Evaluation of Personality Traits and Rational Behavior Relationship with TOPSIS Method

Hatice Nayman Hamamcı   *hnayman@yildiz.edu.tr*
Faculty of Economics and Administrative Sciences/Business Department
Yildiz Technical University
İstanbul, 34210, Turkey

Selim Aren   *saren@yildiz.edu.tr*
Faculty of Economics and Administrative Sciences/Business Department
Yildiz Technical University
İstanbul, 34210, Turkey

Abstract

In this study, it was aimed to determine which personality trait tends to behave most rational. In this context, the Big Five model was used while determining personality traits; and individuals' risky investment intentions, risk aversion, and objective and subjective financial literacy levels were also measured using the survey method. 649 questionnaires were collected with convenience sampling. First of all, factor analysis was performed by using SPSS Statistics program. Following the data collection and analysis process, the TOPSIS method was used to rank the tendency of personality traits to behave rationally. Calculations related to the TOPSIS method were done with Microsoft Excel. In the second stage of the study, the pleasure desire (reward system) and loss aversion, which are the main two motivations of neuro finance, were also included in the model separately and the ranking process was repeated. As a result, it was determined that individuals who tend to behave most rationally have an openness personality trait. However, it was found that when the reward system is included in the model the extroversion personality trait tends to behave most rationally, on the other hand, when the loss aversion is included, the agreeableness personality trait tends to behave most rationally.

Keywords: Big Five, Personality Trait, TOPSIS, Rationality.

1. INTRODUCTION
The concept of "economic rationality", defined as providing the most benefit with the least cost among the economic decision units, has an important place in the literature of finance and economics. The classical and neoclassical view of finance has also accepted that individuals are rational when making decisions. However, with the spread of behavioral finance, researchers have revealed that individuals are not rational when making decisions, and have made researches to support these views by making use of disciplines such as psychology and sociology. Kahneman (2013) mentions dual-process theory in relation to decision making. Accordingly, individuals make decisions analytic or intuitive. Individuals are lazy in the context of thought (Kahneman, 2013) and make use of various short-cuts and heurists to make quick decisions (Tversky and Kahneman, 1974; Kahneman and Lovallo, 1993). This decision-making behavior is common in both experienced and knowledgeable and inexperienced and uninformed individuals (Tversky and Kahneman, 1974).

As the behavioral finance view claims, individuals may tend to behave rationally, even if they are not entirely rational. The main purpose of the study is to determine the tendency of individuals to behave rationally. Within the scope of this purpose, the personality traits in the Big Five model were taken as a basis and it was determined which of the relevant personality traits behaved

most rationally. The Big Five Personality Traits model is one of the most widely used and successful models in the literature (Durand *et al.,* 2008). It has been stated that the model is suitable and sufficient for explaining the investment behaviors of individuals and measuring their risk perceptions (Nicholson *et al.*, 2005; Brown and Taylor, 2014; Pinjisakikool, 2017; Jalilvanda *et al.*, 2018). The environment of uncertainty and accompanying risks have an important place in the decision-making processes of individuals (Dal and Eroglu, 2015). For this reason, the risk factor is included very much in the studies.

Another factor associated with risk is financial literacy. However, many studies in the field of finance only measure objective financial literacy (Aren and Köten, 2019). Studies on subjective financial literacy have been on the agenda recently. When measuring the level of objective financial literacy, questions on various financial issues such as risk, interest calculation, and understanding inflation (Lusardi and Mitchell, 2014) are used; in subjective financial literacy, there are question/questions about the level at which individuals see their financial level of knowledge (Bellofatto *et al.,* 2018).

TOPSIS method, which is one of the multiple decision-making techniques, was used to determine which personality traits tend to behave more rationally. TOPSIS helps researchers to determine the best alternative among decision units or alternatives. TOPSIS has been preferred by researchers as a decision-making method in various sectors for many years (Dandage *et al.*, 2018). However, in the literature review, a study on personality traits and financial decision making was not encountered by using TOPSIS. In this context, we think it will contribute to the literature. The second important contribution of the study is related to the field of neuro-finance. In this framework, the reward system and loss aversion, which are the two main motivations of neuro finance, were included in the model separately, and personality traits were reevaluated.

In the second section of the study, a wide literature review was given. In the third section, there was information about the methods used and the data set. Then, in the fourth section, there were analyses. In the last section, the findings were discussed.

2. LITERATURE REVIEW
2.1 Personality Traits
In recent years, personality traits have been at the center of many studies that have been conducted and it has been pointed out that it is an important factor (Durand *et al.*, 2013; Brown and Taylor, 2014; Kourtidis *et al.,* 2016). In this context, the only research which investigate personality traits and risky investment and risk appetite separately belongs to (Aren and Hamamcı, 2020). Other studies have generally investigated the relationship between risk taking / avoidance and personality traits. Although the results indicate a general judgment, there is no dominant opinion in some personality traits. Neurotic individuals's risk preferences harbor affective characteristic (Wilt and Revelle, 2015) and are generally considered to avoid to risk (Nicholson *et al.,* 2005; Durand *et al.*, 2013; Lönnqvist *et al.*, 2015; Kleine *et al.,* 2016). However, in this context, Aren and Hamamcı (2020), which is the only study that evaluates risk aversion and risky investment intention separately, did not find a meaningful relationship with risk aversion, but found a positive relationship with risky investment intention. It is accepted that there is a positive relationship between the extraversion personality trait and risk appetite (Nicholson *et al.,* 2005; Durand *et al.*, 2013; Lönnqvist *et al.*, 2015; Kleine *et al.,* 2016). However, differently, Aren and Hamamcı (2020) and Aren *et al.* (2019) could not identify a relationship with risk taking. Regarding the Openness personality trait, Aren and Hamamcı (2020) found a positive relationship with risk aversion, and the general judgment regarding these people is that risk appetites are high (Kleine *et al.,* 2016; Aren *et al.,* 2019). It is accepted that there is a positive relationship between risk aversion and the other two personality traits that are aggreeableness (Nicholson *et al.,* 2005; Soane and Chmiel, 2005; Durand *et al.*, 2013; Lönnqvist *et al.*, 2015; Kleine *et al.,* 2016) and conscientiousness (Aren and Hamamcı, 2020).

Various models were developed to measure personality traits. Among these models, the Big Five Personality Model (Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness) is one of the most preferred. It was determined that the Big Five model is suitable and sufficient to measure risk perception (Nicholson *et al.,* 2005; Pinjisakikool, 2017) and to understand and explain investment decisions (Brown and Taylor, 2014; Jalilvanda *et al.*, 2018).

Individuals with extraversion are social, energetic, sympathetic, cooperative, optimistic, seeking innovation, talkative and assertive (Durand *et al.,* 2008; Pinjisakikool, 2017; Tauni *et al.,* 2017a). Similar to other personality traits, extroversion is also associated with risk-taking, financial decision and investment decision (Durand *et al.*, 2008; Brown and Taylor, 2014; Pinjisakikool, 2017). Becker *et al.* (2012) and Pinjisakikool (2017) found that individuals with extraversion want more risks. On the contrary, Durand *et al.* (2008) and Durand *et al.* (2013) stated that they tend to trade less.

Individuals with conscientiousness are disciplined, goal-oriented, responsible, careful, capable, and who have organization skills (Durand *et al.,* 2008; Becker *et al.*, 2012; Tauni *et al.,* 2017a). Dohmen *et al.* (2010) and Akhtar and Batool (2012) stated that they would want more risks; on the contrary, Pinjisakikool (2017) found a negative relationship between risk appetite and related personality trait.

Individuals with agreeableness are benevolent, respectful to others' beliefs, harmonious, reliable, successful social relationships, friendly, sympathetic, and avoider from disagreement and dispute (Durand *et al.,* 2008; Kleine *et al.,* 2016; Pinjisakikool, 2017). Becker *et al.* (2012) could not find a relationship between agreeableness and investment preferences and financial decisions. In contrast, Dohmen *et al.* (2010) stated that individuals with agreeableness personality traits will have high-risk appetites.

Individuals with neuroticism personality trait are emotionally unstable, anxious, fragile, shy, anxiety, pessimistic, and have the potential to experience negative emotions such as fear and anger in a lack of self-confidence and self-control (Durand *et al.*, 2008; Pinjisakikool, 2017; Tauni *et al.,* 2017a; Tauni *et al.,* 2017b). Becker *et al.* (2012) stated that individuals with neuroticism trait would avoid more risks. In contrast, more researchers have emphasized that these individuals will want more risk (Durand *et al.,* 2008; Chitnis and Vaidya, 2016; Pinjisakikool, 2017).

Individuals with openness are highly imaginative, intellectual, open-minded, intelligent, creative and open to innovation and knowledge (Durand *et al.,* 2008; Becker *et al.*, 2012; Tauni *et al.,* 2017a). Durand *et al.* (2008) and Pinjisakikool (2017) found that individuals with this trait want more risk.

2.2 Personality and Rationality
People make conscious or unconscious decisions constantly. The finance theory regarding these decisions has two different perspectives. The first is the normative approach and deals with the logic that causes the decision and addresses how to make decisions. The other is descriptive, concerned with beliefs and preferences that lead to decisions (Kahneman and Tversky, 1984). It is generally accepted that the first approach represents standard finance and the second approach represents behavioral finance. Normative approach has some basic principles such as transitivity, dominance and immutability. If A is preferred to B and B is preferred to C, then A is preferred to C. This is called transitivity. If A is at least as good as B in all respects and better than B in at least one respect, then A should be preferred over B. This is dominance. The last one is immutability. Preference is independent of defining options. However, when the same option is framed or defined differently (loss / gain) this condition is generally not provided. For this reason, Kahneman and Tversky (1984) say that immutability is normatively essential, intuitively attractive, but psychologically impossible.

Kahneman (2013) stated that Expectation Theory, which is the basis of behavioral finance, was accepted by many researchers and the reason for this was considered as various contributions such as loss avoidance and reference point, rather than the accuracy of the theory. Kahneman and Tversky first mentioned this theory in their 1979 article. In this study, a new approach is presented with a critical view of the expected utility theory (Kahneman and Tversky, 1979). The focus of the new approach is human behaviors that is not consistent with rational theory. In this context, over time, both them and other behavioral finance researchers have shown that many bias and mental shortcuts distort the rationality in financial decisions. In fact, in many cases individuals make choices that are incompatible with the rational decision-making theory, but they do not even know that their choices are not rational (Kahneman and Tversky, 1979). This is because of the cognitive biases they have. Cognitive biases cause individuals to neglect basic rates, not paying attention to the abilities and skills of others as much as they trust their own beliefs, talents and abilities and neglect the role of luck in success (Kahneman, 2013).

Both individual and institutional investors can make irrational decisions (Aren and Dinç-Aydemir, 2015). Various psychological factors and personality have an effect on these irrational decisions (Aren and Aydemir, 2014; Kokkinos et al., 2017). Personality is the characteristics that affect an individual's emotions, thoughts and behaviors (Wilt and Revelle, 2015; Nishita et al., 2016; Isıdore and Christie, 2017).

Mind Theory states that decision making has cognitive and affective characteristics (Abu-Akel et al., 2012). Cognitive traits consist of information, beliefs, and intentions (Wilt and Revelle, 2015; Volkova and Rusalov, 2016; Bajwa et al., 2017). It includes the individual to have awareness of information, to search for it, to analyze and interpret it. The focus is on information. However, various biased behaviors can be seen frequently in the steps related to the interaction of beliefs and intentions. On the other hand, affective traits refer to the effect of emotion, sentiment and mood in the decision-making process (Ahmad et al., 2017). As Kahneman (2013) stated, decision making does not only occur with analytical processes, that is, cognitive processes. It is also often affected by affective processes. The mutual interaction and degree of these two forms personality (Peterson, 2007).

Personality is effective on risk preference (Aren and Zengin, 2016; Aydemir and Aren, 2017a; Aydemir and Aren, 2017b). Although the general attitude towards risk and the tendency to take financial risk are conceptually different, they are not very different in terms of behavior (Schoemaker, 1993). Although there are many different personality traits classifications, the Big Five Personality Trait is considered better than other approaches (Digman, 1990; Peterson, 2007). There are five dimensions in the Big Five Personality Model: neuroticism, extraversion, openness to experience, adaptability and responsibility (Benet-Martinez and John, 1998).

As the level of neuroticism rises, investors trade more Durand et al. (2013). Although their attitudes towards risk are inconsistent (Wilt and Revelle, 2015), they generally avoid risk (Nicholson et al., 2005; Durand et al., 2013; Lönnqvist et al., 2015; Kleine et al., 2016). Individuals with the trait of extroversion have a high risk appetite (Nicholson et al., 2005; Durand et al., 2013; Lönnqvist et al., 2015; Kleine et al., 2016). Individuals with openness personality traits trade more due to their self-confidence (Isıdore and Christie, 2017) and therefore their risk acceptance (Kleine et al., 2016) is also high (Nicholson et al., 2005; Durand et al., 2013; Lönnqvist et al., 2015; Kleine et al., 2016). On the other hand, individuals with the agreeableness personality trait trade less (Kleine et al., 2016). Herd behavior is typical characteristic of these individuals (Isıdore and Christie, 2017) but they do not want to take risks (Nicholson et al., 2005; Soane and Chmiel, 2005; Durand et al., 2013; Lönnqvist et al., 2015; Kleine et al., 2016). Individuals with conscientiousness personality trait have low risk appetite despite high trade (Nicholson et al., 2005; Soane and Chmiel, 2005; Durand et al., 2013; Lönnqvist et al., 2015; Kleine et al., 2016).

2.3 Risk-Taking and Risky Investment Intention

Financial risk perception is one of the factors affecting the decision of the individual investor to distribute his/her money among various investment instruments in an optimal portfolio in terms of risk and return (Dizdarlar and Şener, 2016). Risky investment intention is investors' willingness to invest in a risky market or asset. While it is expected to be largely related to risk-taking, it is not an inference that should be precisely true. Weber *et al.* (2002) and McCarty (2000) stated that taking risks may vary depending on the situation at risk. Pinjisakikool (2017) states that whether risk attitudes are specific to a particular area or general, is a controversial issue and, both opinions are found in the literature. After that Sanou *et al.* (2018) stated that area-specific measurement is easier and more convenient.

In many studies, significant relationships were found between financial literacy and risk-taking (Sjöberg and Engelberg, 2009; Guiso and Jappelli, 2012; Aren and Zengin, 2016) and investment preferences. Tauni *et al.* (2017a) investigated the effect of information about financial assets on stock trading according to different personality characteristics. While this information reduces the stock trading volume of individuals with neuroticism trait; it has the opposite effect on individuals with agreeableness, extraversion and conscientiousness traits. Durand *et al.* (2008) also found similar results that individuals with neuroticism trait trade less.

2.4 Financial Literacy

With the developments in the financial system, the number of financial products and services increases and financial decision-making processes such as borrowing, investment and savings become more complicated (Nicolini and Haupt, 2019). For this reason, the need of individuals for financial literacy also gains importance (Aren and Dinç-Aydemir, 2015). Financial literacy is defined as the ability of individuals to understand, analyze or manage their financial situation and also, it expresses the financial knowledge and skills required for individuals to overcome the difficulties they face in their daily lives and decision-making processes (Soane and Chmiel, 2005; Servon and Kaestner, 2008; Bellofatto *et al.,* 2018; Kalwij *et al.*, 2019). Grohmann (2018) also points out that financial literacy is associated with good diversification, choosing the right investment tools, and conscious use of credit cards. When the literature is analyzed, many studies are examining whether financial literacy is effective in financial decision making (Dhar and Zhu, 2006; Rooij *et al.*, 2007; Rooij *et al.*, 2011; Guiso and Jappelli, 2012).

Various objective and subjective scales are used to measure financial literacy (Aren and Canikli, 2018). Lusardi and Mitchell (2014) have created a set of questions based on three basic factors in measuring financial literacy; being able to calculate math and interest rates, and understand inflation and risk diversity. In subjective financial literacy, it is based on the question or questions that individuals assess their financial knowledge and expertise (Bellofatto *et al.,* 2018). With this type of subjective evaluation, psychological variables that affect the decision-making process are obtained (Bellofatto *et al.,* 2018). When the relationship between objective and subjective financial literacy is examined, different results were obtained. While some researchers find a positive and strong relationship (Dorn and Huberman, 2005; Rooij *et al.*, 2011); some found a weak relationship (Lusardi, 2011; Guiso and Jappelli, 2012; Bucher-Koenen *et al.*, 2012).

3. METHODOLOGY

3.1. Research Aim

The study aims to determine the personality trait that tends to behave most rationally within the framework of the Big Five personality model. For this purpose, risk aversion, risky investment intention and objective and subjective financial literacy levels of individuals were measured. The low level of difference between risk appetite and risky investment intention was accepted as the first indicator of rationality. On the other hand, questions were asked to measure the objective financial literacy of individuals and objective financial literacy levels were calculated from this point. Also, individuals were wanted to evaluate themselves in terms of financial literacy levels. This assessment was called as subjective financial literacy. The low level of difference between the two levels of financial literacy achieved in this way was also regarded as a second rationality

indicator. It was also aimed to contribute to a limited number of non-laboratory neuro finance studies by including the effect of two basic motivations (reward system and loss aversion) expressed by neuro finance as a second step in the investigation of this relationship.

3.2. Research Method and Data Set

In the study, individuals' risky investment intentions, risk appetite, and subjective and objective financial literacy were measured with a survey method in order to determine the rational tendency of personality traits. In this context, a total of 649 subjects were reached using online and face-to-face questionnaires with convenience sampling and voluntary participation. Then, it was preferred TOPSIS method, which is one of the multi-criteria decision-making methods, to determine which personality trait behaves most consistently. Related calculations were made with Microsoft Excel.

The variables and scales used in the research were shown in Table 1. Also, four demographic questions were asked: gender, age, educational status and marital status.

Variables	Number of Items	Scales
Risky Investment Intention	4	Putrevu et al. (1994) / Dodds et al. (1991) (Modified by Aydemir and Aren, 2017a)
Risk Aversion	7	Donthu and Gilliland (1996)/Burton et al. (1998) (Modified by Aydemir and Aren, 2017a)
Big Five Personality Traits	25	Benet-Martines and John (1998) (Modified by Kalabalık and Aren, 2018)
Subjective Financial Literacy	1	Aren and Canikli, 2018
Objective Financial Literacy	10	Kahneman and Tversky (1984)

TABLE 1: Variables and Scales.

When the demographic characteristics of the research participants were examined, 295 (45.5%) of the respondents were male and 354 (54.4%) female; 211 (32.5%) were married and 438 (67.5%) single. While 137 (50.4%) were undergraduate graduates and 162 (25%) were graduate/doctorate graduates, the remaining 160 (24.6%) had high school and less education. When evaluated according to age groups, there were 416 people (64.1%) between the ages of 20-30 and 166 people (25.6%) between the ages of 31-40. There were 67 people (10.3%) aged 41 and over. It was gender-balanced according to demographic characteristics; a single, educated and young sample was achieved.

3.2.1. TOPSIS Method

Multi-criteria decision-making methods have attracted perfect attention for many years by the researchers and practitioners in evaluating and ranking decision units or alternatives (Dandage *et al.*, 2018). Multi-criteria decision-making models perform their analysis by ranking alternatives according to the different characteristics of them and then choosing the best one. There are more than one multiple criteria decision-making methods, including TOPSIS (Dandage *et al.*, 2018).

The TOPSIS method was first developed by Hwang and Yoon in 1981 (Ayaydın *et al.*, 2018). TOPSIS is based on the principle of choosing the best alternative among decision units (Chitnis and Vaidya, 2016). There are two main qualities in the TOPSIS method: ideal distance and non-ideal (negative) distance (Chitnis and Vaidya, 2016; Bilbao-Terol *et al.*, 2019). According to these qualities, the relative proximity value (C*) to the ideal solution is calculated. In this way, the method tries to choose the alternatives that are closest to the ideal solution and also the farthest from the non-ideal (negative ideal) solution (Hwang *et al.*, 1993; Chitnis and Vaidya, 2016; Ayaydın *et al.*, 2018; Bilbao-Terol *et al.*, 2019). For this reason, Bilbao-Terol *et al.* (2019) stated that the TOPSIS method is based on a compromise philosophy.

The main stages of the TOPSIS method were briefly described in Table 2.

Steps	Descriptions	Matrices and Formulas
Step 1	Creating the decision matrix	$K_{hi} = \begin{bmatrix} k_{11} & \cdots & k_{1p} \\ \vdots & \ddots & \vdots \\ k_{m1} & \cdots & k_{mp} \end{bmatrix}$
Step 2	Creating the "Normalized Matrix" by performing the normalization process	$N_{hi} = \dfrac{k_{hi}}{\sqrt{\sum_{i=.}^{m} k_{hi}^2}}$
Step 3	Creating a Weighted Normalized Matrix according to the determined weights	$V_{hi} = \begin{bmatrix} v_{11} & \cdots & v_{1p} \\ \vdots & \ddots & \vdots \\ v_{m1} & \cdots & v_{mp} \end{bmatrix}$
Step 4	Finding the ideal solution value and non-ideal solution value	$I^+ = \{\max v_i\}$ (2) $I^- = \{\min v_i\}$ (3)
Step 5	Calculation of ideal distance (S +) and non-ideal distance (S-) for each decision unit	$S^+ = \sqrt{\sum_{i=1}^{n}(v_{hi}-v_i^+)^2}$ $S^- = \sqrt{\sum_{i=1}^{n}(v_{hi}-v_i^-)^2}$ $C_h = \dfrac{S^-}{S^-+S^+}$ $S^+ = \sqrt{\sum_{i=1}^{n}(v_{hi}-v_i^+)^2}$ $S^- = \sqrt{\sum_{i=1}^{n}(v_{hi}-v_i^-)^2}$ $C_h = \dfrac{S^-}{S^-+S^+}$
Step 6	Calculating the relative proximity to the ideal solution (C*)	$S^+ = \sqrt{\sum_{i=1}^{n}(v_{hi}-v_i^+)^2}$ $S^- = \sqrt{\sum_{i=1}^{n}(v_{hi}-v_i^-)^2}$ $C_h = \dfrac{S^-}{S^-+S^+}$
Step 7	Decision units are ranked from good to bad according to calculated C * value.	

TABLE 2: Stages of the TOPSIS.

4. ANALYSES AND RESULTS
4.1. Factor and Reliability Analysis Results
Firstly, factor analysis and reliability analysis were performed on the collected data using SPSS and the results reported in the table below.

	Factor1	Factor2	Factor3	Factor4	Factor5	Factor6	Factor7
	K11	K1	K21	I1	R1	K16	K7
	K12	K2	K22	I2	R2	K17	K8
	K13	K3	K24	I3	R4	K18	K9
	K14	K4	K25	I4	R5	K19	
	K15	K5			R7	K20	
Reliability	0,827	0,818	0,785	0,826	0,739	0,717	0,629
KMO Value	0,905						
Bartlett's Test of Sphericity	10724,543(0,000)						

TABLE 3: Factor and Reliability Analyses.

Considering the factor analysis results in Table 3, the KMO value was found to be 0,905, and according to this result, the selected sample size is suitable for factor analysis. Bartlett test statistics are also significant at the 0,000 error level, so it can be accepted there is consistency

between the questions. 37 items were spread over 7 different factors. Factor1, "conscientiousness personality trait"; Factor 2, "extraversion personality trait"; Factor 3, "openness personality trait"; Factor 4, "risky investment intention; Factor 5, "risk aversion"; Factor 6, "neuroticism personality trait"; and Factor 7 is called the "agreeableness personality trait". When the reliability values of the factors were analyzed, the reliability of the three factors was above 0.80 and the other three factors were above 0.70. The reliability of the agreeableness personality trait factor was calculated as 0.629. Although this value is not very high, it was expressed by Aren and Hamamcı (2020) as an acceptable value.

4.2. TOPSIS Results
After the factor and reliability analyzes were performed, the differences between the objective and subjective financial literacy and risk-taking and risky investment intention levels of the individuals were calculated using SPSS. With the help of the SPSS program, the responses of the participants to the specified variables were subtracted from each other (objective-subjective and risky investment intention-risk aversion) calculations were made. The lowness of these differences was accepted as a sign of rationality (consistency) and, the most rational one was determined according to personality characteristics with the TOPSIS method. The decision units and criteria to be used in the TOPSIS method were determined and shown in Table 4. The expectation is that the difference between the risk aversion and the risk investment intention value is "0". This situation was also accepted as a sign of rational behavior. The difference between objective and subjective literacy equal to "0" was accepted as the determinant of the fact that people evaluate themselves realistically regardless of their emotions.

		Abbreviations
Decision Units	Extraversion (Personal Trait)	
	Agreeableness (Personal Trait)	
	Conscientiousness (Personal Trait)	
	Neuroticism (Personal Trait)	
	Openness (Personal Trait)	
Criteria	The difference between Objective Financial Literacy and Subjective Financial Literacy	FLD
	The difference between Risky Investment Intention and Risk Aversion Behavior	ROD

TABLE 4: Decision Units and Criteria Used in the TOPSIS Method.

First of all, the weight values of the criteria needed in the 3rd step of the TOPSIS method were calculated by the Entropy Weighting Method, and then the ranking was made among decision units by switching to TOPSIS.

4.2.1. Weight Calculation with Entropy Weighting Method
Step 1: Creating the Decision Matrix
The values of each decision unit related to the relevant criteria were found and a decision matrix was created with these values.

Step 2: Creating the Normalized Decision Matrix
To obtain the normalized matrix, the sum of each column in the decision matrix was calculated separately. Then, normalization was performed by dividing each value in the columns into their column totals separately.

Step 3: Finding Entropy Value Related to Criteria
In this step, each normalized value was multiplied by its "ln" value. Then the total value of the columns was taken. The "k value" needed to calculate the entropy value was calculated as $k = 1 / \ln (5) = 0.621335$. Entropy values of the criteria were obtained by multiplying the total value of the

columns with the (–k) value. (Note: Since the number of decision units in the study is 5, it was used as "ln (5)" in the calculation of k value.)

Step 4: Calculating the Degree of Differentiation of Information
The degree of differentiation (dj) of the information was calculated by subtracting the entropy values obtained in the previous step from 1.

Step 5: Weights of Criteria
Finally, the dj value of each criterion was divided by the total dj value and the weights of the criteria were calculated: *FLD: 0,0982570; ROD:0,90174297*

4.2.2 Calculations with TOPSIS

After determining the research criteria and decision units, the decision matrix for the TOPSIS method was created and shown Table 5. Then, normalization was performed by squaring each value in the decision matrix (Equation 1). In the 3rd step, the weighted normalized matrix was formed by multiplying the weight values of the criteria calculated by the entropy weighting method with the relevant values in the normalized matrix. In the 4th step, the ideal solution value and the non-ideal solution value were calculated according to the Equation 2 and 3. In the next step, the ideal distances (S +) and non-ideal distances (S-) for each decision unit using Equation 4 and 5 (in Table 2) were calculated. In the last step, using the Equation (6), the relative proximity value to the ideal solution (C*) was calculated and all of these values were shown in Table 5. Finally, the results were ranked from good to bad.

	S+	S-	C*	Ranking
Extraversion	0,011824	0,014844	0,556622	4
Agreeableness	0,004882	0,020899	0,810640	3
Conscientiousnes s	0,003623	0,022070	0,858988	2
Neuroticism	0,025687	0	0	5
Openness	0,001705	0,0252259	0,936701	1

TABLE 5: Ideal distance (S +), Non-Ideal Distance (S-) and Relative Proximity Value to the Ideal Solution (C*) Results and Ranking.

When the results in Table 5 are analyzed, it was obtained that individuals with Openness personality traits are more consistent in terms of financial literacy and risk-taking intentions with a value of 94%. Individuals with openness personality trait were followed by individuals with conscientiousness (85%) and agreeableness (81%) personality traits. However, this consistency was not found in individuals with prominent neurotic features.

At the second stage of the research, while determining the decision units, the attitudes of pleasure and loss aversion in individuals were also taken into consideration. In this context, individuals with different personality traits were grouped according to their high sense of pleasure or loss aversion. The decision units and criteria determined by these conditions were shown in Table 6.

		Abbreviations
	Extraversion (High Pleasure)	EPT_1
	Extraversion (High Loss Aversion)	EPT_2
Decision Units	Agreeableness (High Pleasure)	APT_1
	Agreeableness (High Loss Aversion)	APT_2
	Conscientiousness (High Pleasure)	CPT_1
	Conscientiousness (High Loss Aversion)	CPT_2

	Neuroticism (High Pleasure)	NPT_1
	Neuroticism (High Loss Aversion)	NPT_2
	Openness (High Pleasure)	OPT_1
	Openness (High Loss Aversion)	OPT_2
Criteria	The difference between Objective and Subjective Financial Literacy	FLD
	The difference between Risk Intention and Risk Aversion Behavior	ROD

TABLE 6: Decision Units and Criteria Used in the TOPSIS Method.

In this part of the research, the weights related to the criteria were also calculated with the Entropy Weighting Method. In the previous section, weight calculations made in detail were repeated. The weight values of criteria found after the calculations: *FLD:0,500460; ROD:0,499540*

Then, the weights found the above processes were used in the calculation step of the weighted matrix in the TOPSIS Method and the weighted normalized matrix was obtained. Next step, the ideal solution value (taking the maximum value of each column) and the non-ideal solution value (taking the minimum value of each column) were calculated. After this step, the ideal distances (S +) and non-ideal distances (S-) for each decision unit were calculated using Equation 4 and 5, and finally when looking at Table 7; using the Equation (6), the relative proximity value to the ideal solution (C *) was calculated and the results were ranked from good to bad.

	S+	S-	C*	General Ranking	Pleasure (High)	Loss Aversion (High)
EPT_1	0,0102	0,0334	0,7656	5	1	3
EPT_2	0,0037	0,0407	0,9177	3		
APT_1	0,0146	0,0295	0,6699	6	2	1
APT_2	0,0001	0,0435	0,9972	1		
CPT_1	0,0158	0,0286	0,6435	7	3	2
CPT_2	0,0034	0,0402	0,9219	2		
NPT_1	0,0422	0,0069	0,1410	10	5	5
NPT_2	0,0365	0,0073	0,1666	9		
OPT_1	0,0211	0,0239	0,5308	8	4	4
OPT_2	0,0070	0,0366	0,8401	4		

TABLE 7: Ideal distance (S +), Non-Ideal Distance (S-) and Relative Proximity Value to the Ideal Solution (C *) Results and Ranking.

When the results in Table 7 were analyzed, it was concluded that individuals with high agreeableness personality traits with loss aversion attitude were more consistent with a value of 99%, both in terms of objective and subjective financial literacy and risky investment intentions. Individuals with the conscientiousness personality trait (92%) with a high attitude of loss aversion were in the second rank, and individuals with extraversion (91%) with a high attitude of loss aversion were in the third rank. Individuals with high-pleasure neuroticism personality trait were in the last in the general ranking. This means that they are not very consistent in terms of both financial literacy (objective and subjective) and risky investment intentions.

At the same time, when each personality trait is evaluated in itself in terms of two motivational elements (loss avoidance and pleasure), it was found that individuals exhibit more consistent behaviors in the situation of high loss aversion compared to the situation of high pleasure emotion (EPT_2>EPT_1; APT_2 > APT_1; CPT_2 > CPT_1; NPT_2 > NPT_1; APT_2 > APT_1).

When we rank the personality traits according to the situation where the attitude of loss aversion is high, it was found that the individuals with agreeableness personality trait are the most consistent (rational). It can be said that individuals with conscientiousness trait follow these individuals, and on the contrary, individuals with neuroticism trait behave more inconsistently than others.

When it was rank the personality traits according to the situation in which the emotion of pleasure is high, it can be said that individuals with extraversion trait are more consistent (rational) but again, as before, individuals with neuroticism trait behave more inconsistent than others.

5. CONCLUSION

Despite the claim that neoclassical finance is rational for individuals, behavioral finance states that individuals are normal and systematically deviate from rationality. Many studies conducted within this framework have investigated psychological variables that may be related to investment preferences. In recent years, personality trait is also a subject that has been investigated in terms of its relationship with investment preference. On the other hand, studies on neuro finance try to establish a link between investment preferences and brain-activated regions by using various brain imaging techniques. In this context, two main phenomena are emphasized: pleasure and loss aversion. This study investigated the tendency to behave rationally according to both personality traits purely and personality traits under the phenomena of pleasure and loss aversion. As far as we know, this is the first study in the field because of this feature.

It was expected that individuals' risk-taking will be consistent with their risky investment intentions, and their objective and subjective financial literacy levels should be close or the same. Two features mentioned were accepted as rational behavior criteria in this study. In this way, the rational behavior relation according to personality traits was investigated with the TOPSIS method, which is one of the multiple decision-making methods. As a result of analyzes, a personality trait that behaves the most rational was determined as openness. Individuals with neuroticism trait are those who do not behave rationally at all. The characteristics that define the openness personality trait are intellectuality, open-mindedness, and demanding information. It is not surprising that they exhibit rational behavior because of these features. On the other hand, neuroticism is expressed as emotional instability. It is quite possible and expected that people with this feature will be reflected in the decisions of the tides experienced in their inner worlds. For this reason, people with this feature demand risk on the one hand, and do not prefer risky investments on the other. On the contrary, people with openness personality traits exhibit more consistent behavior.

In addition to these findings, the effect of pleasure and loss aversion on rational behavior was investigated based on personality traits. Each personality trait was divided into two groups, as high pleasure and high loss aversion. Neurotics were also identified as those that displayed the most irrational behavior in both cases.

When evaluated in general, our study provides some findings that are the first in the literature. The relationship between personality traits and rationality was frequently evaluated with risk appetite, especially in some studies in the field of finance. However, according to the difference between risk appetite and risky investment intention, the first assessment was made in this study to the best of our knowledge. As cited in the literature section, even the number of studies evaluating the relationship between risk appetite and risky investment intention in the context of personality traits is quite limited. In addition, especially pension fund consultants and investment consultants tend to advise according to their customers' risk perceptions. However, their basic acceptance here is that individuals' risk perceptions and risky investment intentions are in harmony. Behavioral finance studies frequently cite such irrational behavior of individuals. This study is noteworthy in terms of showing which personality trait individuals have a higher potential to have such inconsistent behaviors in terms of personality traits. For example, it is not wrong to pay attention to risk appetite while advising individuals with openness personality traits. However,

due to the inconsistency between risk appetites and risky investment intentions of individuals with neurotic personality traits, recommendations given solely according to their risk appetite may not make customers happy.

On the other hand, the examination of pleasure seeking and loss aversion tendencies, which stand out with neurofinance studies, in terms of personality traits is interesting for both the literature and the industry. In addition to personality traits, individuals have a tendency to avoid loss resulting from their genetic makeup and experiences or to seek pleasure. These two contrasting tendencies are also closely related to attitude towards risk and rationality. İndividuals with openness personality trait found as the most rational personality trait in our study drift away from rationality as their feelings of seeking pleasure and avoiding loss increase. On the other hand, it is understood that individuals with agreeableness personality traits that tend to avoid high loss and extroverts who seek high pleasure can make more rational decisions. These findings show how individuals with different personality traits, whose different impulses are activated, deviate from rationality.

As a result, these findings are more useful for investors and investment consultants. From the perspective of the investor, it is important in terms of recognizing himself/herself and knowing which type of behavior s/he is more prone to. On the other hand, it is also noteworthy for investment consultants as it will help them get to know their customers and provide them with rational or emotional advice.

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