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The Influence of Cognitive Bias Moderated by Demographic Factors and Re-Moderated by Education and Income on Individual Investment Decisions

Elva Herlianti¹, Nugraha Nugraha², Disman³, Yayat Supriyatna⁴ Universitas Pendidikan Indonesia, Bandung, Indonesia

*Correspondence: E-mail: elvaherlianti@upi.edu

ABSTRACT

This study investigates the causal relationship between cognitive biases and individual investment decisions. The research involved a population of 600 investors, with 574 valid respondents. Data were analyzed using multiple linear regression and moderation-moderation models tested with Model 3 in the PROCESS Procedure for SPSS 26 by Hayes. Results indicate that Herding bias negatively influences investment decisions, while Loss Aversion and Framing biases are significantly moderated by demographic factors such as gender and age, with further moderation by education and income. The findings suggest that demographic factors influence investment decisions independently rather than interactively. This study offers new insights into the moderating and remoderating effects of demographics on the relationship between cognitive biases and investment behavior.

Penelitian ini mengkaji hubungan kausal antara bias kognitif dan keputusan investasi individu. Penelitian ini melibatkan populasi 600 investor dengan 574 responden valid. Data dianalisis menggunakan regresi linier berganda dan model moderasi-moderasi yang diuji dengan Model 3 pada Prosedur PROCESS untuk SPSS 26 oleh Hayes. Hasil penelitian menunjukkan bahwa bias Herding berpengaruh negatif terhadap keputusan investasi, sedangkan bias Loss Aversion dan Framing dimoderasi secara signifikan oleh faktor demografis seperti jenis kelamin dan usia, serta dimoderasi kembali oleh tingkat pendidikan dan pendapatan. Temuan ini menunjukkan bahwa faktor demografis mempengaruhi keputusan investasi secara independen, bukan secara interaktif. Studi ini menawarkan wawasan baru mengenai efek moderasi dan re-moderasi faktor demografis terhadap hubungan antara bias kognitif dan perilaku investasi.

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1. INTRODUCTION

In the era of globalization marked by rapid technological advances and dynamic economic development, the need for individuals to have comprehensive knowledge and insight into financial management is becoming increasingly important. Effective and appropriate personal financial management is no longer an optional skill, but a fundamental requirement for dealing with the complexities of modern economic life. Given the pervasive influence of financial considerations on daily activities, individuals must develop sufficient financial management skills to make informed decisions about their assets and wealth (Mehmood et al., 2024). Good financial planning is essential, as it provides the basis for economic stability and enables individuals to adapt to the opportunities and challenges of an ever-evolving global economy.(Rasool and Ullah, 2020).

Individual investment refers to the allocation of current resources with the aim of generating future returns. Investments can be made in various forms, such as real investments or financial investments (e.g., stocks, bonds) (Zahera and Bansal, 2018). Several factors influence investment decisions, including psychological factors, emotions, access to information, and the broader economic environment. Behavioral finance, a field that explores psychological influences on financial decision-making, has shown that investors often make decisions that deviate from rationality (Badola et al., 2023). Mental errors or cognitive biases, such as overconfidence, loss aversion, and herding, can distort the way investors perceive risk and reward, ultimately affecting expected outcomes. It has been widely demonstrated that these biases lead to suboptimal financial decisions, as investors misinterpret or mismanage information (Goyal et al., 2021).

Research on cognitive biases and their influence on investor decisions highlights the important role of these psychological factors in shaping investment behavior. Cognitive biases such as herding, loss aversion, framing, significantly influence how investors interpret and respond to market information (Başarir and Yilmaz, 2019). These biases not only lead to irrational decision making, but also create systematic patterns that can enhance or undermine investment returns (Badola et al., 2023). High herding in investors will have an impact on high investment decisions based on behavior that imitates the decisions of other people or groups. (Kumar and Goyal 2015) supported by research by Afriani & Halmawati (2019) stating that herding has a significant positive effect on investment decisions. Herding behavior is the behavior of an investor who tends to follow other investors or larger groups of investors in making investment decisions (Ramdani 2018).

While biases such as loss aversion can increase caution and prevent excessive risk taking, Loss Aversion behavior is the concept that individuals get happiness when they get money but suffer greatly if they lose money. The torment from this loss is greater than when getting a profit that is the same as the loss. Similar to the study conducted by Areiqat et al. (2019) that there was a significant influence of loss aversion behavior on investment decision making, other biases, such as Framing, can also influence the decisions taken.

The information received becomes a decision on a problem based on framing. (Susanto, 2011) in his research has proven the ability of the framing effect to manipulate the risk tendency of decision making. When decision alternatives are framed positively, groups tend to avoid risk than individuals, and when decision alternatives are framed negatively, groups tend to take risks compared to individuals, in addition to that there are also research results and analysis that framing effects have an influence on investment decision making (Yahya and

Surya, 2012). The results of this study also support the results of research (Kahneman & Tversky, 1979), Tversky & Kahneman (1981), (Mittal & Rose, 1998), (Rutledge, 1994) which found that framing effects affect individual decision making and confirmed that framing affects investment decision making. A deeper understanding of these cognitive biases is essential, as it not only helps explain deviations from traditional economic models of rationality, but also offers insights into improving investment strategies and decision-making processes.

Despite extensive research on the impact of cognitive biases on individual investor decisions, significant gaps remain, particularly in understanding these biases in emerging markets such as Indonesia compared to non-emerging markets. The economic, cultural, and information gaps between these regions can result in varying degrees of susceptibility to cognitive biases in investment decision-making (Adiputra, 2021; Badola et al., 2023; Othman, 2024). Investors in emerging markets may exhibit higher herd behavior due to less developed financial infrastructure, or aversion to losses due to economic volatility. To address these gaps, the study incorporates key demographic factors—gender, age, as a moderator and remoderated by education level, and income—into its analysis.

Moderator variables such as gender, age, moderated back by education, and income can significantly affect the relationship between behavioral financial factors and investment decisions. Research shows that generational differences are important to analyze because there will definitely be different mindsets and levels of decision-making. Millennials tend to show stronger group behavior compared to older generations, who may rely more on their own analysis (Adielyani & Mawardi, 2020; Rosdiana, 2020). Gender also plays a role, as women generally exhibit higher risk aversion and lower self-confidence than men, which reduces their likelihood of engaging in risky investments (Syaikh et al., 2019; Srijanani & Vijaya, 2018). Education level affects financial literacy, individuals with higher education are usually better at managing loss aversion bias (Iram et al., 2021).

Income level further moderates this relationship, as those with higher incomes tend to exhibit lower status quo bias, likely due to their greater access to financial resources and information (Atmaningrum et al., 2021; Rasyid et al., 2018). By examining how these demographic variables interact with cognitive biases, this study aims to provide a deeper understanding of the factors that influence investment decisions across different market contexts. The integration of demographic factors allows for the exploration of variations in bias susceptibility, offering implications and novelties for improving investor behavior and investment decisions.

2. METHODS

This study uses an explanatory survey design to investigate the relationships between variables by collecting quantitative data through a structured questionnaire. This approach allows for clear identification of independent and dependent variables, allowing the researcher to explore potential causal relationships. By analyzing the data collected, this design helps explain how certain factors influence outcomes, providing a structured framework for hypothesis testing. The causal relationships in the model begin with the independent variables, which represent various cognitive biases that influence investment decisions. Herding, where individuals follow the behavior of the majority, has been shown to significantly influence investor decisions, especially in volatile markets (Compen et al., 2022; Mehmood et al., 2024). Investors who exhibit herd behavior tend to make decisions based on

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collective trends rather than independent analysis, which can produce both positive and negative outcomes. Loss aversion, another important factor, reflects an individual's tendency to prioritize avoiding losses over gaining gains, which often leads to risk-averse investment strategies (Otsman, 2024; Tahir & Danarsari, 2023). This bias can cause investors to hold underperforming assets for too long or avoid profitable risks, ultimately impacting their overall financial results.

Framing refers to how the presentation of information influences investor decisions. Depending on whether investment choices are framed in terms of potential gains or losses, investors may react differently, often with irrational risk-taking or risk-avoiding behavior.(Badola et al., 2023; Zahera & Bansal, 2018)

The dependent variable, Investment Decision (Y), is directly shaped by these cognitive biases, with investor choices often reflecting the combined effects of herding, loss aversion, framing, etc. The presence of these biases can lead to irrational or suboptimal investment decisions, thereby reducing the likelihood of achieving expected returns. Understanding the causal relationship between cognitive biases and investment behavior is essential to developing approaches to mitigate their negative impacts.

This model introduces moderating variables, such as gender and age, which further shape the strength and direction of the relationship between cognitive biases and investment decisions.(Bairagi & Chakraborty, 2021; Phan et al., 2018; Rosdiana, 2020; Srijanani & Vijaya, 2018). For example, women tend to exhibit higher risk aversion than men, which may attenuate the effects of biases such as herding and framing.

Similarly, younger investors may be more susceptible to cognitive biases than older ones, as experience and financial analysis play a role in mitigating irrational behavior. In addition, the moderating effects of education and income introduce complex interactions, where higher levels of education and income tend to mitigate the effects of cognitive biases. These demographic factors, within the moderation-re-moderation framework, help explain the varying degrees to which investors are affected by cognitive biases, providing a more comprehensive understanding of investment decision making across groups. The main effects model can be described in Figure 1 and the moderation-re-moderation model in Figure 2.



Figure 1. Main Effects Model

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In the main effect model, the analysis uses multiple linear regression after confirming the classical assumptions (linearity, normality, homoscedasticity, and independence test). The main effect in multiple regression analysis can be formulated in Equation (1) while the moderation-moderated model in Equation (2). To calculate the moderated moderation, Model 3 is used in the PROCESS Procedure for SPSS Version 4.1 by Hayes.

$$Y = 60 + 61 \cdot X1 + 62 \cdot X2 + 63 \cdot X3 + \epsilon \tag{1}$$

$$Y = \beta_0 + \sum_{i=1}^5 \beta_i X_i + \sum_{j=1}^2 \beta_{6+j} W_j + \sum_{k=1}^2 \beta_{8+k} Z_k + \sum_{i=1}^5 \sum_{j=1}^2 \beta_{9+i+j} (X_i * W_j) + \sum_{i=1}^5 \sum_{k=1}^2 \beta_{11+i+k} (X_i * Z_k) + \epsilon$$
(2)



Figure 2. Moderated-Moderation Model

Where:

WJare demographic moderators (Gender, Age), Zkis the moderator of Education and Income.

The population in this study is all individual investors totaling 574 people who are registered and still active, and are SID, make investments other than shares, and make transactions other than trading, are registered on the stock exchange, and are active members based on the random sampling formula, a minimum sample of 600 was obtained.

3. RESULTS AND DISCUSSION

A total of 574 data collected can be analyzed as follows:

Table 1. Results									
Hypot	Statement	р	Interacti	Hypothesis					
hesis			on	Statement					
1	Gender significantly moderates cognitive bias towards investment	0.0	There is	Accepted					
	decisions which is moderated again by education.	04							
2	Gender significantly moderates cognitive bias towards investment	0.0	There	Rejected					
	decisions which is further moderated by income.	67	isn't any						
3	Age significantly moderates cognitive bias towards investment decisions	0.0	There is	Accepted					
	which is moderated again by education.	00							
4	Age significantly moderates cognitive bias towards investment decisions	0.1	There	Rejected					
	which is moderated again by income.	66	isn't any						

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This table shows how different genders and ages are distributed across education and income categories, indicating patterns in demographic composition. "High-High" (high education and high income) indicates that younger, well-educated, and high-income individuals are prominent in this investor sample. Older investors may represent a more conservative segment of the investor population. The smaller representation of older groups may imply lower involvement with investing or a higher preference for different types of investments outside the categories covered here.

The concentration of highly educated and high-income people in this category indicates that high-income and highly educated individuals are more likely to actively invest. This is in line with the tendency of people with higher financial literacy and income to invest more.(Mehmood et al., 2024)The low-income, highly educated category may represent individuals with strong financial literacy or professional knowledge (from education) but limited capital, perhaps recent graduates or young professionals entering the investment space with caution. Smaller numbers in the "Low-Low" and "Low-High" categories may indicate that investors with lower levels of education are investing less or less actively, which may reflect a general trend where financial literacy is correlated with investment engagement.(Rosdiana, 2020)Higher levels of education and income appear to correlate with greater participation, while younger investors dominate the sample, which is in line with broader trends in investment behavior.

The main impact estimates involve five cognitive biases as independent variables and investment decisions as dependent variables. Table 2 presents the main impact estimates.

Table 2. Main effect								
Variables	Coefficient	English	standardized	t statistics	p value			
(constant)	1,477	0.545		2,709	0.007			
Shepherding (X1)	-0.043	0.011	-0.076	-3,782	0.000			
Loss Avoidance (X2)	0.201	0.037	0.158	5.465	0.000			
Framing (X3)	0.096	0.039	0.095	2,478	0.013			

Table 2 presents estimates of the impact of various behavioral biases on the outcome variables. Each variable is evaluated through its coefficient, standard error (SE), standardized coefficient, t-statistic, and p-value. The constant term has a coefficient of 1.477 with a t-statistic of 2.709 and a p-value of 0.007, indicating that the intercept is significant in the model. This significance indicates that even without the specific impact of the included bias, there is a baseline effect on the outcome variable.

The table shows that all hypotheses are accepted, as all p-values are below the threshold of 0.05. The first bias, Herding (X1), has a coefficient of -0.043 and a standardized coefficient of -0.076, indicating a negative impact on investment decisions. The significance of herding is confirmed with a t-statistic of -3.782 and a p-value of 0.000. Loss Aversion (X2), on the other hand, shows a positive effect with a coefficient of 0.201 and a standardized coefficient of 0.158; a t-statistic of 5.465 and a p-value of 0.000 further support the acceptance of the hypothesis. Similarly, Framing (X3), with a coefficient of 0.096, also has a positive effect, with a t-statistic of 2.478 and a p-value of 0.013, confirming the hypothesis.

Which supports its impact on investment decisions. In short, all tested behavioral biases are significant predictors, with p-values below 0.05, confirming that each hypothesis is accepted and confirming their role in influencing investment decision variables.

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The research findings, with a negative coefficient for herding, suggest that investors affected by this tendency are more likely to make decisions that deviate from optimal and rational investment choices, which negatively impacts their overall financial outcomes. Thus, the conclusion is that herding bias, as reflected in the items in the questionnaire, can reduce good investment decision making.(Mamidala et al., 2023).

This means that most investors in Indonesia still experience this herding bias. Furthermore, loss aversion has a positive effect on investment decisions. On the positive side, loss aversion can make investors more cautious, reducing impulsive or risky decisions that can lead to significant losses. This tendency to avoid losses can motivate investors to evaluate investment options carefully, which can be beneficial in protecting their capital, especially during market downturns.(Mallik et al., 2017).

The positive effect of framing on investment decisions suggests that the way information is presented influences investors in a way that results in favorable decisions. Framing can positively impact decision-making by shaping perceptions in a way that emphasizes important information, simplifies complex data, or directs focus to long-term goals and overall strategy. It also suggests that when information is presented carefully, investors can interpret choices more clearly and confidently, making decisions that align with their long-term financial goals rather than reacting impulsively.(Badola et al., 2023). Realistic valuation benchmarks—these tendencies can guide more disciplined decision-making. Anchoring a stock's average price over a number of years can help investors avoid paying too much during market peaks or panic selling during downturns. However, while it's helpful when the reference point is logical and contextually relevant.

Calculation of moderation involves several steps, namely combining the Model in the PROCESS Procedure for SPSS Version 4.1 by Hayes. To gain a deeper understanding of the influence of cognitive biases moderated by demographic factors and re-moderated by education and income on individual investment decisions, several interaction models were tested. The following tables present the results of the moderation and re-moderation analysis. Table 3 displays the interaction between gender, education, and cognitive biases on investment decisions. Table 4 examines the interaction between gender, income, and cognitive biases. Table 5 explores the interaction between age, education, and cognitive biases, while Table 6 focuses on the interaction between age, income, and cognitive biases. The results from these models provide comprehensive insights into how demographic variables independently and jointly shape the relationship between cognitive biases and investment behavior.

Table 3. Model 1 results										
Model	Investment	Gender	Interaction	Education	Interaction	Interaction	Interaction			
	Decisions									
1	Х	W1	X.W1	Z1	W1.Z1	X.Z1	X.W1.Z1			
Prob	0.000	0.028	0.027	0	0	0.003	0.004			
Information	Significant	Significant	Significant	Significant	Significant	Significant	Significant			
		Т	able 4. Mod	lel 2 result	S					
Model	Investment	Gender	Interaction	Income	Interaction	Interaction	Interaction			
	Decisions									
2	Х	W1	X.W1	Z2	W1.Z2	X.Z2	X.W1.Z2			
Probability	0.000	0.246	0.189	0.001	0.002	0.079	0.67			
Information	Significant	Not	Not	Significant	Significant	Not	Not			

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Table 5. Model 3 results									
Model	Investment	Gender	Interaction	Income	Interaction	Interaction	Interaction		
	Decisions								
3	Х	W2	X.W2	Z1	W2.Z1	X.Z1	X.W2.Z1		
Probability	0.000	0.000	0.000	0.000	0.001	0.000	0.000		
Information	Significant								

Table 6. Model 4 results									
Model	Investment	Gender	Interaction	Income	Interaction	Interaction	Interaction		
	Decisions								
4	Х	W2	X.W2	Z2	W2.Z2	X.Z2	X.W2.Z2		
Probability	0.000	0.007	0.019	0.004	0.023	0.107	0.166		
Information	Significant	Significant	Significant	Significant	Significant	Not	Not		
						Significant	Significant		

The table presents the results of the estimation of the moderation effects for three behavioral biases (Herding, Loss Aversion, Framing, on investment decisions, with the moderating effects of demographic factors. The independent variables (X1 to X3) reflect certain biases, and the dependent variable (Y) is the investment decision. Two moderating variables, W (gender and age) and Z (education and income), reveal how demographic factors shape these relationships. The significance values indicate whether these biases and their interactions with the moderators have a significant impact on investment decisions.

The first row shows the direct effect of each bias (X1 to X3) on investment decisions (Y). Herding (X1) is not significant, meaning it has no direct impact on investment decisions. However, Loss Aversion (X2), Framing (X3), A, and all have significant impacts, indicating that these biases play an important role in investment decision making. These findings suggest that people's investment choices are more influenced by these biases than by herding behavior, likely due to the individualistic nature of loss and gain perceptions, as well as how information is presented and processed. The influence of gender and age (W) as well as education and income (Z) as individual moderators on investment decisions, indicating that demographic factors such as gender and age can shape how individuals make financial choices. Education and income (Z) also show a significant impact when moderated by certain biases such as Loss Aversion (X2) and Framing (X3), highlighting that financial literacy and individual income levels can influence the effects of certain biases on investment behavior.

By examining the two-way interactions (i.e., XW and XZ), we see that gender/age (W) only moderates the relationship between Herding (X1) and investment decisions significantly. This interaction suggests that the effect of herding on investment choices differs significantly across gender and age groups, possibly due to different social influences or risk perceptions. Meanwhile, education/income (Z) significantly moderates the effects of Loss Aversion, Framing, Anchoring, on investment decisions, suggesting that higher education or income levels can either reduce or amplify these biases in financial choices.

The three-way interaction (XWZ) did not show a significant moderating effect across all variables, implying that the combination of gender, age, education, and income does not jointly influence the effect of bias on investment decisions. The lack of significance in this three-way interaction suggests that the influence of behavioral bias may be influenced by individual demographic factors, but these factors do not interact in a way that jointly influences how bias affects investment behavior.

DOIs:https://doi.org/10.17509/jbme.v10i1 p-ISSN: 2715-3045 and e-ISSN 2715-3037 The findings in this study are consistent with previous literature highlighting the impact of behavioral biases on investment decisions. For example, the significance of Loss Aversion, Framing, , is in line with Badola et al.(2023), who found that this bias critically influences individuals' investment choices. Loss aversion, as highlighted by Mamidala et al.(2023), greatly influences risk-averse behavior, where investors tend to avoid losses rather than gain, in line with the findings of this study on the importance of Loss Aversion. Similarly, the Framing effect, which refers to the way information is presented to investors, is highlighted as influential by Othman(2024), indicating that investors are affected by the framing of potential outcomes, which supports the observed significant effect of Framing in this study.

The study's findings on the moderating effects of demographics such as education and income on bias are also supported by previous research. Uhr et al.(2021)found that individuals with higher financial literacy and income are less susceptible to biases such as Framing, because they have better self-control and analytical skills, a finding that is consistent with the significant moderation of education/income on biases observed here. Furthermore, the limited impact of gender and age as moderators on biases other than herding resonates with Bibi(2021), who noted that demographic factors such as self-attribution bias and illusion of control have varying impacts across age and gender, but may not drastically alter the influence of most biases on investment decisions. The study's insights contribute to understanding how individual demographics selectively interact with behavioral biases, supporting previous research on bias susceptibility among individual investors.

4. CONCLUSION

This study concludes that behavioral biascognitive bias influences investment decisions, there are differences in cognitive bias and character in each investor group based on gender, age moderated by education and income and have a significant impact on individual investment decisions among investors in Indonesia. Specifically, the main hypothesis is accepted, indicating that Herding, Loss Aversion, Framing, all play an important role in shaping investment choices. They have a positive impact on investment decisions by influencing how investors perceive risk, process information, and evaluate gains and losses.

By using the estimation of moderation-moderation effects, the results show that Education has significantly moderated gender moderation on the influence of cognitive bias on investment decisions. There is an interaction with the accepted hypothesis because each gender that invests will be influenced by the high and low levels of Education and Income. Gender moderation does not significantly moderate gender moderation on the influence of cognitive bias on investment decisions and there is no interaction with the rejected hypothesis because income is a benchmark in deciding on investment.

While in the Age Education Factor has significantly moderated the moderation of age on the influence of cognitive bias on investment decisions, there is interaction and the hypothesis is accepted because the higher the age, the higher the knowledge and education so that this can help the calculation and safer investment decisions both in terms of return, risk and time period in investing, then Income does not significantly moderate the moderation of age i on the influence of cognitive bias on investment decisions, there is no interaction and the hypothesis is rejected because income is a benchmark in investing while age is not a benchmark in investing, which means that high income does not depend on young or old age where investment decisions depend on financial

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