

## EXPLORING THE INTERPLAY BETWEEN SENSATION SEEKING, BIOLOGICAL INDICATORS, AND FINANCIAL RISK-TAKING BEHAVIOR: A DIGITAL RESEARCH PERSPECTIVE

DOI: 10.17261/Pressacademia.2024.1955

JEFA- V.11-ISS.2-2024(2)-p.76-84

Emin Avci<sup>1</sup>, Aydin Erden<sup>2</sup>, Murat Cinko<sup>3</sup><sup>1</sup>Marmara University, Business Administration, Istanbul, Turkiye.[eavci@marmara.edu.tr](mailto:eavci@marmara.edu.tr), ORCID: 0000-0003-3172-897X<sup>2</sup>Marmara University, Management Information Systems, Istanbul, Turkiye.[aydin.erden@marmara.edu.tr](mailto:aydin.erden@marmara.edu.tr), ORCID: 0000-0002-5124-8335<sup>3</sup>Marmara University, Business Administration, Istanbul, Turkiye.[mcinko@marmara.edu.tr](mailto:mcinko@marmara.edu.tr), ORCID: 0000-0001-8560-7482

Date Received: October 18, 2024

Date Accepted: November 22, 2024



### To cite this document

Avci, E., Erden, A., Cinko M. (2024). Exploring the interplay between sensation seeking, biological indicators, and financial risk-taking behavior: a digital research perspective. *Journal of Economics, Finance and Accounting (JEFA)*, 11(2), 76-84.

Permanent link to this document: <http://doi.org/10.17261/Pressacademia.2024.1955>

Copyright: Published by PressAcademia and limited licensed re-use rights only.

### ABSTRACT

**Purpose-** This study investigates the complex relationship between sensation-seeking, biological indicators, and financial risk-taking behavior. Utilizing a digital research approach, the study examines how individual differences in sensation seeking, measured by the Zuckerman Sensation Seeking Scale (SSS-V), correlate with financial risk tolerance.

**Methodology-** Each unit of analysis is categorized as a risk-averse, risk-neutral, and risk-lover according to both biological and probabilistic game attitudes. Biological indicators, specifically the 2D:4D ratio, are used to categorize individuals as risk-averse, risk-neutral, or risk-lover. The research employs a probabilistic lottery game to further classify participants' risk preferences.

**Findings-** Findings reveal that while sensation seeking is generally associated with higher financial risk-taking, the interplay between biological indicators and risk behavior is nuanced. Probabilistic game categorization results indicate that sensation-seeking score not only for total but also for subdimension is not statistically significant.

**Conclusion-** Notably, individuals with higher sensation-seeking scores do not always exhibit higher financial risk tolerance. Biological indicators and probabilistic game classification will indicate the different mean values of the sensation-seeking score. Biological indicators differentiate the mean difference of individuals' sensation-seeking scores. The study contributes to the understanding of how psychological traits and biological factors jointly influence financial decision-making.

**Keywords:** Financial risk-taking, 2D:4D ratio, digital research, sensation seeking, risk tolerance

**JEL Codes:** D81, D84, D91

## 1. INTRODUCTION

Risky decision-making in real life is a very complex structure. That is why several explanations have been attempted from different disciplines. Some researchers have tried to explain the factors that affect risky behavior by using human biology, such as prenatal testosterone exposure (PTE), gender, certain hormones like salivary testosterone levels in men (Apicella, et al., 2008), and some genes like the 7-repeat allele of the dopamine receptor D4 gene (Dreber, et al., 2009). Some other researchers try to explain risky behavior through individual character traits or psychological factors such as sensation seeking, self-control, and personality. The whole process of decision-making and engaging in risky behavior is complex, involving a combination of several factors that ultimately shape our decisions. Ju and Wallraven (2023) found a significant positive correlation between the BART (Balloon Analogue Risk Task) score, sensation-seeking, and risky driving behavior. In this study, sensation seeking is used to understand risky decision-making behavior. Individuals' risky behavior is measured using a probabilistic lottery and the 2D:4D ratio. The individual will be categorized as risk-lover, risk-neutral, or risk-averse either by accepting the guaranteed money in the lottery or by the ratio of 2D:4D. According to the literature, if the individual's ring finger is longer than the index finger, they are categorized as risk-lover; if they are equal, as risk-neutral; and if the index finger is longer, as risk-averse. The lottery game categorization is done by calculating the expected value of the lottery: if the individual plays the lottery when the expected value is less than the guaranteed money, they are categorized as risk-lover; if the expected value and guaranteed money are equal, as risk-neutral; and if the expected value is greater than the guaranteed money, as risk-averse. In the research, sensation-seeking scores and sub-dimension scores are compared by the categorized individuals to determine if there is any mean difference among the categories. One should always remember that sensation-seeking tends toward financial risk-taking behavior, as it creates both a fear of loss and a thrill of gain (Wong & Carducci,

2015). Hanoch et al. (2006) argued that individuals who prefer high risk in one domain can prefer lower risk levels in another domain. For this study, the sensation-seeking trait is defined by individual differences "in the seeking of varied, novel, complex, and intense sensations and experiences, and the willingness to take physical, social, legal, and financial risks for the sake of such experience" (Zuckerman, 1994, p. 17). Although there is a correlation between sensation-seeking scale and risk-taking behavior (Dahlen, Martin, Ragan, & Kuhlman, 2005; Dunlop & Romer, 2010; Adams & Moore, 2007), low sensation seekers are not just risk-averse in their view of sensation-seeking activities; they also believe that activities are not worth the high level of risk.

The existing literature on sensation seeking, biological indicators, and financial risk-taking behavior is first reviewed to provide a comprehensive background for the study. Following this, the methodology is detailed, which includes the use of the Zuckerman Sensation Seeking Scale (SSS-V) and the 2D:4D ratio to categorize individuals' risk preferences. The findings are then presented, highlighting the nuanced relationship between sensation-seeking and financial risk-taking, as well as the role of biological indicators. Finally, the implications of the results for understanding financial decision-making are discussed.

## **2. LITERATURE REVIEW**

Zuckerman & Kuhlman, (2000) found that several types of risky activities, including substance use (drugs, alcohol, etc.), risky driving, unprotected sex, and gambling, are significantly related to sensation seeking. Similar findings have been reported by various studies (Quinn & Harden, 2013; Leeman, Hoff, Krishnan-Sarin, Patock-Peckham, & Potenza, 2014; Vayisoğlu, Öncü, & Güven, 2019). Based on such evidence, some researchers have used the tendency to engage in risky behavior as a proxy for sensation seeking. Among those researchers Grinblatt and Keloharju (2009) proposed that sensation seeking can be associated with speeding violations, as sensation seekers may take pleasure in risky driving. The findings of the study indicate that drivers who engaged in speeding violations (measured by the number of speeding tickets and severity of the violations) tend to trade more in the stock market. Moreover, increasing the severity of speeding violations is a more significant predictor of trading activity. The study also documents that sports car ownership is related to trading activity. In a similar vein, Brown et al. (2018) examined the trading activity and risk-return composition of hedge fund managers who own performance cars. Their findings indicate that hedge fund managers who own sports cars tend to take more risks but do not generate higher returns. Such managers tend to trade more and invest in lottery-like stocks. Lee et al. (2019) explore the relationship between alcohol consumption, which represents sensation-seeking behavior, and retail investor stock investment and trading behavior. They found that alcohol consumption positively relates to investing in lottery-type stocks and portfolio turnover. Using drug use as a measure of sensation seeking, Rabbani et al. (2021) report a significant positive relationship between risk tolerance and sensation seeking. Moreover, gender, race, and education were significantly associated with financial risk tolerance. In addition to using some proxies for sensation seeking, some researchers relied on the Zuckerman Sensation Seeking Scale to measure individuals' tendencies for risk-taking. Among these studies, Wong and Carducci (1991) found that men have higher sensation-seeking scores and a greater tendency to take financial risks compared to women. Regardless of gender, those with high sensation-seeking scores tend to take higher financial risks. Using the Zuckerman Sensation Seeking Scale Form V (SSS-V), Worthy et al. (2010) found that college students with high sensation-seeking scores tend to have problematic financial issues, such as difficulties in paying bills and overdrawn checking accounts. Moreover, they also documented that students' financial scores are related to gambling behavior. Mishra and Lalumière (2010) documented that individual differences, measured by questionnaires (including Zuckerman's sensation-seeking scale) and laboratory-based behavioral measures of risk acceptance, can play an important role in risk-taking where there is no constraint. On the other hand, they also found that individual differences do not have a significant role in risk acceptance if there is a need constraint. On both questionnaires and laboratory measures, men have higher risk scores than women. Vela (2023) found that males consistently demonstrated higher risk-taking behaviors than females in financial, health/safety, recreational, and ethical domains, while no significant sex differences were observed in the social domain, and no notable decline in these differences over time or with age was found. Sokolowska and Makowiec (2017) analyzed the individuals' risk preferences under different market conditions by controlling for sensation seeking. The findings of the study show that the investors' risk preferences are subject to change under different market conditions and such risk preference is also linked to sensation seeking. Under a bear market, differences in sensation-seeking among individuals do not have an impact on risk perception, but under bull market conditions individuals with higher sensation-seeking scores tend to have lower risk perception than individuals with low sensation-seeking scores. While Grinblatt and Keloharju, (2009), Brown et al. (2018), Lee et al. (2019) and Rabbani et al. (2021) use some proxies as an aggregate sensation-seeking measure, Antonelli-Filho et al. (2021) found that it is not the aggregate sensation seeking (ZKA-PQ—the Zuckerman-Kuhlman-Aluja Personality Questionnaire) but individual facets that affect the trading volume of day traders. They document that both the thrill and adventure facet and the boredom susceptibility/impulsivity facet have a positive impact on daily trading activity, while the experience-seeking facet has a negative effect. Patterson et al. (2023) used a mixed-methods approach to refine and validate the construct of positive risk-taking in adolescence, finding that it aligns with traits like extraversion and openness, and differs from negative risk-taking in its developmental benefits and associations with personality. Li, Zhou, Ge, and Qu (2023) investigated the relationships among sensation seeking, difficulties in emotion regulation, and driving behavior, revealing that difficulties in emotion regulation mediate the effect of sensation seeking on driving behaviors, supporting the dual-process model.

Other than Zuckerman's Sensation Seeking Scale, some other scales and questionnaires have been used to examine the link between financial risk-taking and sensation-seeking. Among these types of studies, Sjöberg and Engelberg (2009) found that finance students have a higher tendency to take economic risks, gamble, and seek sensations, whereas students have less money concern than non-students. Women have fewer financial concerns in both groups. Zabel et al. (2009) found that age and financial risk-taking are negatively correlated; moreover, sensation-seeking is correlated with both age (negative correlation) and financial risk-taking (positive correlation). Controlling for sensation seeking (Brief Sensation Seeking Scale), no significant relation can be found between age and financial risk-taking.

Several studies have been conducted to examine the relationship between personal traits, risk aversion, and risk tolerance. Wong and Carducci (2015) examined risk tolerance and personal traits. The findings of their study showed that sensation seeking, and locus of control have direct effects on financial risk tolerance. The relationship between sensation seeking and financial risk tolerance is not affected by gender, age, or academic success. Desmoulin-Lebeault et al. (2018) found that women are more risk-averse. Respondents with a master's degree and a quantitative background are more risk-averse, while those following stock markets are less risk-averse. Using the Myers-Briggs Type Indicator personality measures, respondents classified as Introversion, Sensing, Feeling, and Judging are more risk-averse. Rahman (2020) reported that propensity for regret, propensity for trust, attributing success to luck, and overconfidence have significant positive relationships with financial risk tolerance, but happiness in life has a significant negative effect. Moreover, Rahman (2020) found that religiosity has a moderating effect between such behavioral factors and financial risk tolerance. Thanki and Baser (2021) found that personality type, financial literacy, gender, income, marital status, occupation, and number of dependents significantly affect financial risk tolerance, while age and education do not. Personality type is the most significant variable, with Type A personalities being more risk-tolerant. Additionally, men have higher risk tolerance than women. De Sá et al. (2024) empirically investigated gender differences in financial risk aversion among Brazilian investors, concluding that statistically significant higher risk aversion is exhibited by women compared to men, as reflected in lower portfolio volatility.

There are a limited number of studies in Turkish literature that examine the relationship between sensation-seeking and financial risk-taking. Most related literature documents the relationship between demographic and socio-economic factors and financial risk tolerance or perception. Among these studies, Çankaya et al. (2013) studied the risk attitudes of university students and examined gender differences. The findings indicate that male students perceive financial risk as a thrill and opportunity, while female students are reluctant to take financial risks and are less risk-tolerant, which is related to their potential regret. A similar finding is reported by Çatak and Arslan (2023), where women are less risk-tolerant. Kübilay and Bayrakdaroğlu (2016) documented the relationship between personality traits and financial tolerance, noting that extraverted, neurotic, and open personalities tend to have high financial risk tolerance, while agreeable and conscientious personalities have low financial risk tolerance. Aydemir and Aren (2016) explored the motives behind insurance and found that sensation seeking, along with Type A personality, can explain financial risk tolerance. Bayrakdaroğlu and Kuyu (2018) examined the financial risk perceptions of female investors. The findings of their study indicated that the level of income, financial literacy, upbringing style, avoiding regret, and lack of courage affect women's financial risk perceptions. They also concluded that female investors are risk-averse and, as a result, are unable to tolerate financial risks. Bayar et al. (2020) found that the level of financial literacy, education, and income have a positive effect on financial risk tolerance, while age has a negative effect. Men have a higher risk tolerance than women.

While the above studies documented the relationship between demographic and socio-economic factors and financial risk tolerance or perception, Anbar and Eker (2009) argue that although several demographic and socioeconomic factors (like gender, age, income, marital status, financial literacy, education level, etc.) have been documented to impact individual financial risk tolerance, such demographic and socio-economic factors may not be sufficient to measure financial risk tolerance, which is a multi-dimensional behavioral issue.

While the effects of demographic, socio-economic, and physiological factors on financial decision-making have been documented by several studies, some researchers also argue that biological factors may play a determining role in such decisions. For example, Manning (2002) claims that the relationship between prenatal testosterone exposure (PTE) affects the fetus's brain and endocrine system and subsequent behavior. Scientists try to understand economic behavior by using biological differences such as the ratio of the length of the index and ring fingers (2D:4D or digit ratio, with lower ratios associated with higher prenatal testosterone levels). The longer the ring finger, the higher the level of risk-taking. Gender is an important discriminator of the ratio, with men typically having lower ratios than women (Lutchmaya, Baron-Cohen, Raggatt, Knickmeyer, & Manning, 2004; Hönekopp & Watson, 2010). There is no consensus about the effects of PTE; some studies have shown that higher PTE yields lower risk aversion (Garbarino, Slonim, & Sydnor, 2011; Branäs-Garza & Rustichini, 2011; Barel, 2019; Stenstrom, Saad, Nepomuceno, & Mendenhall, 2011), while others do not support this finding (Parslow, et al., 2019; Alonso, Di Paolo, Ponti, & Sartarelli, 2018; Apicella, et al., 2008; Neyse, et al., 2020; Pearson & Schipper, 2012).

### 3. METHODOLOGY

Risk can be defined as the possibility that something unpleasant or undesirable might happen. There are several methodologies to measure people's risk perception. Some use Likert scale questionnaires, some use probabilistic games, and others use task choice procedures to measure risk. Some studies have found a correlation between biological differences and risk-taking behavior, such as the 2D:4D ratio. In this study, risk is measured using a probabilistic game and the 2D:4D ratio. The Zuckerman (1994) Sensation Seeking Scale (SSS-V) is used to understand the relationship between risk perception and sensation seeking.

For this purpose, we conducted an online survey to evaluate the relationship between sensation seeking and risk aversion. The application used for data collection in the research survey was developed as a single-page application on the .NET 8.0 platform using the C# programming language and the ASP.NET MVC framework. The application is hosted on Azure App Service, and the data collected from participants is stored in an MSSQL database. Participants accessed the application through a link.

#### 3.1. Zuckerman Sensational Seeking Scale

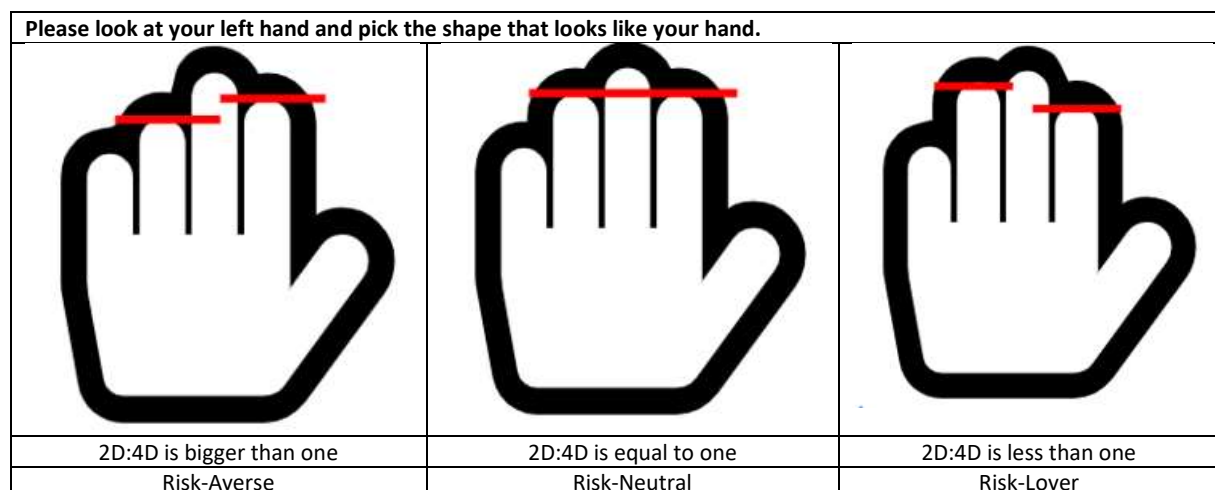
The sensation-seeking scale has four dimensions, each containing ten questions with two possible answers: A or B. Respondents select one of the options and are assigned a value of zero or one according to their answer. The summation of the ten questions produces each dimension's value and total score for each respondent. Reliability and validity analysis of the sensation-seeking scale (SSS-V) has been conducted by several researchers (Zuckerman, Eysenck, & Eysenck, 1978; Ridgeway & Russell, 1980; Ball, Farnill, & Wangeman, 1984; Pérez & Torrubia, 1986; Öngen, 2007).

The four dimensions of the sensation-seeking scale are Thrill and Adventure Seeking (*TAS*), Experience Seeking (*ES*), Disinhibition (*Dis*), and Boredom Susceptibility (*BS*). The items used in the scale are phrased as desired experiences, not actual ones. *TAS* is measured by adventure through socialized but exciting activities such as driving fast or skiing down extreme slopes. *ES* is measured by items that describe seeking novel experiences through the senses, such as in music, art, and travel. *Dis* is measured by a desire to engage in disinhibited social behavior, often facilitated by alcohol at parties. *BS* is measured by items that express an intolerance for routine work and boring people or a need for change and unpredictability in stimulation.

#### 3.2. 2D:4D Ratio

In this study, three different ratios of left-hand pictures (index finger longer, equal, or shorter than the ring finger) were shown to the respondents, and they were asked what kind of hand shape they had (see **Figure 1**). A lower 2D:4D ratio (where the index finger is shorter than the ring finger) leads to less risk aversion (risk-lover). An equal ratio (where the index and ring fingers are the same length) is assumed to be risk-neutral. If the 2D:4D ratio is higher (where the index finger is longer than the ring finger), the individual will be risk-averse.

**Figure 1: Hand Type Selection**



#### 3.3. Probabilistic Game

There are three lotteries in the questionnaire where the expected value of the lottery is less than, equal to, and more than the guaranteed money in the first, second, and third lottery, respectively (see **Hata! Başvuru kaynağı bulunamadı.**). Respondents make a preference between the lottery and the guaranteed money. Whenever the respondent selects the guaranteed money, they will not see the subsequent lottery option(s). This means that if the respondent selects the money

instead of the lottery in the first lottery, they will not see the second and third lotteries and will continue with the rest of the questionnaire. The logic behind this is that since the guaranteed money increases with each lottery, it is logical that a respondent who selects the smaller guaranteed money will not change their selection for the larger guaranteed money. In the research, respondents will be classified as risk-averse, risk-neutral, and risk-lover based on their selections in the lottery. In the first lottery, respondents who select the guaranteed money will be categorized as risk-averse. In the second lottery, respondents who select the guaranteed money will be categorized as risk-neutral. If the respondents see the third lottery but take the guaranteed money, they will be categorized as risk-neutral; if they play the lottery, they will be categorized as risk-lover.

Figure 2: Probabilistic Game

First Game	Second Game	Third Game
At this stage of the study, you are being offered a game.  You can either take 100TL without playing the game or flip a coin with a 50% chance to win 1,000TL and a 50% chance to win 0TL.  Would you like to play this game?	At this stage of the study, you are being offered a new game.  This game is completely independent of the first game, so please disregard any previous winnings and assume you are starting from scratch.  You can either take 500TL without playing the game or flip a coin with a 50% chance to win 1,000TL and a 50% chance to win 0TL.  Would you like to play this game?	At this stage of the study, you are being offered a new game.  This game is completely independent of the first two games, so please disregard any previous winnings and assume you are starting from scratch.  You can either take 600TL without playing the game or flip a coin with a 50% chance to win 1,000TL and a 50% chance to win 0TL.  Would you like to play this game?
The expected value of the game is greater than the guaranteed money.  Individuals who take the guaranteed money will be categorized as <u>risk-averse</u> .	The expected value of the game is equal to the guaranteed money.  Individuals who take the guaranteed money will be categorized as <u>risk-neutral</u> .  Individuals who play the game will be categorized based on the other game.	The expected value of the game is less than the guaranteed money.  Individuals who take the guaranteed money will be categorized as <u>risk-neutral</u> .  Individuals who play the game will be categorized as <u>risk-lover</u> .
<b>Risk-Averse</b>	<b>Risk-Neutral</b>	<b>Risk-Neutral OR Risk-Lover</b>

4. FINDINGS

125 undergraduate and graduate students answered the questionnaire voluntarily. 45% of them (56 students) are female, and 55% of them (69 students) are male. 5.6% of the students took the guaranteed money in the first lottery, and 118 students saw the lottery. 40.8% of the 118 students took the guaranteed money in the second lottery, and 70 of them saw the result of the lottery. Among these 70 students, only 15.7% (11 students) took the guaranteed money, and 59 of the students saw the lottery result. According to the calculated expected monetary value of the lottery, students were categorized as risk-averse, risk-neutral, or risk-lover. Students in the first lottery who took the guaranteed money were categorized as risk-averse since the expected value of the lottery was higher. Students in the second lottery who took the guaranteed money (48 students) and saw the third lottery and took the guaranteed money (11 students) were categorized as risk-neutral because the expected value of the lottery was equal to or less than the guaranteed money. Students who played the third lottery were categorized as risk-lover. According to this classification, 7 students (5.6%) were risk-averse, 59 students (47.2%) were risk-neutral, and the remaining 59 students were risk-lover. These findings can also be seen in detail in Table .

Table 1: Participant Preferences in Probability Games and the Number of Participants per Risk Category

	Guarantee Money	Play Lottery	Risk Averse	Risk Neutral	Risk Lover
First Game	7	118	7		
Second Game	48	70		48	
Third Game	11	59		11	59

<b>Total</b>			7	59	59
--------------	--	--	---	----	----

The four sub-dimensions of the Sensation Seeking Scale and the total score are calculated using the respondents' answers and transformed into standardized scores using the tables in Zuckerman (1994). To compare the values of *TAS*, *ES*, *Dis*, *BS*, and *total score* with respect to risk categories, a nonparametric Kruskal-Wallis H (KW test) was conducted. The KW test is a nonparametric counterpart of ANOVA, and the mean ranks of the categories are compared. A higher mean ranking indicates a higher score for the corresponding dimension. The scores of 125 students were compared with respect to risk categories, and no statistical differences were found. The same comparison was done separately for males and females; no statistically significant results were found. In summary, it was found that there was no significant difference in the *TAS*, *ES*, *Dis*, *BS*, and *total score* of participants categorized as risk-averse, risk-neutral, or risk-loving based on their game preferences. No difference was found in the gender-based analysis either.

Risk classification was also done using hand pictures (2D:4D ratio, see Figure 1) and found that 22.4% of participants (28 individuals) were categorized as risk-averse, 24.8% of participants (31 individuals) were categorized as risk-neutral, and the remaining 52.8% of participants (66 individuals) were categorized as risk-lover. A KW test was conducted to find significant differences in the mean rank among the categories, and only the significant results are provided in the following Table .

**Table 2: Kruskal-Wallis H Test Results for TAS and Total Scores Based on the 2D:4D Finger Ratio Classification**

		Number of Students	Mean Rank	KW test Statistics	Df	Asymptotic Significance
TAS Score	Risk Averse	28	79.70	8.829	2	.012
	Risk Neutral	31	52.58			
	Risk Lover	66	60.81			
Total Score	Risk Averse	28	77.05	5.585	2	.061
	Risk Neutral	31	56.89			
	Risk Lover	66	59.89			

As shown in Table above, a significant difference was found only in the *TAS* and *total score* values of participants based on the 2D:4D finger ratio classification. Individuals with high average scores in both *TAS* and total scores tend to be risk-averse, while those with low average scores tend to be risk-neutral. Those categorized as risk-lover based on 2D:4D finger ratios have a mean rank close to risk-neutral individuals, but they tend to have lower average values than risk-neutral ones. In a general sense, it is expected that risk-loving individuals would have higher scores, whereas risk-averse individuals having such scores seems contrary to the expectation.

The KW test was conducted separately for males and females, as they have different 2D:4D ratios, to further deepen the analysis (Table 3).

**Table 3: Kruskal-Wallis H Test Results per Gender based on the 2D:4D Finger Ratio Classification**

		Number of Students	Mean Rank	KW test Statistics	Df	Asymptotic Significance
TAS Score Female	Risk Averse	19	35.55	5.918	2	.052
	Risk Neutral	16	22.84			
	Risk Lover	21	26.43			
ES Score Female	Risk Averse	19	36.63	7.393	2	.025
	Risk Neutral	16	24.41			
	Risk Lover	21	24.26			
Total Score Female	Risk Averse	19	35.39	5.914	2	.052
	Risk Neutral	16	22.31			
	Risk Lover	21	26.98			
ES Score Male	Risk Averse	9	24.22	7.090	2	.029
	Risk Neutral	15	45.40			
	Risk Lover	45	33.69			

The Kruskal-Wallis test results show distinct patterns in risk categories based on gender. For females, a significant difference was found in the *ES* (Experience Seeking) scores among different risk categories, with risk-averse individuals having the highest mean rank. This indicates that risk-averse females had the highest *ES* scores, suggesting they tend to seek new and varied experiences more than their risk-neutral and risk-loving counterparts. While the differences in *TAS* (Thrill and Adventure Seeking) and Total Scores for females were significant at ten percent, mean ranks indicate that risk-neutral females' scores are greater than that of both risk-neutral and risk-lover females. It is obvious that risk risk-averse females who answered the questionnaire indicated that they wanted to do things but they did not take action.

On the other hand, for males, there was a significant difference in *ES* scores, with risk-neutral individuals having the highest mean rank. The risk-neutral males had the highest *ES* scores, indicating a stronger tendency to seek novel experiences compared to risk-averse and risk-loving males. These findings suggest that the *ES* score, which reflects the tendency to seek novel experiences, varies significantly among different risk categories for both genders, whereas the *TAS* and Total Scores show less pronounced differences for females. Both male and female participants exhibited significant differences in their *ES* scores among different risk categories. However, the patterns differ: risk-averse females had the highest mean ranks in *ES*, while for males, it was the risk-neutral group that topped the mean ranks. These findings highlight gender-specific tendencies in seeking new experiences based on their risk preferences.

## 5. CONCLUSION

In conclusion, this study explored the intricate relationship between sensation-seeking, biological indicators, and financial risk-taking behavior through a digital research perspective. The findings revealed that there is no significant difference in the sensation-seeking scores and sub-dimension scores (*TAS*, *ES*, *Dis*, *BS*) among participants categorized as risk-averse, risk-neutral, or risk-loving based on their game preferences. Additionally, the study found that individuals with high average scores in both *TAS* and *total scores* tend to be risk-averse, while those with low average scores tend to be risk-neutral.

When comparing these findings with other research, it is evident that the relationship between sensation-seeking and risky behavior is complex and multifaceted. For instance, Zuckerman & Kuhlman (2000) found that various risky activities, including substance use and gambling, are significantly related to sensation seeking. Similarly, Grinblatt and Keloharju (2009) proposed that sensation-seeking can be associated with speeding violations and trading activity in the stock market. However, the current study's findings contrast with those of Wong and Carducci (1991), who found that men have higher sensation-seeking scores and a greater tendency to take financial risks compared to women.

The digital research aspect of this study played a crucial role in data collection and analysis. The online survey and application developed on the .NET 8.0 platform allowed for efficient data collection and storage, enabling a comprehensive analysis of the relationship between sensation-seeking and financial risk-taking behavior.

The research on the interplay between sensation-seeking, biological indicators, and financial risk-taking behavior offers significant academic and practical implications. Academically, it contributes to the understanding of how psychological traits and biological factors jointly influence financial decision-making. This study provides a nuanced perspective on the relationship between sensation-seeking and financial risk tolerance, challenging the assumption that higher sensation-seeking scores always correlate with higher financial risk tolerance. Practically, the findings can inform financial risk management strategies by highlighting the importance of considering both psychological and biological factors when assessing an individual's risk profile. Financial advisors and institutions can use these insights to tailor their advice and products to match their clients' risk preferences better, potentially leading to more effective and personalized financial planning.

## REFERENCES

- Adams, T., & Moore, M. (2007). High-Risk Health and Credit Behavior Among 18- to 25-Year-Old College Students. *Journal of American College Health*, 56(2), 101-108.
- Alonso, J., Di Paolo, R., Ponti, G., & Sartarelli, M. (2018). Facts and misconceptions about 2D: 4D, social and risk preferences. *Frontiers in Behavioral Neuroscience*, 12, 432-449.
- Anbar, A., & Eker, M. (2009). Demographic and Socioeconomic Factors That Affect Financial Risk Perceptions of Individual Investors. *ZKU Journal of Social Sciences*, 5(9), 129-150.
- Antonelli-Filho, P., Bressan, A., Vieira, K., & Potrich, A. (2021). Sensation Seeking and Overconfidence in day traders: evidence from Brazil. *Review of Behavioral Finance*, 13(5), 486-501.
- Apicella, C., Dreber, A., Campbell, B., Gray, P., Hoffman, M., & Little, A. (2008). Testosterone and financial risk preferences. *Evolution and Human Behavior*, 29(6), 384-390.
- Aydemir, S., & Aren, S. (2016). An Empirical Study on Psychological Motives for Individuals' Risk Mitigating Strategies. *Journal of Finance Letters*, 105, 75-92.
- Ball, I., Farnill, D., & Wangeman, J. (1984). Sex and age differences in sensation seeking: Some national comparisons. *British Journal of Psychology*, 75(2), 257-265.
- Barel, E. (2019). 2D: 4D, optimism, and risk taking. *Current Psychology*, 38, 204-212.
- Bayar, Y., Sezgin, H., Öztürk, Ö., & Şaşmaz, M. (2020). Financial Literacy and Financial Risk Tolerance of Individual Investors: Multinomial Logistic Regression Approach. *Sage Open*, 10(3), 234-244.
- Bayrakdaroğlu, A., & Kuyu, E. (2018). Analysis of financial risk perceptions on investment decisions of women with different demographic profiles. *Journal of Mehmet Akif Ersoy University Economics and Administrative Sciences Faculty*, 5(3), 705-724.

- Branas-Garza, P., & Rustichini, A. (2011). Organizing effects of testosterone and economic behavior: not just risk taking. *PLoS one*, 6(12), 678-692.
- Brown, S., Lu, Y., Ray, S., & Teo, M. (2018). Sensation seeking and hedge funds. *The Journal of Finance*, 73(6), 2871-2914.
- Çankaya, S., Ucal, M., & O'neil, M. (2013). Nothing ventured nothing gained: Gender differences in financial risk behavior among Turkish university students. *International Journal Of Economics And Finance Studies*, 5(1), 322-334.
- Çatak, Ç., & Arslan, S. (2023). Behavioral Investor Types-Determinants of Individual Investors' Financial Risk Tolerance. *Journal of Accounting & Finance*, (99), 2345-2358.
- Dahlen, E., Martin, R., Ragan, K., & Kuhlman, M. (2005). Driving anger, sensation seeking, impulsiveness, and boredom proneness in the prediction of unsafe driving. *Accident Analysis & Prevention*, 37(2), 341-348.
- De Sá, R., Tessmann, M., & Pinto, A. (2024). Are women more risk averse in investments? Brazilian evidence. *Review of Behavioral Finance*, 16(5), 958-969.
- Desmoulin-Lebeault, F., Gajewski, J.-F., & Meunier, L. (2018). Personality and risk aversion. *Economics Bulletin*, 38(1), 472-489.
- Dreber, A., Apicella, C., Eisenberg, D., Garcia, J., Zamore, R., Lum, J., & Campbell, B. (2009). The 7R polymorphism in the dopamine receptor D4 gene (DRD4) is associated with financial risk taking in men. *Evolution and Human Behavior*, 30(2), 85-92.
- Dunlop, S., & Romer, D. (2010). Adolescent and Young Adult Crash Risk: Sensation Seeking, Substance Use Propensity and Substance Use Behaviors. *Journal of Adolescent Health*, 46(1), 90-92.
- Garbarino, E., Slonim, R., & Sydnor, J. (2011). Digit ratios (2D: 4D) as predictors of risky decision making for both sexes. *Journal of Risk and Uncertainty*, 42, 1-26.
- Grinblatt, M., & Keloharju, M. (2009). Sensation seeking, overconfidence, and trading activity. *The Journal of finance*, 64(2), 549-578.
- Hanoch, Y., Johnson, J., & Wilke, A. (2006). Domain Specificity in Experimental Measures and Participant Recruitment: An Application to Risk-Taking Behavior. *Psychological Science*, 17(4), 300-304.
- Hönekopp, J., & Watson, S. (2010). Meta-analysis of digit ratio 2D: 4D shows greater sex difference in the right hand. *American Journal of Human Biology*, 22(5), 619-630.
- Ju, U., & Wallraven, C. (2023). Relationship between virtual reality balloon analogue risk task and risky decision-making. *PLoS ONE*, 18(2), 65-71.
- Kubilay, B., & Bayraktaroglu, A. (2016). An empirical research on investor biases in financial decision-making, financial risk tolerance and financial personality. *International Journal of Financial Research*, 7(2), 171-182.
- Lee, S., Pantzalis, C., & Park, J. (2019). Does local culture trigger speculative investment behavior? *Journal of Business Research*, 103, 71-88.
- Leeman, R., Hoff, R., Krishnan-Sarin, S., Patock-Peckham, J., & Potenza, M. (2014). Impulsivity, Sensation-Seeking, and Part-Time Job Status in Relation to Substance Use and Gambling in Adolescents. *Journal of Adolescent Health*, 54(4), 460-466.
- Li, J., Zhou, Y., Ge, Y., & Qu, W. (2023). Sensation seeking predicts risky driving behavior: the mediating role of difficulties in emotion regulation. *Risk analysis*, 43(9), 1871-1886.
- Lutchmaya, S., Baron-Cohen, S., Raggatt, P., Knickmeyer, R., & Manning, J. (2004). 2nd to 4th digit ratios, fetal testosterone and estradiol. *Early Human Development*, 77(1-2), 23-28.
- Manning, J. (2002). *Digit ratio: A pointer to fertility, behavior, and health*. Rutgers University Press, ISBN: 978-0813530307.
- Mishra, S., & Lalumière, M. (2010). You can't always get what you want: The motivational effect of need on risk-sensitive decision-making. *Journal of Experimental Social Psychology*, 46(4), 605-611.
- Neyse, L., Vieider, F., Ring, P., Probst, C., Kaernbach, C., van Eimeren, T., & Schmidt, U. (2020). Risk attitudes and digit ratio (2D: 4D): Evidence from prospect theory. *Journal of Risk and Uncertainty*, 60, 29-51.
- Öngen, D. (2007). The relationships between sensation seeking and gender role orientations among Turkish university students. *Sex Roles*, 57, 111-118.
- Parslow, E., Ranehill, E., Zethraeus, N., Blomberg, L., von Schoultz, B., Hirschberg, A., . . . Dreber, A. (2019). The digit ratio (2D: 4D) and economic preferences: no robust associations in a sample of 330 women. *Journal of the Economic Science Association*, 5, 149-169.
- Patterson, M., Pivnick, L., Mann, F., Grotzinger, A., Monahan, K., Steinberg, L., Harden, K. (2023). A Mixed-Methods Approach to Refining and Measuring the Construct of Positive Risk-Taking in Adolescence. *Journal of Research on Adolescence*, 33(2), 680-700.
- Pearson, M., & Schipper, B. (2012). The visible hand: finger ratio (2D: 4D) and competitive bidding. *Experimental Economics*, 15, 510-529.
- Pérez, J., & Torrubia, R. (1986). Fiabilidad y validez de la versión española de la Escala de Búsqueda de Sensaciones (Forma V). *Revista Latinoamericana de psicología*, 18(1), 7-22.
- Quinn, P., & Harden, K. (2013). Differential changes in impulsivity and sensation seeking and the escalation of substance use from adolescence to early adulthood. *Development and Psychopathology*, 25(1), 223 - 239.



- Rabbani, A., Yao, Z., Wang, C., & Grable, J. (2021). Financial Risk Tolerance, Sensation Seeking, and Locus of Control among Pre-Retiree Baby Boomers. *Journal of Financial Counseling and Planning*, 32(1), 146-157.
- Rahman, M. (2020). Propensity toward financial risk tolerance: an analysis using behavioural factors. *Review of Behavioral Finance*, 12(3), 259-281.
- Ridgeway, D., & Russell, J. (1980). Reliability and validity of the Sensation-Seeking Scale: Psychometric problems in Form V. *Journal of Consulting and Clinical Psychology*, 48(5), 662-664.
- Sjöberg, L., & Engelberg, E. (2009). Attitudes to economic risk taking, sensation seeking and values of business students specializing in finance. *The Journal of Behavioral Finance*, 10(1), 33-43.
- Sokolowska, J., & Makowiec, P. (2017). Risk preferences of individual investors: The role of dispositional tendencies and market trends. *Journal of Behavioral and Experimental Economics*, 71, 67-78.
- Stenstrom, E., Saad, G., Nepomuceno, M., & Mendenhall, Z. (2011). Testosterone and domain-specific risk: Digit ratios (2D:4D and rel2) as predictors of recreational, financial, and social risk-taking behaviors. *Personality and Individual Differences*, 51(4), 412-416.
- Vayisoğlu, S., Öncü, E., & Güven, Y. (2019). The frequency of Gambling among University students and its relationships to their sensation-seeking Behaviors. *Addicta: The Turkish Journal on Addictions*, 6(1), 69-90.
- Wong, A., & Carducci, B. (1991). Sensation seeking and financial risk taking in everyday money matters. *Journal of Business and Psychology*, 5, 525-530.
- Wong, A., & Carducci, B. (2015). Do sensation seeking, control orientation, ambiguity, and dishonesty traits affect financial risk tolerance? *Managerial Finance*, 42(1), 34-41.
- Worthy, S., Jonkman, J., & Blinn-Pike, L. (2010). Sensation-seeking, risk-taking, and problematic financial behaviors of college students. *Journal of Family and Economic Issues*, 31, 161-170.
- Zabel, K., Christopher, A., Marek, P., Wieth, M., & Carlson, J. (2009). Mediation effects of sensation seeking on the age and financial risk-taking relationship. *Personality and Individual Differences*, 47(8), 917-921.
- Zuckerman, M. (1994). *Behavioral expressions and biosocial bases of sensation seeking*. New York: The press Syndicate of the University of Cambridge, ISBN: 978-0521432009.
- Zuckerman, M., & Kuhlman, D. (2000). Personality and Risk-Taking: Common Bisocial Factors. *Journal of Personality*, 68(6), 999-1029.
- Zuckerman, M., Eysenck, S., & Eysenck, H. (1978). Sensation seeking in England and America: cross-cultural, age, and sex comparisons. *Journal of consulting and clinical psychology*, 46(1), 139-149.