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**The Impact of Financial Literacy on Students' Behavioral Biases in Financial
Decision-Making in Kazakhstan (Astana Focus)**

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Abstract

This research aims to explore how financial literacy relates to decision-making biases among young adults in Astana, Kazakhstan. It focuses on three biases: overconfidence (overestimating one's knowledge), loss aversion (fearing losses more than valuing gains), and present bias (preferring short-term rewards over long-term benefits). Data was collected through an online survey of 200 university students. Participants completed a standardized financial literacy test and behavioral tasks measuring these biases.

The analysis used ordinary least squares (OLS) regression models. Each model examined the effect of financial literacy on each bias while controlling for gender, age, academic major, and education level. Results show that higher financial literacy is significantly associated with lower overconfidence ($\beta = -0.740, p < .001$) and lower present bias ($\beta = -0.084, p = .033$). However, loss aversion appears unaffected by literacy levels ($\beta = 0.009, p = .823$).

Among demographic variables, gender, academic major and education level had significant effects. Male and Economics & Business students exhibited higher levels of overconfidence and present bias. In contrast, Humanities & Education students reported lower levels of overconfidence but higher levels of present bias. Graduate students showed significantly lower overconfidence compared to undergraduates.

These findings highlight the need to combine financial education with behavioral strategies. Future research should use longitudinal or experimental methods and more diverse samples to examine causal effects across different demographic groups.

***Keywords:* financial literacy, overconfidence bias, loss aversion, present bias, demographic factors.**

Table of contents

1. Introduction.....	4
2. Literature review.....	6
2.1 Theoretical Foundations.....	6
2.2 Financial Literacy: Definition and Global Perspective.....	7
2.3 Behavioral Biases in Financial Decision-Making.....	8
2.4 Relationship Between Financial Literacy and Behavioral Biases.....	10
2.5 Demographic Variables and Their Impact on Biases.....	11
3. Research Methodology.....	13
4. Results and Analysis.....	15
4.1 Descriptive Statistics.....	15
4.2 Correlation Analysis.....	16
4.3 Regression Analysis.....	17
4.4 Diagnostic Checks.....	32
5. Discussion and Conclusions.....	35
Summary of Key Findings.....	35
Conclusion.....	37
References.....	38
Appendices.....	43

1. Introduction

1.1 Background and context

Financial literacy plays an essential role in making informed financial decisions. It refers to the ability to make sound choices in areas such as saving, budgeting, and investing. The growing importance of this financial knowledge, now more than ever before, is driven by an increasing variety and complexity of financial products, longer life expectancies, low levels of financial knowledge, and other evolving trends (OECD, 2005). Among these trends, the most concerning is the widespread lack of basic financial literacy globally.

Only about 33% of people worldwide are estimated to be financially literate, according to S&P (Lusardi & Klapper, 2015). Numerous studies have shown that financial illiteracy leads individuals to make biased and poor financial decisions (Aprea et al., 2016). A research by Chen and Volpe (1998) found that most students lacked sufficient knowledge about personal finance and showed a need for further education in this area.

In this context, it is important to recognize that financial knowledge alone does not fully determine how people make financial decisions. Psychological factors, particularly behavioral biases, also play a considerable role in influencing financial choices. This study focuses on three common biases: overconfidence, loss aversion, and present bias. The first bias, overconfidence, describes the tendency to overrate one's knowledge or abilities. The second, known as loss aversion, refers to the tendency to avoid risks and prefer safer options. The third one, present bias, reflects a preference for quick rewards instead of planning for the future.

By combining financial literacy and behavioral biases, the research provides a better understanding of the financial decision-making process of students.

1.2 The Case of Astana and Kazakhstan

In Kazakhstan, only 45% of students are financially literate (Mukan et al., 2023). This growing gap in financial knowledge should be a serious concern for the government, as the younger generation is

increasingly unable to make sound financial decisions. This issue not only affects individuals but also poses a threat to the national economy.

In conclusion, low financial literacy among students contributes to irrational decision-making and increases susceptibility to behavioral biases. Enhancing students' understanding of financial concepts can help them avoid such biases and make more informed choices.

1.3 Relevance of the Study

This study will be useful for policymakers and economists of Kazakhstan, researchers, teachers and students. Economists can use our research results to better understand the role that financial literacy plays when financial behavioral biases are present. They can also assist policymakers in creating laws and programs that will improve the population's financial well-being. Researchers can advance research in behavioral finance, teachers can create courses to remove biases, and students can gain a better understanding of how financial literacy interacts with biases.

1.4 Purpose

This study aims to identify how financial literacy influences behavioral biases among university students. To explore this, the research will assess the financial literacy level among students in Astana, identify specific biases affecting their decision-making processes, and analyze the connection between financial literacy and behavioral biases. In addition, the study will consider demographic factors such as age, gender, and level of education as moderating variables in the relationship between financial literacy and behavioral biases.

Therefore, the research questions of the study are as follows:

1. How does the level of financial literacy influence the presence of behavioral biases among students?
2. Which behavioral biases persist regardless of the level of financial literacy?
3. What demographic factors influence the relationship between financial literacy and behavioral biases?

2. *Literature review*

2.1 Theoretical Foundations

The study will reference two key theoretical frameworks: Behavioral Finance Theory and Prospect Theory. These are widely used frameworks in existing literature on the research topic and will help in understanding the financial behavior of students during the research process.

Behavioral Finance Theory is a framework that explains how psychological factors influence financial decision-making (Hirshleifer, 2015). In contrast to traditional financial theories, which assume that individuals consistently make rational decisions, behavioral finance acknowledges that emotions and cognitive biases frequently influence decision-making, even among those with strong financial knowledge (Thaler, 2016). Despite having financial knowledge, this theory helps explain why university students may still fall victim to biases such as loss aversion, overconfidence, and present bias. It highlights the gap between what individuals know (financial literacy) and how they actually behave when faced with financial decisions, especially under emotional or cognitive influence (Shefrin & Statman, 2000). Using this perspective, the study examines how financial literacy interacts with behavioral biases and investigates whether demographic factors, such as age and gender, affect this relationship. In summary, behavioral finance provides a solid framework for understanding why increasing financial literacy alone may not always lead to better financial decisions due to the persistence of psychological biases (Thaler, 2016).

Prospect Theory is a psychological theory that explains why people often make irrational decisions when choosing between two outcomes with similar expected values. According to the theory, under conditions of risk and uncertainty, individuals prefer guaranteed gains over those associated with higher risk.

One of the key principles of Prospect Theory is loss aversion. This means that people feel the pain of losses more strongly than the satisfaction of equal gains. As a result, individuals are more likely to choose a guaranteed outcome over a larger, but uncertain, one.

For example, consider two options:

- Option A: A 50% chance to win \$1,000, and a 50% chance to win nothing.
- Option B: A guaranteed win of \$450

(Kahneman & Tversky, 1979). Most people tend to choose Option B, although the value of Option A is higher. This behavior demonstrates how the fear of loss influences decision-making more than the potential for gain. Experiments with students have also shown evidence of loss aversion during decision-making tasks, supporting the theory's relevance across different populations (Schmidt & Traub, 2002).

In conclusion, understanding loss aversion as outlined in Prospect Theory helps individuals make more rational decisions by understanding the biases that typically influence human behavior. This awareness allows people to reconsider their choices and avoid repeating past mistakes.

2.2 Financial Literacy: Definition and Global Perspective

In today's world, basic financial knowledge is essential. Financial literacy is a person's capability to understand saving, budgeting, investing, borrowing, long-term planning, and to make judicious financial decisions (Lusardi & Klapper, 2015). Nevertheless, overall financial literacy remains low.

According to a global survey conducted by S&P in 2015, only about 33% of people worldwide are financially literate. The results indicate that financial literacy rates in developing countries are below 40%, while developed countries perform better (Lusardi & Klapper, 2015). These statistics highlight that more than half of the global population lacks adequate financial education.

This issue is not limited to only adults. Young adults and students also exhibit low levels of financial literacy. A study conducted in the U.S. demonstrated overall "low levels of financial literacy (39.5%), particularly among female (26%), minority (24%) and first-generation (33%) students." (Artavanis & Karra, 2021).

Studies from Turkey and Indonesia confirm these patterns: male students and those in business fields perform better, while overall student financial literacy is low (Sarigül, 2014; Nidar & Bestari, 2012).

Financial literacy in Astana and Kazakhstan

Kazakhstan is also not exempt from the issue of low financial literacy. According to a recent OECD assessment, Kazakhstani students scored lower on financial literacy tests than their peers in Western countries. They struggled with understanding fundamental financial concepts such as saving, budgeting, interest rates, and others (Dyussenov & Zhumagozhayev, 2024). This finding is further supported by another study, which revealed that only 45% of students in Kazakhstan are financially literate (Mukan et al., 2023).

2.3 Behavioral Biases in Financial Decision-Making

Behavioral biases impact financial decision-making by influencing how individuals process information and assess risks. The most prevalent biases include:

Loss Aversion

Loss aversion was introduced by Kahneman and Tversky (1979), and describes how people perceive losses as more important than comparable gains under uncertainty. This behavioral bias affects both risky and risk-free financial decisions. Many individuals choose certainty, even when the risk may give them a better outcome in the long run (Sokol-Hessner & Rutledge, 2018). For young people, including college students, loss aversion plays a big role in financial decision-making. Research shows that college students have difficulty making choices when there is a possibility of losing money - they exhibit loss-averse behavior (Brooks & Zank, 2005).

Overconfidence

Overconfidence is a cognitive bias that affects financial decision-making, leading people to overestimate their ability to predict and control outcomes. It influences investment choices, corporate

decisions, and even academic expectations. Pikulina et al. (2017) found that overconfident investors trade too much, mistaking luck for skill, which lowers portfolio performance. Malmendier and Taylor (2015) also argue that this bias causes market inefficiencies as investors misjudge their abilities.

This pattern is not limited to financial markets. Magnus and Peresetsky (2018) found that students often overestimate their academic performance, a habit that extends to financial decisions. Molteni and Chan (2015) observed that students tend to believe they are more skilled in research than they are, leading to financial mistakes such as overspending, poor investments, or taking on too much debt. Magnus and Peresetsky (2018) further show that overconfidence distorts self-assessment, just as it leads people to overestimate their financial skills and risks.

Present bias

Another of the most common types of biases that influence people's financial decisions is present bias. Hardisty et al. (2013) stated that “Present bias is a tendency of people being impatient and simply wanting to have gains immediately, above and beyond any material reasons” (p. 348). This cognitive bias significantly impacts financial behavior, including savings, borrowing, and spending patterns. Individuals exhibiting present bias are more likely to overspend, accumulate high-interest debt, and struggle with long-term financial planning (Xiao & Porto, 2019).

The occurrence of present bias can be explained through the theory of hyperbolic discounting, under which people apply a higher discount rate for future rewards compared to immediate rewards, thereby making impulsive financial decisions (Cheung et al., 2021). The bias is most evident in procrastination regarding financial responsibilities, such as late payment of credit cards or the failure to save for retirement (Brown & Previtro, 2014). Furthermore, researches demonstrate that individuals with present-biased preferences hold a greater extent of credit card debt since they exhibit a bigger preference for consumption in the short term at the cost of financial security (Kuchler & Pagel, 2018).

2.4 Relationship Between Financial Literacy and Behavioral Biases

Loss aversion

The relation between loss aversion and financial literacy is complex. On one hand, according to most research, higher financial literacy could reduce loss aversion. People who are financially literate can control their emotional responses to potential losses more and better understand financial risks than those who are illiterate in finance (Aren & Zengin, 2016). Nonetheless, recent findings indicate that greater financial literacy can sometimes lead to unexpected results. Specifically, higher financial literacy may amplify cognitive biases, including loss aversion, depending on individual characteristics and particular decision-making contexts (Costa et al., 2020; Gerth et al., 2021). For example, Gerth et al. (2021) found that even financially literate individuals remain susceptible to loss aversion. This finding emphasizes that financial knowledge alone does not fully eliminate emotional reactions to potential losses.

Overconfidence

In the context of behavioral finance, many researchers have explored the relationship between overconfidence and financial literacy. A study by De Zwaan et al. (2017) found that higher financial literacy tended to lower students' confidence in their ability to make good financial decisions. Another study on this topic found that individuals with high overconfidence often had lower financial literacy and engaged in riskier financial behaviors (Asaad, 2015). A similar pattern was observed in research on athletes' financial literacy, where data revealed that despite having limited financial knowledge, athletes exhibited high self-confidence (McCoy et al., 2019). These findings suggest that individuals with low financial literacy but excessive self-confidence may be more likely to make significant financial mistakes, highlighting the importance of improving financial literacy in society.

Present bias

A lot of research conducted on the connection between financial literacy and present bias resulted in significant impact of the first term on reducing the second. Wang and John (2024) stated that "Financial literacy emerges as the foremost determinant or predictor of present bias when considering

various factors”(p. 5). They mostly were conducted in the United States of America households. Our research aims to explore student samples of Kazakhstan, Astana city.

2.5 Demographic Variables and Their Impact on Biases

Loss Aversion

Loss aversion varies based on demographic characteristics, like gender, age and education degree. Women are loss-averse to a larger extent than men because of differences in risk attitude and emotional responses to losses (Brooks & Zank, 2005). The more aged the person, the more he is loss-averse regarding prospective losses owing to decreasing risk tolerance and changing financial priorities (Fisher & Montalto, 2010). People with a higher degree of education exhibit a lower degree of loss aversion, as analytical skills help in overriding emotional biases (Fisher & Montalto, 2010).

Present Bias

Present bias is particularly relevant to young adults, who have greater impulsivity and lower self-control and are thus more susceptible to short-term financial temptations (Xiao & Porto, 2019). It makes it applicable to the sampling group of our research - students. But the literature also shows that present bias does not necessarily decline with age linearly. While young adults lack self-control, middle-aged people could also exhibit present bias in some financial behaviors, such as debt repayment and investment (Xiao & Porto, 2019). This complex relationship makes it an interesting topic to research and leaves questions to discover.

Overconfidence

It is important to examine the relationship between overconfidence and demographic factors, as numerous researchers have explored this topic to identify potential links. Prims and Moore (2017) explored the relationship between overconfidence and age. Their findings demonstrate that individuals tend to overrate their own knowledge as they get older. However, there is limited evidence to suggest that overplacement (the tendency to believe oneself is better than others) and overestimation (overestimating one’s actual abilities) also increase with age.

Regarding gender and education level, research indicates that men are generally more overconfident than women. Additionally, overconfidence tends to increase with education level and investment experience (Mishra & Metilda, 2015).

2.6 Literature Gap

A significant amount of research on the topic of financial literacy and behavioural biases in finance was done in the countries like the USA, Turkey, Indonesia, UAE etc., but there is a lack of studies on the relationship between these two concepts all together, especially in Kazakhstan. Furthermore, the impact of demographic factors, like age, gender, major and educational level, on dependence has not been thoroughly examined in these conditions.

3. Research Methodology

This study uses a quantitative approach to investigate how financial literacy interacts with overconfidence, present, and loss aversion biases in financial decision-making among university students in Astana. Data were collected via an online Google Forms survey. After removing incomplete or inconsistent responses, 200 valid questionnaires were used for analysis.

The survey included three main sections. The first section collected demographic information (age, gender, education level, and academic major). The second section assessed financial literacy using Lusardi and Mitchell's (2011) "Big Five" questions. These questions assess basic financial concepts, including compound interest, inflation, and risk diversification. Respondents received one point per correct answer, with a maximum score of five.

The third section measured behavioral biases on five-point Likert scales. Overconfidence was defined as the difference between self-rated and actual financial knowledge, based on the method by Michailova and Katter (2014). Present bias was assessed through choices between immediate and delayed rewards, adapted from Xiao and Porto (2019). Loss aversion was measured using hypothetical risk scenarios based on Prospect Theory and the FinaMetrica risk-preference items (Kahneman & Tversky, 1979; FinaMetrica, 2020). The full questionnaire is provided in the Appendices.

The following hypotheses were formulated:

H1: Higher financial literacy is associated with a lower level of overconfidence bias.

H2: Higher financial literacy is associated with a lower level of present bias.

H3: Higher financial literacy is associated with a lower level of loss aversion bias.

H4: Overconfidence bias persists regardless of financial literacy levels.

H5: Present bias persists regardless of financial literacy levels.

H6: Loss aversion bias persists regardless of financial literacy levels.

H7: Demographic factors (e.g., gender, age, academic major, education) influence the level of overconfidence bias among students.

H8: Demographic factors influence the level of present bias among students.

H9: Demographic factors influence the level of loss aversion bias among students.

The initial data analysis included descriptive statistics and Pearson correlations to examine associations between literacy and biases. Multiple linear regressions were then used to test the effect of financial literacy on each bias while controlling for gender, age, major, and education. Regression model:

$$Y_i = \beta_0 + \beta_1 \text{Fin. Literacy} + \beta_2 \text{Gender}_i + \beta_3 \text{Age}_i + \beta_4 \text{Major}_i + \beta_5 \text{Educ}_i + \varepsilon_i$$

where Y_i represents the dependent variable (each bias), ε_i = random error term.

Diagnostic checks confirmed that all regressions met the required OLS assumptions.

4. Results and Analysis

This section presents the results in three parts: descriptive statistics, correlation analysis, and regression analysis.

4.1 Descriptive Statistics

The survey included 200 participants ranging from under 18 to 25 and older. The sample showed a gender imbalance, with 69.5% female and 30.5% male. Most participants (73.5%) were aged 18–22, and 74.5% were undergraduate students. Table 1 presents detailed demographic characteristics, including academic majors and education levels.

Table 1. Demographic Distribution of Participants (N = 200)

Characteristic	Category	Frequency	Percentage
Gender	Male	61	30.5%
	Female	139	69.5%
Age	< 18	19	9.5%
	18-22	147	73.5%
	23-24	31	15.5%
	25+	3	1.5%
Education	Undergraduate	149	74.5%
	Graduate	46	23%
	Doctorate	5	2.5%
Major	Economics & Business	101	50.5%
	IT & Data	15	7.5%
	Humanities & Education	35	17.5%
	Creative Arts	3	1.5%
	Medicine & Pharmacy	13	6.5%
	Engineering & Tech	5	2.5%
	Law & Public Admin	22	11%
	Science & Research	5	2.5%
	Sports & Physical Culture	1	0.5%

Note. $N = 200$. Percentages are rounded to one decimal

Participants demonstrated moderate financial literacy, with a mean score of 2.96 (SD = 1.38) on a 5-point scale. Overconfidence bias averaged 0.62 (SD = 1.33), suggesting a slight tendency to overestimate abilities. Present bias was moderate (M = 2.61, SD = 0.71), while loss aversion bias was considerably higher (M = 3.58, SD = 0.68), indicating participants were more sensitive to potential losses.

Table 2. Descriptive Statistics for Key Variables (N = 200)

Variable	Mean	Std. Dev.	Min	Max
Financial Literacy	2.96	1.384915	0.0	5
Overconfidence Bias	0.622	1.332665	-2.2	5
Present Bias	2.612	0.7147098	1.0	5
Loss Aversion Bias	3.58	0.6884547	1.8	5

Note. $N = 200$. Scores are on five-point scales.

4.2 Correlation Analysis

Pearson's correlation (Table 3) indicates a strong negative relationship between financial literacy and overconfidence bias ($r = -0.73, p < 0.001$), supporting Hypothesis 1. A weaker yet significant inverse correlation appears for present bias ($r = -0.21, p = 0.003$). No significant relationship was found between literacy and loss aversion ($r = 0.06, p = 0.372$).

Table 3. Correlations Between Financial Literacy and Behavioral Biases (N = 200)

Variables	Correlation (r)
Overconfidence	-0.73***
Present Bias	-0.21***
Loss Aversion	0.06

Note. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.3 Regression Analysis

4.3.1 Overconfidence Bias Model

Regression results (Table 4) show a significant negative relationship between financial literacy and overconfidence ($\beta = -0.74$, $p < .001$), supporting H1. Holding all other variables constant, a one-point increase in financial literacy reduces 0.74 points in overconfidence. Figure 1 shows a clear downward trend between financial literacy and overconfidence.

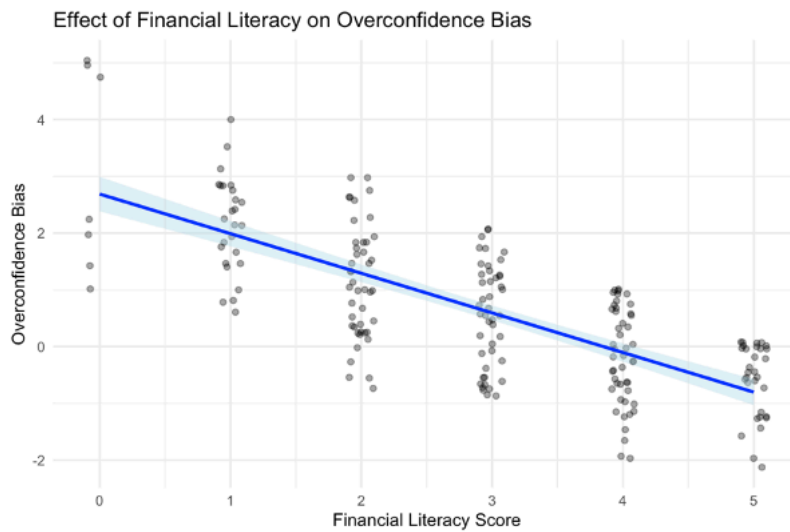


Figure 1. Effect of Financial Literacy on Overconfidence Bias

Overconfidence Bias Regression:

$$Overconfidence_i = \beta_0 + \beta_1 Fin. Literacy_i + \beta_2 Gender_i + \beta_3 Age_i + \beta_4 Major_i + \beta_5 Educ_i + \varepsilon_i$$

Table 4. Regression Coefficients for Overconfidence Bias Model

Variable	Coefficient (SE)	t	p
Intercept	2.980*** (0.183)	16.329	<.001
Financial Literacy (Fin. Literacy)	-0.740 *** (0.048)	-15.355	<.001
Gender: Male	0.486 (0.140)	3.465	<.001
Age: 23–24	-0.022 (0.229)	-0.096	0.923

Age: 25+	-0.711 (0.524)	-1.358	0.176
Age: Under 18	0.168 (0.218)	0.772	0.441
Major: Creative Arts	0.339 (0.530)	0.638	0.524
Major: Engineering & Tech	0.271 (0.397)	0.684	0.495
Major: Humanities & Education	-0.573*** (0.176)	-3.261	0.001
Major: IT & Data	-0.430 (0.254)	-1.692	0.092
Major: Law & Public Admin	-0.413* (0.206)	-2.01	0.046
Major: Medicine & Pharmacy	-0.169 (0.255)	-0.66	0.510
Major: Science & Research	-0.507 (0.444)	-1.143	0.255
Major: Sports & Physical Culture	-1.178 (0.992)	-1.188	0.236
Education: Doctorate	-0.608 (0.493)	-1.234	0.219
Education: Graduate	-0.469** (0.191)	-2.452	0.015
R ² = 0.620, Adjusted R ² = 0.589, F(15, 184) = 19.99, <i>p</i> < .001, Residual Std. Error = 0.8546			

Note. *N* = 200. β = unstandardized coefficient; *SE* = standard error.

Demographic factors directly influence overconfidence levels, supporting H7. Male students are significantly more overconfident than females ($\beta = 0.486, p = .001$).

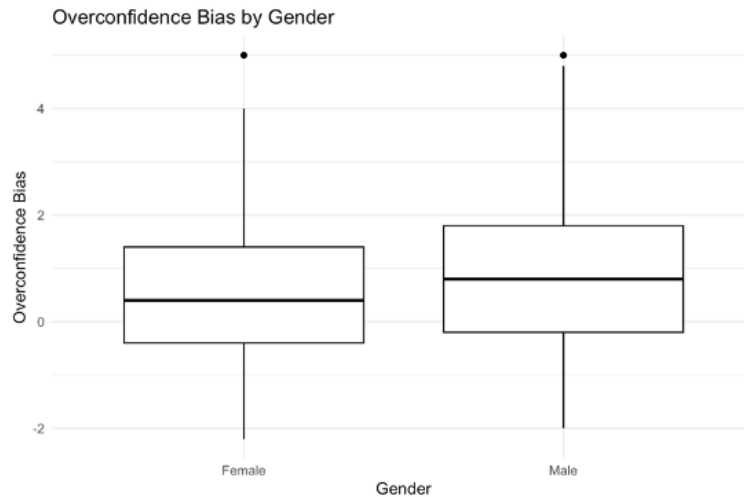


Figure 2. Overconfidence Bias by Gender

Figure 2 indicates that males report higher overconfidence than females.

Students majoring in Humanities & Education ($\beta = -0.573, p = 0.001$) and Law & Public Administration ($\beta = -0.413, p = .046$) showed lower overconfidence compared to those in Economics & Business.

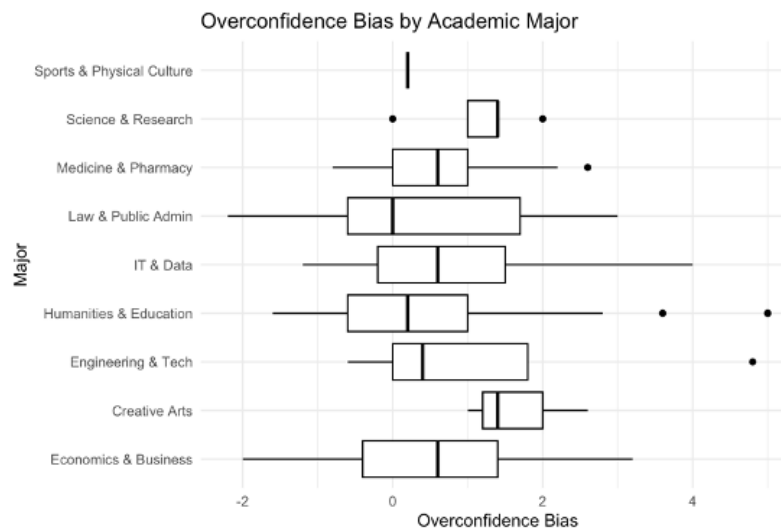


Figure 3. Overconfidence Bias across Academic Majors

Figure 3 highlights high overconfidence among Economics & Business students.

Compared to Undergraduate students, Graduate students report lower overconfidence ($\beta = -0.47$, $p = .015$), while Doctorate students show no statistically significant difference ($\beta = -0.61$, $p = .219$).

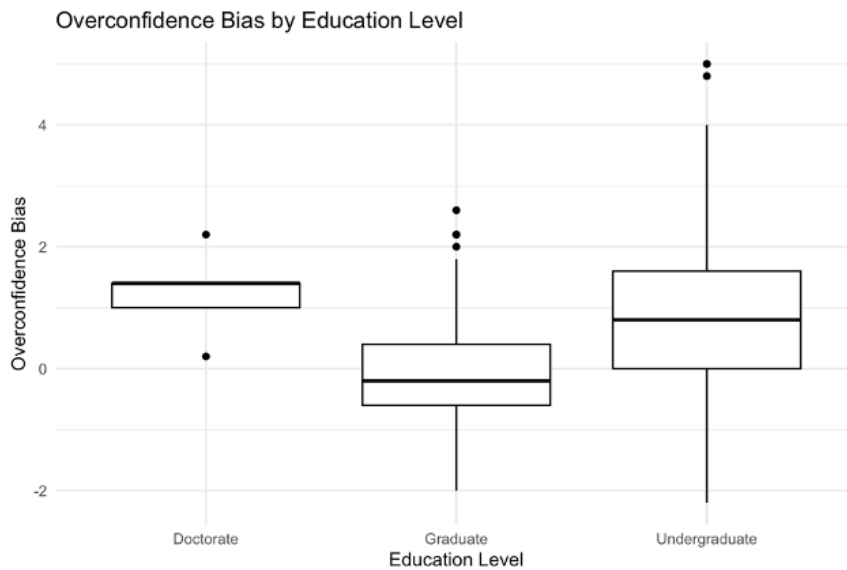


Figure 4. Overconfidence Bias by Education Level

Figure 4 suggests undergraduates are more overconfident than graduate students.

Interaction Model: Financial Literacy × Gender

To test whether the literacy effect differs by gender, Equation 1 was extended with an interaction term:

$$\begin{aligned}
 \text{Overconfidence}_i = & \beta_0 + \beta_1 \text{Fin. Literacy}_i + \beta_2 \text{Gender}_i + \beta_3 (\text{Fin. Literacy}_i \times \text{Gender}_i) + \beta_4 \text{Age}_i \\
 & + \beta_5 \text{Major}_i + \beta_6 \text{Educ}_i + \varepsilon_i
 \end{aligned}$$

An interaction model revealed a non-significant interaction term ($\beta = -0.146$, $p = .135$, Table 5). This suggests that financial literacy reduces overconfidence similarly for both men and women. Males remain consistently more overconfident at all financial literacy levels (Figure 5). However, because overconfidence declines as financial literacy rises for both genders, H4 (persistence) is not supported.

Table 5. Interaction Model Coefficients for Overconfidence Bias

Variable	Coefficient (SE)	t	p
Intercept	2.839 (0.205)	13.88	<.001
Financial Literacy	-0.693 (0.057)	-12.123	<.001
Gender: Male	0.929 (0.326)	2.847	0.005
Age: 23–24	-0.037 (0.229)	-0.163	0.870
Age: 25+	-0.658 (0.523)	-1.257	0.210
Age: Under 18	0.187 (0.218)	0.859	0.391
Major: Creative Arts	0.386 (0.529)	0.728	0.467
Major: Engineering & Tech	0.156 (0.403)	0.388	0.699
Major: Humanities & Education	-0.573 (0.175)	-3.271	0.001
Major: IT & Data	-0.420 (0.254)	-1.656	0.099
Major: Law & Public Admin	-0.434 (0.205)	-2.114	0.036
Major: Medicine & Pharmacy	-0.123 (0.256)	-0.482	0.631
Major: Science & Research	-0.469 (0.443)	-1.058	0.291
Major: Sports & Physical Culture	-1.231 (0.989)	-1.245	0.215
Education: Doctorate	-0.660 (0.492)	-1.341	0.182
Education: Graduate	-0.448 (0.191)	-2.348	0.020
Financial Literacy × Gender: Male	-0.146 (0.097)	-1.503	0.135
$R^2 = 0.624$, Adjusted $R^2 = 0.592$, $F(16, 183) = 19.01$, $p < .001$, Residual Std. Error = 0.8517			

Note. $N = 200$. β = unstandardized coefficient; SE = standard error.

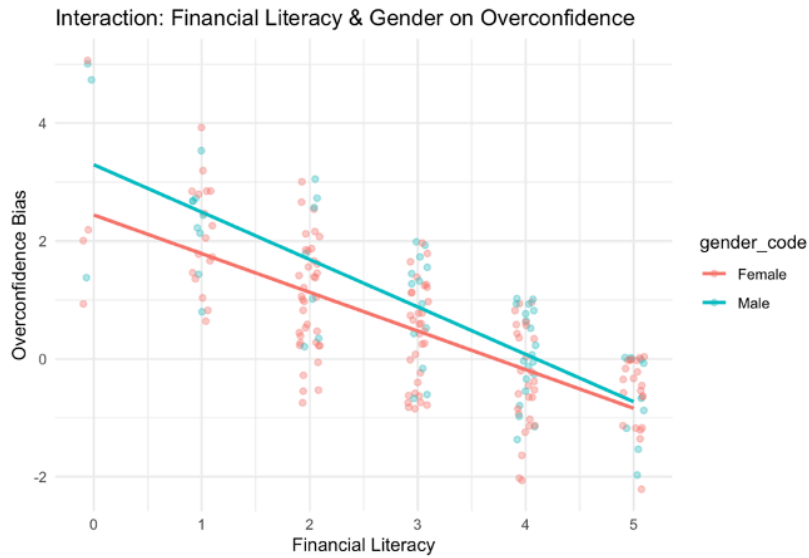


Figure 5. Interaction Effect of Financial Literacy and Gender on Overconfidence Bias

Figure 5 shows that both genders experience declines in overconfidence with rising financial literacy, but males maintain higher overall scores.

4.3.2 Present Bias Model

Financial literacy weakly but significantly reduces present bias ($\beta = -0.084, p = .033$, Table 6), providing partial support for H2. Each additional literacy point lowers present bias by 0.084.



Figure 6. Effect of Financial Literacy on Present Bias

Figure 6 illustrates a slight decline in present bias with higher financial literacy.

Present Bias Regression:

$$Present\ Bias_i = \beta_0 + \beta_1 Fin. Literacy + \beta_2 Gender_i + \beta_3 Age_i + \beta_4 Major_i + \beta_5 Educ_i + \varepsilon_i$$

Table 6. Regression Coefficients for Present Bias Model

Variable	Coefficient (SE)	t	p
Intercept	2.683 (0.148)	18.132	<.001
Financial Literacy	-0.084* (0.039)	-2.152	0.033
Gender: Male	0.094 (0.114)	0.829	0.408
Age: 23–24	0.256 (0.186)	1.38	0.169
Age: 25+	0.241 (0.425)	0.568	0.571
Age: Under 18	-0.081 (0.177)	-0.459	0.647
Major: Creative Arts	-0.286 (0.430)	-0.666	0.506
Major: Engineering & Tech	0.394 (0.322)	1.226	0.222
Major: Humanities & Education	0.325* (0.142)	2.283	0.024
Major: IT & Data	0.056 (0.206)	0.272	0.786
Major: Law & Public Admin	0.311 (0.167)	1.867	0.063
Major: Medicine & Pharmacy	-0.136 (0.207)	-0.659	0.511
Major: Science & Research	0.063 (0.360)	0.175	0.861
Major: Sports & Physical Culture	0.290 (0.804)	0.361	0.718
Education: Doctorate	0.501 (0.400)	1.252	0.212

Education: Graduate	0.026 (0.155)	0.165	0.869
R ² = 0.131, Adjusted R ² = 0.060, F(15, 184) = 1.85, p = 0.031, Residual Std. Error = 0.693			

Note. N = 200. β = unstandardized coefficient; SE = standard error.

Gender is not significant ($\beta = 0.094, p = .408$). Humanities & Education majors, however, show higher present bias than Economics & Business ($\beta = 0.325, p = .024$).

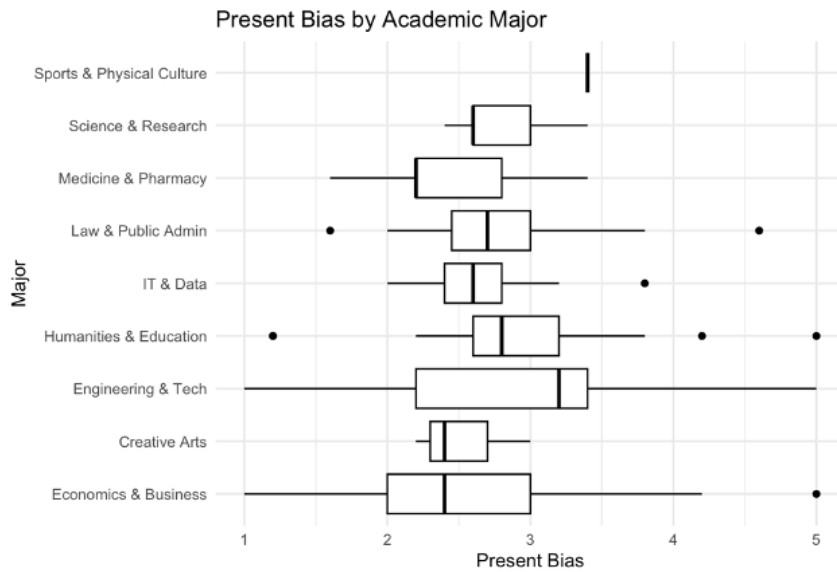


Figure 7. Present Bias across Academic Majors

Figure 7 shows that Humanities majors score higher on present bias than Economics & Business students.

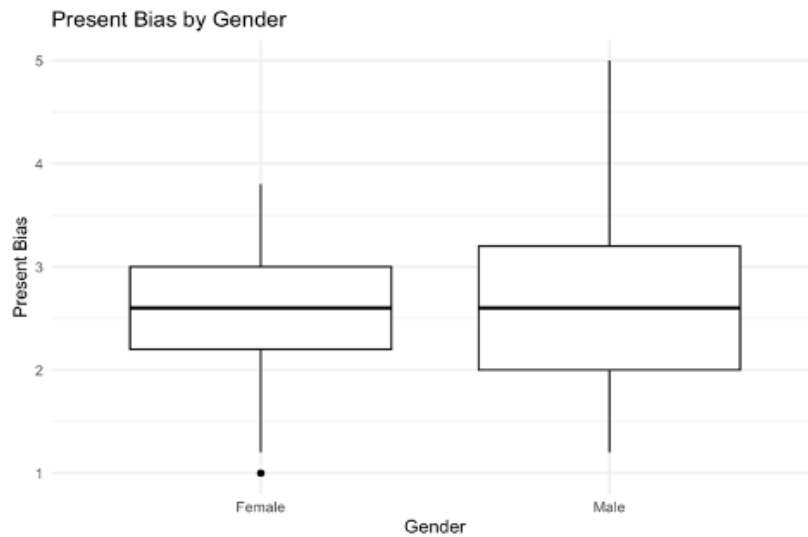


Figure 8. Present Bias by Gender

Figure 8 shows similar levels of present bias for both genders, with slightly greater variability among males

Regarding education level, neither Graduate nor Doctorate students differ significantly from Undergraduates in terms of present bias ($\beta = 0.03, p = .869$ for Graduate; $\beta = 0.50, p = .212$ for Doctorate).

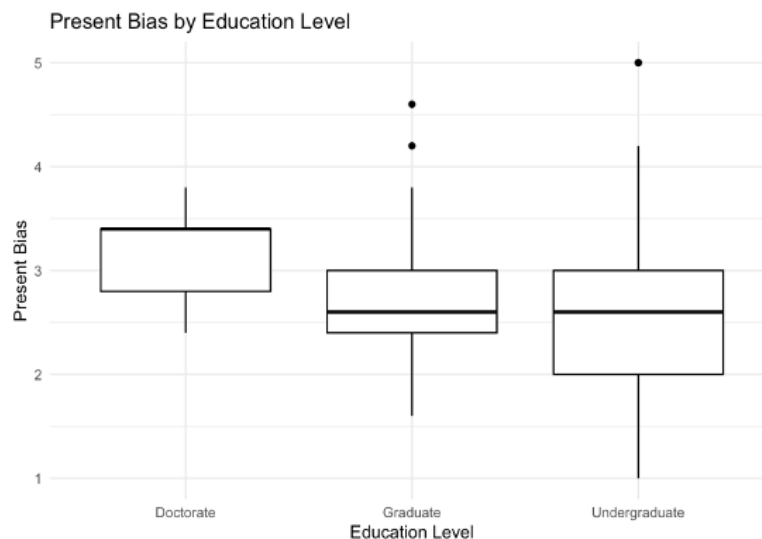


Figure 9. Present Bias by Education Level

Figure 9 shows small differences in present bias across education levels.

Present Bias Interaction Model:

$$Present\ Bias_i = \beta_0 + \beta_1 Fin. Literacy_i + \beta_2 Gender_i + \beta_3 (Fin. Literacy_i \times Gender_i) + \beta_4 Age_i + \beta_5 Major_i + \beta_6 Educ_i + \varepsilon_i$$

The interaction model (Table 7) shows a non-significant effect of financial literacy on present bias ($\beta = 0.010, p = .823$). However, there is a strong main effect of gender ($\beta = 0.989, p < .001$). This confirms H8, indicating that men exhibit significantly higher present bias than women. Additionally, a significant interaction between financial literacy and gender ($\beta = -0.294, p < .001$) suggests that as financial literacy increases, the gap in present bias between men and women narrows.

Table 7. Interaction Model Coefficients for Present Bias

Variable	Coefficient (SE)	t	p
Intercept	2.399*** (0.160)	14.952	<.001
Financial Literacy	0.010 (0.045)	0.224	0.823
Gender: Male	0.989*** (0.256)	3.862	<.001
Age: 23–24	0.226 (0.179)	1.258	0.210
Age: 25+	0.349 (0.410)	0.851	0.396
Age: Under 18	-0.043 (0.171)	-0.253	0.800
Major: Creative Arts	-0.192 (0.415)	-0.462	0.645
Major: Engineering & Tech	0.162 (0.316)	0.512	0.610
Major: Humanities & Education	0.325 (0.137)	2.369	0.019
Major: IT & Data	0.077 (0.199)	0.387	0.700
Major: Law & Public Admin	0.269 (0.161)	1.672	0.096

Major: Medicine & Pharmacy	-0.045 (0.201)	-0.224	0.823
Major: Science & Research	0.140 (0.347)	0.404	0.687
Major: Sports & Physical Culture	0.184 (0.776)	0.237	0.813
Education: Doctorate	0.396 (0.386)	1.025	0.307
Education: Graduate	0.067 (0.150)	0.445	0.657
Financial Literacy × Gender: Male	-0.294*** (0.076)	-3.866	<.001
R ² = 0.197, Adjusted R ² = 0.126, F(16, 183) = 2.80, p = 0.0005, Residual Std. Error = 0.668			

Note. N = 200. β = unstandardized coefficient; SE = standard error.

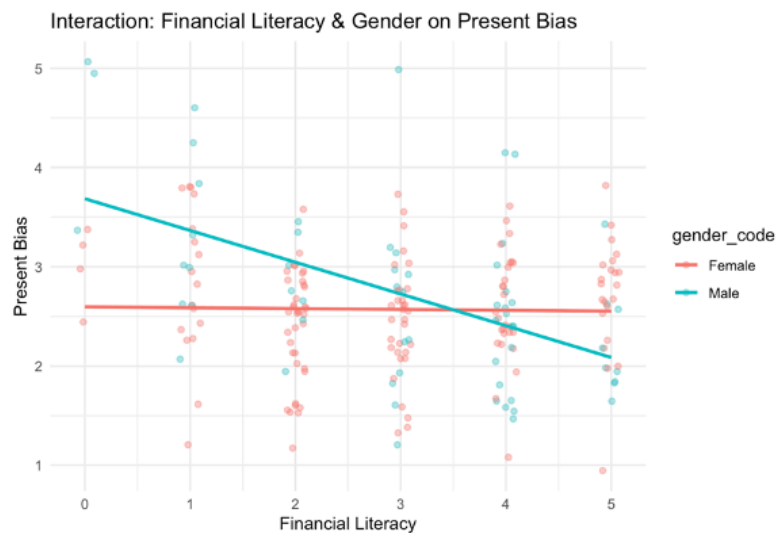


Figure 10. Interaction Effect of Financial Literacy and Gender on Present Bias

Figure 10 shows that the slope for males is steeper, indicating a stronger effect.

4.3.3 Loss-Aversion Bias Model

Neither financial literacy nor any demographic variable is significant (all $p > .10$), aligning with

H6.



Figure 11. Effect of Financial Literacy on Loss-Aversion Bias

Figure 11 shows no clear pattern between financial literacy and loss aversion.

Loss Aversion Bias Regression:

$$Loss\ Aversion\ _i = \beta_0 + \beta_1 Fin.\ Literacy + \beta_2 Gender_i + \beta_3 Age_i + \beta_4 Major_i + \beta_5 Educ_i + \epsilon_i$$

Table 8. Regression Coefficients for Loss-Aversion Bias Model

Variable	Coefficient (SE)	t	p
Intercept	3.632 (0.147)	24.782	<.001
Financial Literacy	0.009 (0.039)	0.224	0.823
Gender: Male	-0.045 (0.113)	-0.4	0.690
Age: 23–24	0.018 (0.184)	0.1	0.920
Age: 25+	-0.466 (0.421)	-1.109	0.269
Age: Under 18	-0.072 (0.175)	-0.409	0.683
Major: Creative Arts	-0.378 (0.426)	-0.889	0.375
Major: Engineering & Tech	-0.188 (0.318)	-0.591	0.555
Major: Humanities & Education	0.135	0.954	0.341

	(0.141)		
Major: IT & Data	-0.237 (0.204)	-1.163	0.246
Major: Law & Public Admin	-0.080 (0.165)	-0.484	0.629
Major: Medicine & Pharmacy	-0.201 (0.205)	-0.979	0.329
Major: Science & Research	-0.420 (0.356)	-1.179	0.240
Major: Sports & Physical Culture	0.647 (0.796)	0.812	0.418
Education: Doctorate	-0.651 (0.396)	-1.644	0.102
Education: Graduate	-0.011 (0.153)	-0.07	0.944
$R^2 = 0.081$, Adjusted $R^2 = 0.007$, $F(15, 184) = 1.09$, $p = 0.371$, Residual Std. Error = 0.686			

Note. $N = 200$. $\beta =$ unstandardized coefficient; $SE =$ standard error.

Economics & Business, IT & Data, and Humanities & Education students display the widest spread (Figure 12). Loss aversion scores are slightly higher and more variable among females than males (Figure 13). Undergraduates exhibit the greatest variability (Figure 14).

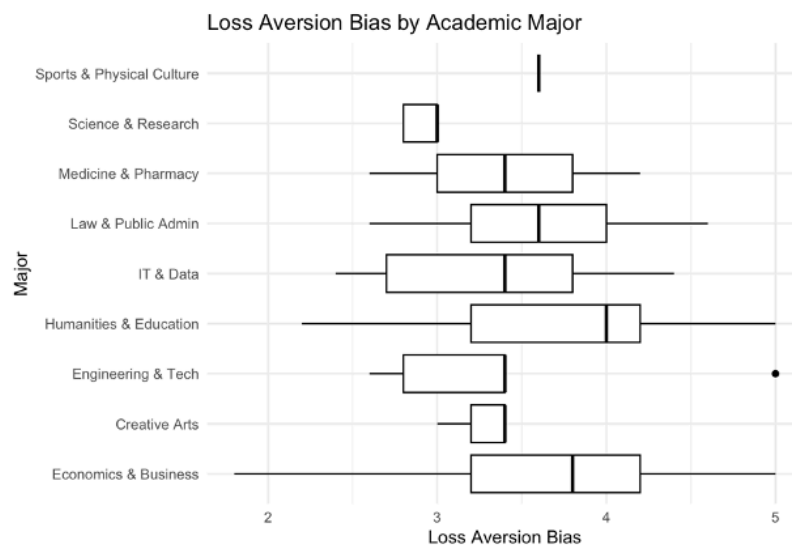


Figure 12. Loss-Aversion Bias across Academic Majors

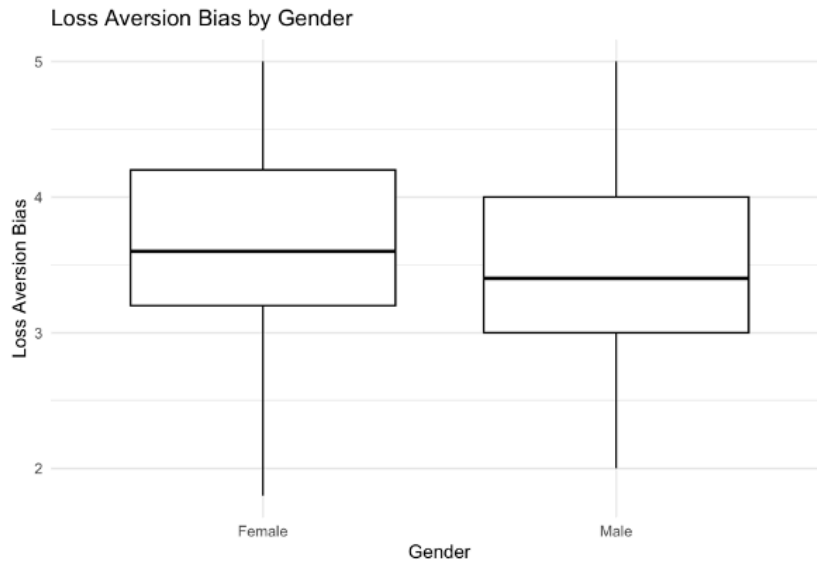


Figure 13. Loss-Aversion Bias by Gender

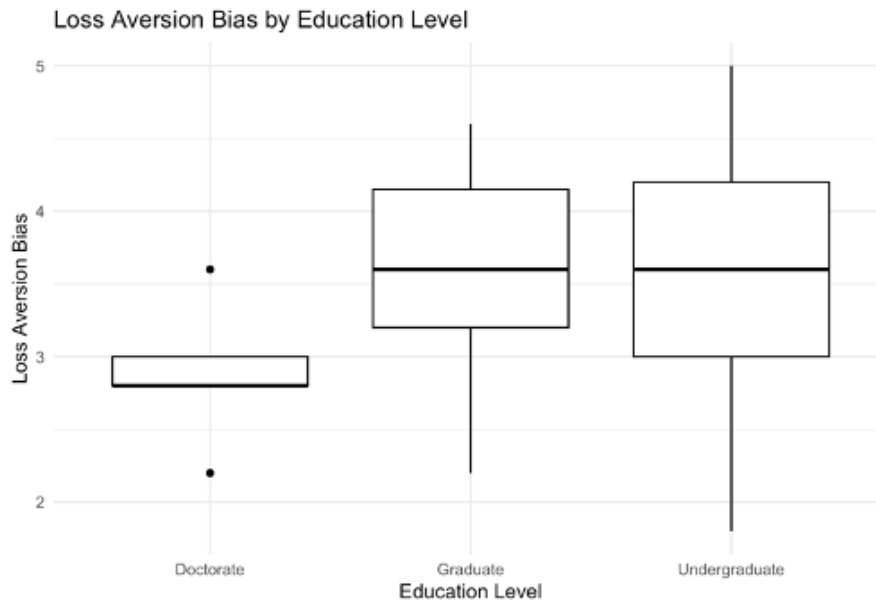


Figure 14. Loss-Aversion Bias by Education Level

Loss Aversion Bias Interaction Model:

$$\begin{aligned}
 \text{Loss Aversion}_i = & \beta_0 + \beta_1 \text{Fin. Literacy}_i + \beta_2 \text{Gender}_i + \beta_3 (\text{Fin. Literacy}_i \times \text{Gender}_i) + \beta_4 \text{Age}_i \\
 & + \beta_5 \text{Major}_i + \beta_6 \text{Educ}_i + \varepsilon_i
 \end{aligned}$$

There is a small but statistically significant interaction between financial literacy and gender ($\beta = -0.160, p = .040$, Table 9), indicating that higher literacy slightly reduces loss aversion among men. However, the effect size is small and the model explains little variance (Adj $R^2 = 0.024$).

Table 9. Interaction Model Coefficients for Loss Aversion

Variable	Coefficient (SE)	t	p
Intercept	3.477 (0.163)	21.284	<.001
Financial Literacy	0.060 (0.046)	1.313	0.191
Gender: Male	0.443 (0.261)	1.698	0.091
Age: 23–24	0.002 (0.183)	0.009	0.993
Age: 25+	-0.407 (0.418)	-0.975	0.331
Age: Under 18	-0.051 (0.174)	-0.293	0.770
Major: Creative Arts	-0.327 (0.423)	-0.773	0.441
Major: Engineering & Tech	-0.315 (0.322)	-0.98	0.329
Major: Humanities & Education	0.135 (0.140)	0.963	0.337
Major: IT & Data	-0.226 (0.202)	-1.116	0.266
Major: Law & Public Admin	-0.103 (0.164)	-0.626	0.532
Major: Medicine & Pharmacy	-0.151 (0.205)	-0.737	0.462
Major: Science & Research	-0.378 (0.354)	-1.069	0.287
Major: Sports & Physical Culture	0.589 (0.790)	0.746	0.457
Education: Doctorate	-0.708 (0.393)	-1.8	0.074
Education: Graduate	0.012	0.076	0.939

	(0.152)		
Financial Literacy × Gender: Male	-0.160* (0.077)	-2.07	0.040
R ² = 0.102, Adjusted R ² = 0.024, F(16, 183) = 1.31, p = 0.198, Residual Std. Error = 0.680			

Note. N = 200. β = unstandardized coefficient; SE = standard error.

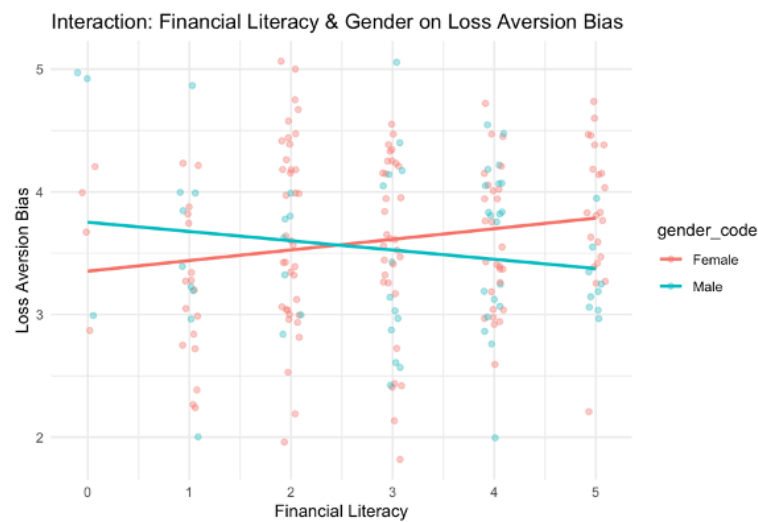


Figure 15. Interaction Effect of Financial Literacy and Gender on Loss-Aversion Bias

Figure 15 shows a slight reduction in loss aversion for men with higher literacy.

4.4 Diagnostic Checks

Diagnostic checks were conducted to validate the regression models. Four diagnostic plots (**Figures 16-18**) were produced in R with `par(mfrow = c(2, 2)); plot(model_x)` (Fox & Weisberg, 2019). The residuals versus fitted values plot indicated that linearity and homoscedasticity assumptions were met. The normal Q-Q plot showed that residuals were normally distributed. The scale-location chart showed constant variance across fitted values. The residuals versus leverage plot showed no influential outliers. Adjusted variance inflation factors in Table 10 were below 5, confirming there is no multicollinearity (James et al., 2021).

Table 10. Multicollinearity Diagnostics (Adjusted GVIF^{1/2}_D)

Predictor	Overconfidence	Present_bias	Loss_aversion
Financial literacy	1.1	1.12	1.08
Gender	1.07	1.09	1.05
Age	1.15	1.14	1.11
Major	1.06	1.07	1.04
Education	1.3	1.28	1.25

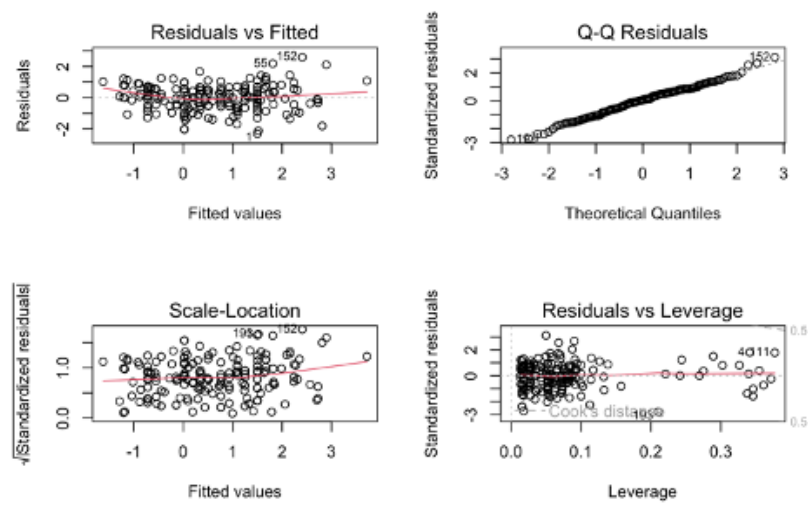


Figure 16. Diagnostic panels for the overconfidence regression

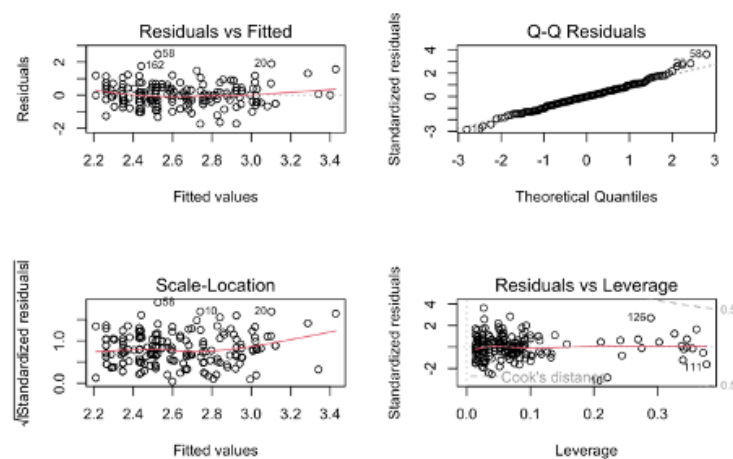


Figure 17. Diagnostic panels for the present bias regression

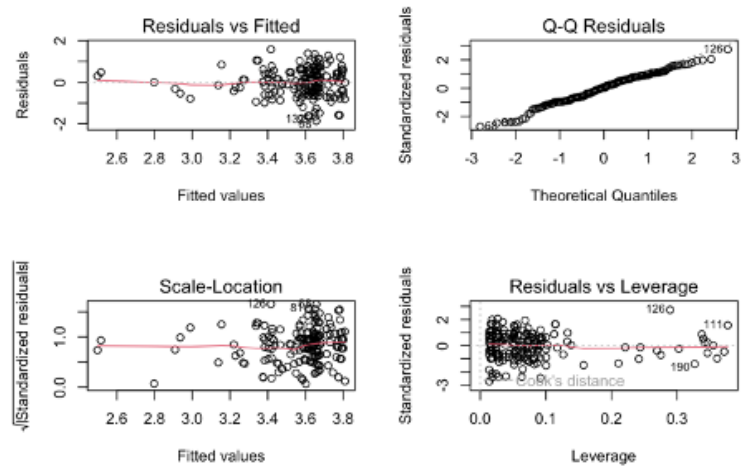


Figure 18. Diagnostic panels for the loss aversion regression

5. Discussion and Conclusions

Summary of Key Findings

Higher financial literacy significantly lowers overconfidence. A one-unit increase in literacy leads to a 0.740 decrease in overconfidence ($\beta = -0.740, p < .001$; Table 4). This supports H1 and rejects H4 (persistence). These findings align with prior research showing that people with lower levels of financial literacy tend to be more overconfident and take greater financial risks (Asaad, 2015; McCoy et al., 2019). This directly addresses RQ1 on overconfidence.

Male students demonstrated greater overconfidence than female students ($\beta = 0.486, p < .001$; Table 4). The reason why men in Kazakhstan are more prone to overconfidence than women may be the difference in the upbringing of different genders in Kazakh culture. Bendas (2002) wrote in her social study of Russian and Kazakh ethnic groups that people characterized by masculinity had a higher level of confidence.

Compared to undergraduate students, graduate students report significantly lower overconfidence ($\beta = -0.47, p = .015$). Students in Humanities & Education show less overconfidence than Economics & Business students ($\beta = -0.573, p = .001$). Law & Public Admin students also show lower overconfidence ($\beta = -0.413, p = .046$). This difference may be related to how a particular academic environment shapes students' views of their own financial abilities. These findings confirm H7 and answer RQ3 by identifying key demographic drivers of overconfidence. Also, it supports previous research on domain-specific confidence and cultural norms (Mishra & Metilda, 2015).

Financial literacy slightly but significantly reduces present bias. With each unit increase in literacy, present bias decreases by 0.084 ($\beta = -0.084, p = .033$; Table 6). This supports H2 and rejects H5. Men exhibit significantly higher present bias than women ($\beta = 0.989, p < .001$, Table 7), confirming H8. This could be due to societal norms that foster decisiveness in men, while women tend to be more patient and future oriented. Additionally, Humanities & Education majors show higher present bias than

Economics & Business majors ($\beta = 0.325, p = .024$). This may be due to the fact that Economics students have more opportunities for financial planning practice than Humanities students (Aprea et al., 2016). These findings address both RQ1 and RQ3.

Financial literacy does not significantly affect loss aversion ($\beta = 0.009, p = .823$, Table 8), rejecting H3 and confirming H6. This addresses RQ2 by showing that loss aversion persists regardless of financial literacy. Moreover, loss aversion showed no significant association with gender, age, major, or education, leading to rejection of H9. This supports Prospect Theory's view of loss aversion as an emotion-based bias (Kahneman & Tversky, 1979).

Theoretical Implications

The research results show that university students can still make irrational decisions despite having sufficient financial knowledge. This directly supports Behavioral Finance Theory, which shows that financial knowledge alone cannot influence an individual's decision-making (Thaler, 2016). Additionally, analysis demonstrates that emotional biases, such as loss aversion, can persist regardless of high or low financial knowledge, aligning with Prospect Theory. These findings indicate that while financial literacy can reduce overconfidence and present bias, its influence on loss aversion remains limited.

Limitations and Future Research

This study uses a single-wave survey of university students in Astana. This design limits the establishment of causality. The gender imbalance in the sample (69.5% female) may also affect generalizability. Another limitation is that the measures relied on self-assessments, so the answers may not fully reflect students' actual behavior or attitudes. Only three behavioral biases were analysed, even though anchoring, herding and confirmation bias also influence decisions (Hayat et al., 2016). Future research should employ longitudinal or experimental designs, expand samples and include additional biases for a more comprehensive understanding.

Practical Implications

Kazakhstani universities can improve students' financial decisions by adding behavioral finance modules to existing courses. To reduce overconfidence, programs should include self-assessment exercises and feedback sessions. Present bias may be addressed through practical tools such as budgeting templates. To address loss aversion, it may be more effective to use exercises that involve decision-making under risk.

Conclusion

Financial literacy helps students make more thoughtful financial decisions, especially by reducing overconfidence and present bias. However, some biases, such as loss aversion, appear to be less influenced by knowledge alone. The effects of literacy also vary by gender and academic major. This highlights the importance of combining financial education with behavioral strategies.

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Appendices

Part 1. Demographic Information

1. Please indicate your age:

- Under 18
- 18–22
- 23–24
- 25 and older

2. Please indicate your gender:

- Male
- Female
- Prefer not to say

3. What is your current level of education?

- Bachelor's
- Master's
- Doctorate
- Other

4. What is your field of study?

1. Economics and Business (Management, Finance, Marketing, Accounting)
2. Information Technology (IT) (Programming, Data Analysis, Cybersecurity)
3. Humanities and Education (Journalism, Linguistics, Psychology, Pedagogy)
4. Creative Professions (Music, Theater, Cinema, Design)
5. Medicine and Pharmacy (Doctor, Pharmacist, Dentist)
6. Engineering and Technology (Construction, Mechanical Engineering, Robotics, Trades)
7. Law and Public Administration (Lawyer, Judge, Diplomat)
8. Science and Research (Biology, Chemistry, Physics, Astronomy)
9. Sports and Physical Education (Athlete, Coach, Sports Doctor)
10. Other

Part 2: Financial Literacy Assessment

1. Suppose you have 10,000 KZT in a savings account with an annual interest rate of 2%. How much money will you have after 5 years? (Lusardi & Mitchell, 2011)

- More than 10,200 KZT
- Exactly 10,200 KZT
- Less than 10,200 KZT
- Don't know

2. How confident are you in your answer? (Michailova & Katter, 2014)

- 1 – Not at all confident
- 2 – Mostly not confident
- 3 – Somewhat confident
- 4 – Fairly confident
- 5 – Completely confident

3. Imagine the interest rate on your savings account is 1% per year, and the inflation rate is 2% per year. After one year, you will be able to buy: (Lusardi & Mitchell, 2011)

- More than today
- Exactly the same as today
- Less than today
- Don't know

4. How confident are you in your answer? (Michailova& Katter, 2014)

- 1 – Not at all confident
- 2 – Mostly not confident
- 3 – Somewhat confident
- 4 – Fairly confident
- 5 – Completely confident

5. Is buying shares of a single company generally safer than investing in a mutual fund? (Lusardi & Mitchell, 2011)

- True
- False
- Don't know

6. How confident are you in your answer? (Michailova& Katter, 2014)

- 1 – Not at all confident
- 2 – Mostly not confident
- 3 – Somewhat confident
- 4 – Fairly confident
- 5 – Completely confident

7. If interest rates rise, what usually happens to bond prices? (Lusardi & Mitchell, 2011)

- They increase
- They decrease
- There is no relationship between bond prices and interest rates
- They remain unchanged
- Don't know

8. How confident are you in your answer? (Michailova& Katter, 2014)

- 1 – Not at all confident
- 2 – Mostly not confident
- 3 – Somewhat confident
- 4 – Fairly confident
- 5 – Completely confident

9. A 15-year mortgage usually requires higher monthly payments than a 30-year mortgage, but the total amount of interest paid over the life of the loan will be less. (Lusardi & Mitchell, 2011)

- True
- False
- Don't know

10. How confident are you in your answer? (Michailova & Katter, 2014)

- 1 – Not at all confident
- 2 – Mostly not confident
- 3 – Somewhat confident
- 4 – Fairly confident
- 5 – Completely confident

Part 3: Behavioral Bias Assessment

Loss Aversion Effect

1. I prefer a more secure job with a small pay raise over a less secure job with a large pay raise. (FinaMetrica, 2020)

- 1 – Strongly disagree
- 2 – Disagree
- 3 – Neutral
- 4 – Agree
- 5 – Strongly agree

2. When making an important financial decision, I worry more about potential losses than about potential gains. (FinaMetrica, 2020)

- 1 – Strongly disagree
- 2 – Disagree
- 3 – Neutral
- 4 – Agree
- 5 – Strongly agree

3. How much should the total value of your investments decrease before you feel uncomfortable? (FinaMetrica, 2020)

- 50% or more – This doesn't worry me.
- About 33% – I would start considering the consequences.
- About 20% – I would begin feeling anxious.
- About 10% – It would be uncomfortable for me.
- Any decrease – It would cause me distress.

4. Win Scenario (Kahneman & Tversky, 1979)

Imagine you have 500,000 KZT. Now, you have two options for gaining more money:

Option A: 50% chance to win 500,000 KZT (you would either have 500,000 or 1,000,000 KZT).

Option B: Guaranteed win of 250,000 KZT (you would have 750,000 KZT).

Choose from 1 to 5, where 1 – I definitely choose Option A, 5 – I definitely choose Option B.

5. Loss Scenario (Kahneman & Tversky, 1979b)

Imagine you have 1,000,000 KZT, but you will have to lose part of it. You have two options:

Option A: 50% chance to lose 500,000 KZT (you would either have 500,000 or 1,000,000 KZT).

Option B: Guaranteed loss of 250,000 KZT (you would have 750,000 KZT).

Choose from 1 to 5, where 1 – I definitely choose Option A, 5 – I definitely choose Option B.

Present Bias

1. I tend to live in the present and don't think much about the future. (Xiao and Porto, 2019)

- 1 – Strongly disagree
- 2 – Disagree
- 3 – Neutral
- 4 – Agree
- 5 – Strongly agree

2. In my view, money should be spent, and we should spend it whenever we have money. (Xiao and Porto, 2019)

- 1 – Strongly disagree
- 2 – Disagree
- 3 – Neutral
- 4 – Agree
- 5 – Strongly agree

3. Spending money gives me more satisfaction than saving it. (Xiao and Porto, 2019)

- 1 – Strongly disagree
- 2 – Disagree
- 3 – Neutral
- 4 – Agree
- 5 – Strongly agree

4. I usually delay paying my bills (such as water, gas, electricity, credit card, etc.). (Xiao and Porto, 2019)

- 1 – Strongly disagree
- 2 – Disagree
- 3 – Neutral
- 4 – Agree
- 5 – Strongly agree

5. I usually don't consider my financial situation when shopping. (Xiao and Porto, 2019)

- 1 – Strongly disagree
- 2 – Disagree
- 3 – Neutral
- 4 – Agree
- 5 – Strongly agree