1.801	0.714	0.713	19.724
Being alert to security issues of e-payment (EPA4)	*EPA4*	2.237	0.762	0.763	20.787
e-Payment offers a greater choice (EPA5)	*EPA5*	2.104	0.763	0.762	22.371
e-Payment systems can be readily adopted (EPA6)	*EPA6*	2.522	0.784	0.784	24.885
e-Payment systems can be easily used (EPA7)	*EPA7*	2.624	0.818	0.818	32.996
Aware of the potential risks of e-payment (EPA8)	*EPA8*	1.912	0.739	0.740	20.153
Financial Risk Tolerance					
Speculative risk (FRT1)	*FRT1*	1.175	0.758	0.752	24.318
Investment risk (FRT2)	*FRT2*	1.204	0.807	0.802	27.937
Evaluated financial risk (FRT3)	*FRT3*	1.226	0.639	0.656	10.465
Spending Behavior					
Searched for information about the product item before purchasing it (SPB1)	*SPB1*	2.110	0.843	0.841	22.928
Comparison shopped when purchasing a product or service (SPB2)	*SPB2*	2.157	0.845	0.844	21.079
Kept a written or electronic record of your monthly expenses (SPB3)	*SPB3*	1.315	0.805	0.806	19.336
Saving Behavior					
Saved for a long-term goal (SVB1)	*SVB1*	2.222	0.866	0.866	48.790
Invested money (SVB2)	*SVB2*	1.911	0.859	0.859	42.870
Began or maintained an emergency savings fund (SVB3)	*SVB3*	1.631	0.732	0.733	18.885
Saving money regularly (SVB4)	*SVB4*	1.771	0.759	0.759	22.996

Source: Present study's SEM analysis: calculation using the partial least squares (PLS) regression method
Notes: **objective financial knowledge (OFK) taken from the model; VIF = variation inflation factor: if a collinearity statistic is less than 5, no collinearity problem is present; p-value is less than a significance level of 5%*

Table 12. Measurement Model Evaluation Validity and Reliability

	CR	AVE
Electronic Payment Awareness (EPA)	0.914	0.571
Financial Risk Tolerance (FRT)	0.782	0.547
Saving Behavior (SVB)	0.881	0.650
Spending Behavior (SPB)	0.870	0.690

Source: Present study's SEM analysis: calculation using the partial least squares (PLS) regression method
Notes: *AVE = average variance extracted; CR = composite reliability*

Table 13. Discriminant Validity Heterotrait–Monotrait (HTMT) Ratio Matrix

	EPA	*FIN*	*FRT*	*SVB*	*SPB*
Electronic Payment Awareness (*EPA*)					
Financial Knowledge (*FIN*)	0.242				
Financial Risk Tolerance (*FRT*)	0.538	0.445			
Saving Behavior (*SVB*)	0.465	0.168	0.447		
Spending Behavior (*SPB*)	0.390	0.035	0.335	0.887	

Source: Present study's SEM analysis: calculation using the partial least squares (PLS) regression method

Table 14. Discriminant Validity Fornell–Larcker Criterion Correlation

	EPA	*FIN*	*FRT*	*SVB*	*SPB*
Electronic Payment Awareness (*EPA*)	0.756				
Financial Knowledge (*FIN*)	0.242	1.000			
Financial Risk Tolerance (*FRT*)	0.429	0.348	0.740		
Saving Behavior (*SVB*)	0.409	0.173	0.353	0.806	
Spending Behavior (*SPB*)	0.335	0.021	0.257	0.710	0.831

Source: Present study's SEM analysis: calculation using the partial least squares (PLS) regression method

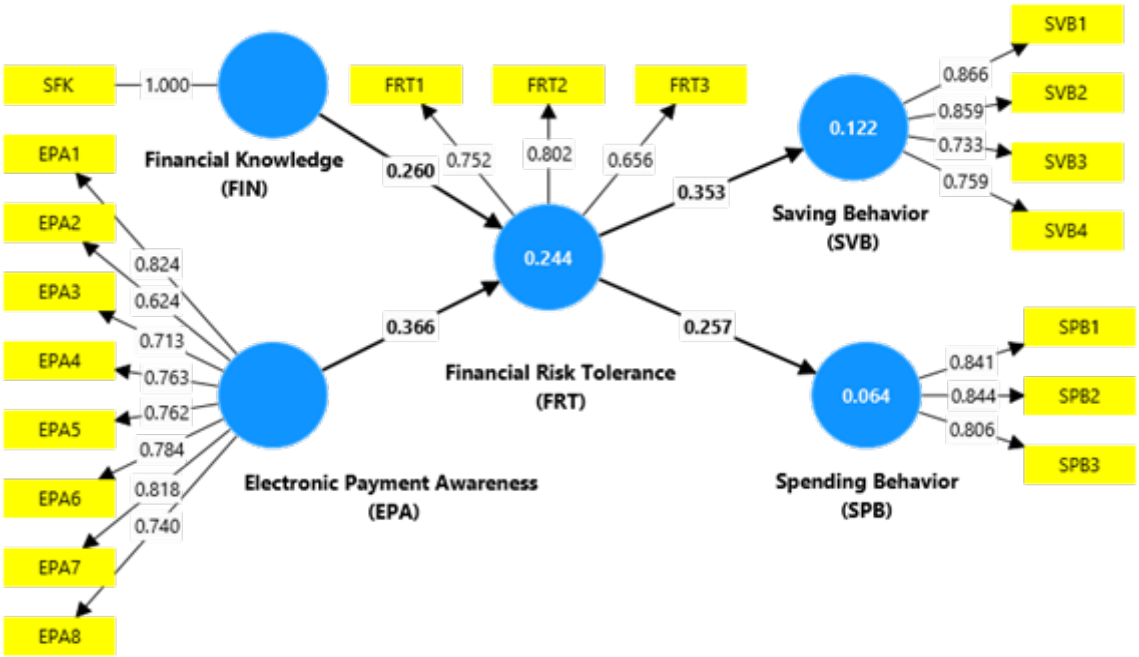

Figure 2. Structural Measurement Model:
Adjusted R-Squared, Path Coefficients and Loadings

Table 15. Structural Model Evaluation

Direct Effect	Original sample (O)	*t*-statistic > 1.960	*p*-value	Sig	f^2 value
Electronic Payment Awareness → Financial Risk Tolerance	0.366	8.687	0.000	significant	0.168
Financial Knowledge → Financial Risk Tolerance	0.260	4.768	0.000	significant	0.084
Financial Risk Tolerance → Saving Behavior	0.353	8.804	0.000	significant	0.142
Financial Risk Tolerance → Spending Behavior	0.257	6.078	0.000	significant	0.071

Source: Present study's SEM analysis: calculation using the partial least squares (PLS) method.

Notes: *Effect size criteria: f-squared (f^2) = 0.02 (low); f^2 = 0.15 (moderate); f^2 = 0.35 (high); sig = significance*

Table 16. Prediction Model Evaluation PLSpredict, Q^2, RMSE, and MAE

	Q^2	RMSE	MAE
Financial Risk Tolerance (FRT)	0.231	0.884	0.687
Saving Behavior (SVB)	0.104	0.952	0.758
Spending Behavior (SPB)	0.048	0.980	0.830

Source: Present study's SEM analysis: calculation using the partial least squares (PLS) regression method

Notes: *Predictive relevance criteria: Q2 is more than zero (Q2 > 0) (Hair et al., 2022; Ringle et al., 2018); root mean squared error (RMSE) is less than 1; MAE = mean absolute error*

Table 17. Mediation Test

	Direct effect	t-value	Sig	Indirect effect	t-value	Sig	Conclusion
Electronic Payment Awareness → Saving Behavior	0.371	9.987	Yes	0.129	5.518	Yes	Complementary (partial mediation)
Electronic Payment Awareness → Spending Behavior	0.351	9.622	Yes	0.094	4.427	Yes	Complementary (partial mediation)
Financial Knowledge → Saving Behavior	0.016	0.333	No	0.092	4.168	Yes	Indirect only (full mediation)
Financial Knowledge → Spending Behavior	-0.110	2.386	Yes	0.067	3.859	Yes	Competitive (partial mediation)

Source: Present study's SEM analysis: calculation using the partial least squares (PLS) regression method. If the sign of the direct effect is positive, the partial mediation is complementary, and if the sign of the direct effect is negative, it is a competitive partial mediation (Hair et al., 2022);(Zhao et al., 2010); (Nitzl et al., 2016).

Discussion

This study offers a valuable opportunity to enhance our understanding of personal financial behavior. It makes a major contribution to research on financial literacy by demonstrating the relationships between financial knowledge and e-payment adoption with saving and spending behavior, with financial risk tolerance as the mediating variable. The study's findings show that financial knowledge (*FIN*) has a positive effect on financial risk tolerance (*FRT*) at a 5% confidence interval level. The coefficient of *FIN* at 0.296 indicated that the direct contribution of *FIN* to *FRT* was approximately 7% (= 0.260). This result is consistent with the findings of Tavor & Garyn-Tal (2016); Samanez-Larkin et al. (2020); Nguyen et al.(2022) who established the relationship between financial knowledge and risk tolerance. Our findings also align with a study in China, which which demonstrated that financial knowledge has a significant positive effect on risk tolerance levels (Zhang et al., 2022) as well as with a study in the United States showing that individual investors' risk tolerance behavior is associated with their subjective financial knowledge (Noman et al., 2023). Additionally, the present study found that individuals with higher financial knowledge tend to be more risk-tolerant (Nguyen et al.,2022).

This study also found that e-payment awareness positively affected financial risk tolerance. This study confirms our earlier findings that e-payment behavior positively affected financial risk tolerance (Dewi et al., 2023). It aligns with a study in Japan that found a relationship between risk tolerance and e-payment services awareness (Long et al., 2023). The coefficient of *EPA* at 0.366 indicated that the direct contribution of *EPA* on *FRT* was 13% (= 0.3662), showing that *EPA* significantly affected financial risk tolerance (*FRT*). The findings also indicated that young people would have a higher level of risk tolerance if they had a higher level of awareness of the e-payment system, as shown by *EPA* significantly affecting financial risk tolerance (*FRT*). Furthermore, financial risk tolerance (*FRT*), in turn, has positive effects on saving behavior (*SVB*) and spending behavior (*SPB*). The coefficient of *FRT* at 0.353 indicated that the direct contribution of *FRT* on *SVB* was 12.5% (= 0.3532), while the coefficient of *FRT* on *SPB* at 0.257, thus indicating that the direct contribution of *FRT* on *FSB* was 7% (= 0.2572). This study produced results that corroborate the findings of a great deal of the previous work in this field, both in the context of developed and developing countries. Nguyen et al.(2022) conducted a study in Vietnam, revealing that financial literacy indirectly influences saving behavior through risk tolerance, and Almas et al.(2020) found that risk tolerance has a correlation with saving behavior in China. Another interesting finding of this research is the competitive (partial mediation) role of financial risk tolerance on the relationship between financial knowledge and spending behavior: The direct effect is negative and significant, but the indirect effect is positive and significant. This finding indicates the role of *FRT* in encouraging better spending behavior. Higher financial knowledge alone does not necessarily ensure better spending behavior. Our finding suggests that higher financial knowledge must be balanced with more risk-tolerant behavior (i.e., higher *FRT*) to achieve better spending behavior, which is consistent with the previous findings of Azmi & Ramakrishnan (2018). All in all, The findings of the current study are consistent with those of Bapat (2020) and Nguyen et al.(2022), who revealed that subjective financial knowledge is found to influence saving behavior through risk tolerance indirectly. This finding supports previous research that links risk tolerance and subjective financial knowledge in context-developed countries such as the U.S. (Noman et al.,2023) and developing countries such as Vietnam

(Nguyen et al., 2022). However, the current study's findings do not support the previous research by Peiris (2021), who found that financial literacy has a direct and positively significant influence on savings behavior.

This study provides further evidence of the important link between young people's level of risk tolerance and their financial behavior. Finally, financial risk tolerance plays a role in shaping an individual's financial behaviors (Grable, 2016; Grable, 2018). A higher level of risk tolerance would be significant, in the individual achieving good financial behavior.

Conclusion

This study reveals the positive relationships of financial knowledge, e-payment awareness, and financial risk tolerance with saving and spending behavior. Based on the study's findings, financial knowledge and e-payment awareness are factors that are important in the development of a higher level of risk tolerance among young people which, in turn, can affect both saving and spending behavior. The study also reveals that financial knowledge and e-payment awareness play roles in shaping the individual's financial behavior through financial risk tolerance. This study provides evidence that financial risk tolerance has a complementary partial mediation role in this relationship. The relationship of financial knowledge and e-payment awareness with saving behavior can be either direct or indirect. At the same time, the relationship of financial knowledge and e-payment awareness with saving behavior is direct only.

The findings of this study reveal three important insights into the relationships between financial knowledge, e-payment awareness, financial risk tolerance, and financial behavior among young adults: (1) Financial knowledge positively impacts financial risk tolerance. Individuals with higher financial knowledge are more likely to have a higher tolerance for financial risks, aligning with previous research indicating that knowledgeable individuals are more comfortable with risk in financial decisions. (2) E-payment awareness influences both saving and spending behavior, with awareness of e-payment systems leading to better financial risk tolerance and encouraging saving habits. This suggests that familiarity with digital payment systems can promote more cautious financial behavior by enhancing individuals' comfort with managing financial transactions electronically. (3) Financial risk tolerance serves as a mediator in the relationship between financial knowledge and spending behavior. While financial knowledge alone may not directly lead to better spending habits, when combined with higher risk tolerance, it positively influences spending behavior. This highlights the importance of balancing financial knowledge with risk tolerance for optimal financial behavior.

Based on this study's findings, this study highlights the critical role of financial knowledge, digital payment awareness, and risk tolerance in shaping financial behaviors. The implications for research are that future research could expand on these findings by exploring how these factors interact in different demographic contexts or across diverse economic conditions. The practical implication is financial institutions and educational organizations can leverage these findings to design programs that increase digital payment awareness and financial knowledge, especially among young people. By promoting financial literacy programs incorporating digital finance components, financial institutions can help individuals make more informed decisions and build sustainable saving

and spending habits. Moreover, by identifying risk profiles, financial service providers can offer tailored products that align with customers' risk tolerance levels, ultimately improving customer satisfaction and financial stability. Finally, the implication for society is improving financial literacy and digital payment awareness can lead to more financially responsible behavior, fostering economic stability within communities. As individuals become more aware of managing their finances and understanding risk tolerance, they are likely to contribute to a more resilient economy. Enhanced financial knowledge and digital competency also align with national goals of increased financial inclusion, supporting a well-informed and economically active society.

These implications underscore the importance of targeted financial education and inclusive financial policies to promote responsible financial behavior in a digital era.

Limitations

Although the present study successfully demonstrated the relationships between financial knowledge, e-payment awareness, financial risk tolerance, saving behavior and spending behavior, one limitation is the lack of balance in in terms of the number of responses by age, gender, and income level. The researchers were limited by time and the limited number of respondents willing to fill out the survey. This meant that the researchers had insufficient time to collect more responses. Despite this, the sample size met the minimum requirements for statistical validity, ensuring reliability in the core findings.

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Appendix

The questionnaires

Financial Knowledge

Subjective financial knowledge

SFK1.How would you assess your knowledge of investment

1. Very Low 2. Low 3. High 4. Very High

Objective financial knowledge

I would like to know whether you think the following statements are true or false.

OFK1: If you save Rp1,000,000.00 today at an interest rate of 4% for one year, your balance in one year will be Rp1,040,000.00.

OFK2: High inflation has a negative impact on investments.

OFK3: Dewi routinely saves in a monthly term deposit to prepare education funds for the next 5 years. What Dewi does is aimed at achieving long-term financial goals.

OFK4: It is usually possible to reduce the risk of investing in the stock market by buying a diverse range of stocks and shares.

OFK5: The type of investment in stock mutual funds is a mutual fund with higher risk than bond or money market mutual funds.

E-Payment Awareness

EPA1: Transacting using an electronic payment system (E-Payment) saves me time.
EPA2: Transacting using an electronic payment system (E-Payment) saves me money.
EPA3: Transacting using an electronic payment system (E-Payment) is better than using cash.
EPA4: Digital payment users should be aware of security issues when using electronic payment systems.
EPA5: E-Payment offers more options for me.
EPA6: Electronic payment systems are easily adaptable.
EPA7: Electronic payment systems are easy to use.
EPA8: I am aware of the potential risks of using the E-Payment platform, such as personal data theft, account misuse, and fund security concerns.

Spending Behavior

SPB1: If I want to buy something, I always look for information about the product before purchasing it.
SPB2: If I want to buy something, I always compare prices first and do comparison shopping before purchasing a product or service.
SPB3: I keep a written or electronic record of my monthly expenses.

Saving Behavior

SVB1: I have started saving for long-term goals.
SVB2: I have started investing in mutual funds, stocks, or other securities.
SVB3: I have prepared an emergency fund for unexpected needs.
SVB4: I save money regularly.

Financial Risk Tolerance

FRT1. Speculative Risk
1. Suppose that before tossing a coin (side A: Fish head, side B: Fish tail), you are asked to choose one of the following options for the prize you will receive:
A. Guess which side (A or B) will appear and, if correct, you will receive IDR 100,000
B. Guess if side A will appear and, if correct, you will receive IDR 200,000. If side B side appears, you will not receive anything.
2. Suppose you won a quiz with a cash prize of IDR 500,000. You are given the opportunity to choose either:
C. IDR 500,000 which you have won, but without being able to have the second quiz round opportunity.
D. Take the second quiz round with an 80% chance of winning IDR 1 million: if you lose, you will receive nothing at all
FRT2. Investment Risk
If you unexpectedly received IDR 100 million to invest, in what would you invest the funds?

A. 100% savings and deposits
B. 50% savings and term deposits, 50% mutual funds
C. 50% mutual funds and 50% stocks
D. 100% stocks
FRT3. Evaluated Financial Risk
How many losses can you accept in investing?
A. 0%
B. Up to 50%
C. Up to 75%
D. 100%