Developing a Financial Profile Test: Big Five Personality Traits and Degree of Financial Literacy influencing Individual Financial Risk Tolerance

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Dissertation submitted in partial fulfilment of requirements for the MSc in Management, at the Universidade Católica Portuguesa, 12th September 2024

Abstract

In "Developing a Financial Profile Test: Big Five Personality Traits and Degree of Financial Literacy Influencing Individual Financial Risk Tolerance" by Juliane Schwar, the focus is on creating a financial profile test to assess an individual's financial risk tolerance influenced by personality traits and financial literacy. The research builds on existing studies showing that financial risk tolerance is complex and influenced by several factors. The study highlights a common discrepancy between people's perceived financial knowledge and their actual understanding. To address this, the study measures financial literacy by combining self-assessment with questions on diverse financial topics. Personality traits are assessed through questions built on the Big Five personality traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism. Financial risk tolerance is measured using a questionnaire designed to explore various aspects of this trait. Based on their answers, people are grouped into several profiles using cluster analysis. Contrary to previous investigations, conscientiousness is found to positively influence risk tolerance, while openness to experiences has no significant impact. The study ultimately distinguishes individuals into seven risk tolerance clusters, integrating financial literacy and personality traits.

Keywords: financial profile test, financial risk tolerance, personality traits, Big Five personality traits, financial literacy

Resumo

Em “Developing a Financial Profile Test: Big Five Personality Traits and Degree of Financial Literacy Influencing Individual Financial Risk Tolerance”, de Juliane Schwar, o objetivo é criar um teste de perfil financeiro para avaliar a tolerância ao risco financeiro de um indivíduo, influenciada por traços de personalidade e literacia financeira. A investigação baseia-se em estudos existentes que mostram que a tolerância ao risco financeiro é complexa e influenciada por vários factores. O estudo salienta uma discrepância comum entre o conhecimento financeiro percepcionado pelas pessoas e a sua compreensão real. Para resolver este problema, o estudo mede a literacia financeira combinando a autoavaliação com perguntas sobre diversos tópicos financeiros. Os traços de personalidade são avaliados através de perguntas baseadas nos cinco grandes traços de personalidade: abertura, conscienciosidade, extroversão, agradabilidade e neuroticismo. A tolerância ao risco financeiro é medida através de um questionário concebido para explorar vários aspectos desta caraterística. Com base nas suas respostas, as pessoas são agrupadas em vários perfis através da análise de clusters. Contrariamente a investigações anteriores, verifica-se que a conscienciosidade influencia positivamente a tolerância ao risco, enquanto a abertura às experiências não tem um impacto significativo. O estudo acaba por distinguir os indivíduos em sete grupos de tolerância ao risco, integrando a literacia financeira e os traços de personalidade.

Palavras-chave: teste de perfil financeiro, tolerância ao risco financeiro, traços de personalidade, traços de personalidade Big Five, literacia financeira

Acknowledgments

I sincerely thank the Universidade Católica Portuguesa for the valuable experience I was able to gain during my Master's degree, which has been instrumental in shaping my academic career. My special thanks go to Professor Rute Xavier for her guidance, advice, and the opportunity to work with Doutor Finanças. My Master's thesis would not have been possible without the supportive and collaborative environment of the Doutor Finanças team. I would also like to thank my colleague Sophie Malischewsky for her camaraderie and smooth collaboration.

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1 Introduction

Innovation and competition in the financial market have broadened the choice of investment strategies and therefore the range of investment horizons available to consumers. However, this diversity has led to a more complex nature of investment, which means that it is more important for clients to engage in financial planning and have a clearer investment strategy. In this regard, a key consideration is assessing clients' risk tolerance and adjusting their investment portfolios accordingly.

Grable (2000) defined financial risk tolerance (FRT) as the maximum level of uncertainty an individual is willing to accept when making financial decisions. Hermansson and Jonsson (2021) stress its impact on economic decisions, serving as an indicator of financial behavior. Financial risk tolerance (FRT) is multidimensional and influenced by a variety of factors, such as environmental, socioeconomic, and demographic factors (Kannadhasan et al., 2016). Within this spectrum, personality traits emerge as key determinants. Behavioral finance highlights the importance of personality traits for financial behavior, which shape the patterns and irrationality of investor decisions, and emphasizes the close link between individual personality and financial decision-making processes. Additionally, according to the European Commission (n.d.), 'the knowledge and skills needed to make important financial decisions' - or financial literacy - also has a significant impact on risk tolerance. The complex system of all these determinants suggests tailoring financial planning to individual investor profiles.

Serving as an integral component of a consulting project, this research paper was conducted in collaboration with Doutor Finanças, a credit broker based in Lisbon, Portugal. Doutor Finanças has emerged in 2014 and has already employed 209 workers, 70 of whom were hired in 2022. The company's rapid development is evident in the rate at which it recruits staff. Doutor Finanças provides a complete consultation on financial institutions for each client, life and property insurance, energy efficiency solutions, or investing. The customer's division assists with loan applications, negotiates, and provides brief information on personal finances. Doutor Finanças improves household financial literacy in Portugal by providing articles, tools, and simulators on its website to help people better manage their money and make well-informed decisions.

Research on financial risk tolerance focuses primarily on objective factors such as demographics and socio-economic status, neglecting the complex influence of personality traits. This may limit the ability of financial institutions such as Doutor Finanças to offer financial planning that is better tailored to different clients.

Reflecting this observation, this study aims to close this gap and investigate how the Big Five personality traits - extraversion, agreeableness, conscientiousness, neuroticism, and openness - can affect financial risk-taking. Moreover, the study examines how actual and perceived financial competence affects people's willingness to take risks. The results of the analysis will be used to develop a financial profile test that will allow people to be categorized into different profiles based on their characteristics and financial literacy, so that Doutor Finanças can better tailor its financial advice and product offering to the needs of its customers.

This research will answer the following key questions: How do the Big Five personality traits (extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience) influence financial risk tolerance? What role does (actual and perceived) financial literacy play in shaping people's financial risk tolerance? How can insights from personality traits and financial knowledge be used to develop a financial profile test that predicts a person's financial risk tolerance? What strategic recommendations can be given to Doutor Finanças for the development and implementation of a personalized financial profile system for their clients?

This study examines the interaction of personality traits and financial knowledge on financial risk tolerance by empirically testing these hypotheses based on literature research in an online survey with 267 respondents. In this context, the data set is used to investigate whether personality traits and financial knowledge play an important role in predicting financial risk tolerance. The results are then discussed and compared with the results of the literature review and, thus, used to build a financial profile test.

This study has both research and practical implications. It provides critical insights for other researchers studying the specifics of financial risk tolerance. More practical implications belong to the sphere of providing financial advice to clients, particularly by Doutor Finanças. The results will contribute to the development of a personalized financial profile test that will enable financial advice to be tailored to the specific characteristics of each client.

2 Literature Review

2.1 Influence of Personality Traits on Financial Risk Tolerance

To create a financial profile that accurately reflects someone's risk tolerance, it's important to consider what recent studies have found. This paper looks at how personality traits affect financial risk tolerance, using various studies to give a clear picture of how personality impacts financial decisions. The following section explains the theory behind the connection between personality and risk tolerance and introduces the hypotheses tested later.

Individuals' personalities represent the way they act towards and with others, including observable characteristics. It is also the characteristics people display that are relatively stable in nature. Behavioral finance theories believe that investors are not always rational; rather, their financial decisions and behavior are influenced by psychological and personality traits. According to both Pak and Mahmood (2015) and Sadi et al. (2011), personality traits are a critical issue in identifying an individual's propensity to take risks in finance studies. Moreover, understanding an investor's personality is crucial because it has huge impacts on decisions. It affects investment preferences depending on the type of risk tolerance (Gul & Khilji, 2021).

Presently, the five-factor personality model, also known as the Big Five personality traits, is the commonly accepted model in trait-based research and comprises personality in five dimensions: openness, conscientiousness, extraversion, agreeableness, and neuroticism. Importantly, this model presumes that personality traits exist on a spectrum, and each person falls somewhere on a continuum for each one. The basis of this model was laid by the factor-analytical studies of D.W. Fiske (1949). Subsequently, the model was further developed by many researchers. McCrae and Costa (1996) introduced the NEO Personality Inventory, an assessment tool for measuring the five domains. Digman (1990) collected all research on the subject and made a refined description of the feature and the model of the five major factors. Having investigated the issue, researchers and psychologists have now reached common ground on five basic possible variables of personality (Deniz & Satici, 2017). Several studies have proposed this model to examine the impact of personality traits on investors' risk tolerance behavior, considering risk perception and propensity (Pak & Mahmood, 2015; Mayfield et al., 2008).

Risk tolerance has been linked with personality in multiple studies. Bye and Lamvik (2007) also report that there is a relationship between personality and risk tolerance, especially toward financial decision-making, which has been confirmed by Thanki (2015). Afaf and Sarwar (2016) examined the decisions of individual investors relative to investor psychology and socioeconomic factors. Their findings indicated that behavioral biases were far more powerful

drivers of the choices made by small private traders. Moreover, Kourtidis et al. (2017) provided evidence that the Big Five personality traits significantly influence investors' trading behavior and stock trading outcomes. Although these studies suggest that there is some correlation between the Big Five personality traits and financial risk tolerance, there is little empirical work to support such a correlation, so it is possible that the link between personality and risk tolerance is not as strong or even as direct as is often claimed. There are also suggestions by Brown and Taylor (2011) that financial decision-making is not simply stable personality traits but rather is a learned response in which education or experience has created. Accordingly, they posit that linking financial behaviors to stable traits, such as the Big Five personality traits, may be useless. Various opinions suggest that the commonly described correlation between personality traits and risk tolerance may not accurately reflect the relationship. These ambiguities are likely caused by the complex nature of human behavior. For example, Pinjisakikool et al. (2017) claimed that the relationship between Big Five traits and risk-taking behavior cannot solely be dependent on respective affective propensities; they must also interact with such background conditions as socioeconomic conditions across their life span. This implies that the relationship between personality traits and risk tolerance may have more nuances than what is currently being researched.

Extraversion is a trait associated with individuals being sociable, assertive, and enthusiastic. More specifically, extraverts are extremely outgoing, talkative, and especially sociable and highly energized (Cooper, 2003). The connection between extraversion and pro-activity is observed in Myers et al. (2010), as they imply that extroverts are more likely to be not only social but also to communicate their opinion as well as take the lead. Specific research has focused on how extraversion correlates with financial and risk-related decisions. The outcome of the research done by Oehler et al. (2018) indicated that the more extravert a person is, the more risk they are going to take. A study by Sadi et al. (2011) confirmed that extraversion is positively associated with a willingness to engage in riskier endeavors. Extraverted individuals are more inclined to take risks, influencing their decision-making in financial investments. The literature shows a positive correlation between extraversion and financial risk tolerance (Mayfield et al., 2008). Extraverted individuals show a tendency to respond to external stimuli and social influences, adopt an optimistic perspective, and expect favorable outcomes (Pak & Mahmood, 2015). Some previous research has also proven that extraversion might be a predictor of overconfidence in future market conditions (Pan & Statman, 2012). Oehler et al. (2018) conducted research showing that more extraverted people are likely to overpay for risky assets and trade in an overstated market.

Neuroticism describes the personality trait to feel nervous, always on edge, or optimistic (Cooper 2003) as opposed to emotionally stable. Emotionally stable individuals are more likely to be calm and confident, while very neurotic persons tend to be moody, anxious, and depressed (John et al., 2008). Neurotic individuals are less likely to take risks, show a lack of analytical ability, and have reduced critical thinking levels (Pak & Mahmood 2015). Their anxiety leads to disrupted cognitive processes and low risk-taking behaviors, particularly in high-risk situations. Consistent with the finding that risk tolerance decreases as neuroticism increases, studies have shown heightened anxiety-related neurological impairment to amplify risk aversion (Young et al., 2012). Furthermore, neurotics experience higher levels of stress and depression amongst shame (Costa et al., 2001), as compared to more stable individuals; consequently, this reduces their ability to handle the typical fluctuations of risky investments and undermines their confidence in financial information. This erosion of trust creates a pessimistic view of the market future, as fears arise about potential deadline stock exchange crashes (Jiang et al., 2020). As a result, more neurotic individuals are willing to select assets with lower risk compared to being less neurotic (Oehler et al., 2018), thus embodying the specific cautious attitude that comes along with their personality.

Openness to experience explicitly relates with personality characteristics such as imagination, culture specificity, and curiosity (Cooper, 2003). Openness includes curiosity and a willingness to change (Myers et al. 2010). Nandan & Saurabh (2016) link it to a higher propensity for risk-taking, suggesting a connection between this trait and challenges in managing uncertainty. High openness to experience is a trait that describes creativity, adaptability, curiosity, and unconventional approaches (Mayfield et al., 2008), which in turn correlates with increased risk-taking behavior. Salameh et al. (2022) support the relationship between openness and financial risk-taking, proposing that those who are more open are more likely to take risks. This is because they are better able to deal with ambiguity and resilience, are more ready for change, and have an increased tendency to be innovative. Conversely, people who are low in openness prefer familiar routines to new experiences and therefore tend to not engage as much with risky things (Kowert & Hermann, 1997). People who are open to new experiences and more likely creative or imaginative are open-minded innovation seekers who may be more willing, for example, to observe new financial product offerings and absorb the idea of fluctuating risky investment markets faster (Brooks & Williams 2021).

According to empirical evidence, agreeable people are less prone to conflict-aversion due to their general helpfulness and compassion. This is opposed to the less agreeable people, who are more skeptical and inquisitive. Chitra and Sreedevi (2011) found that agreeable people engage

in deeper processing of information, which increases their risk-aversion, making them think twice before they act. Dutta et al. (2010) describes very agreeable individuals as sociable and generous, yet also trustworthy with a discerning eye for authenticity. Costa and McCrae (2001) defined the concept of agreeableness in terms of traits such as being kind, likely or optimally generous, undemanding, and compromising at their preferred costs. Agreeableness is consistently found to be inversely related to risk tolerance in multiple studies. Similarly, Pak and Mahmood (2015) found that people who have a high level of agreeableness have a low propensity to take risks. Taken together, this suggests that individuals who have higher levels of agreeableness are generally less risk averse. It was expected that investor behavior is largely speculative, and decisions are generally neither independent nor rational (Chitra & Sreedevi 2011). The perception that an advisor will have more worthwhile things to say (Brooks & Williams 2021) and the fear of being looked down upon socially combine, respectively making agreeable investors somewhat less likely than others not to comply with their advisor's advice. The study by Pak & Mahmood (2015) also found that risk tolerance negatively and significantly correlated with agreeableness.

Conscientiousness is a trait indicating individuals who are systematic, careful, diligent, responsible, organized, and determined (Cooper, 2003). Jackson et al. (2010) point out that conscientious people show strategic thinking and organized behavior, which are in strong contrast to impulsivity. Conscientious people are characterized by determination, reliability, organization, perseverance, and punctuality, often showing a tendency toward cautious behavior rather than impulsiveness. What sets conscientious people apart is that they have self-discipline, are careful about their behavior, and approach things strategically instead of acting in haste. From an early age, they exhibit keen attention to detail and meticulous planning for assessment, considering the long-term perspective; consequently, their decision-making appears to align with a specific context. Investors scoring high in conscientiousness may have relatively favorable risk tolerance levels (Wong & Carducci, 2013; Pan & Statman, 2012). Yet mixed results appear, with research from Goldfayn-Frank (2018), for example, revealing a positive correlation between conscientiousness and stock market investing.

2.2 Influence of Financial Literacy on Financial Risk Tolerance

The academic literature is rich in research on the relationship between financial knowledge and risk tolerance.

Yong and Tan (2017) investigated the influence of personal characteristics such as parental background, gender, or income on financial literacy as well as these factors in relation to the household-related economic behavior of Malaysian adolescents. The results showed that the financial literacy of male participants was higher on average and that among college students, parents played a very important role in determining students' financial behavior. The researchers therefore concluded that since fully functional financial literacy requires sound financial knowledge, there is a need for educational programs that focus on nurturing young adults with low financial literacy.

Similarly, Bajo et al. While the former demonstrated that people with less financial knowledge are more risk-averse (Lusardi et al., 2015), Hermansson and Jonsson (2021) suggest a positive relationship between high literacy of financial matters, awareness of personal legal rights as it comes to saving and investing, and increased likelihood for taking risks. They also found that the source of financial knowledge, a range from formal education or non-formal experience, can further impact intensity in this relationship.

For instance, Sabri and Afiqah (2016) have concluded that financially literate Millennials are riskier in their investments. To solve the nationwide problem of gross financial ignorance, Lusardi (2015) recommends that schools teach their students about money. Brooks et al. 2019), who also emphasized the importance of education for protecting against financial risk. Integrating financial literacy across boards on educational and professional programs offers people the chance to pick up crucial skills in sound money management and risk aversion.

On the other hand, comprehensive financial education and corresponding evaluation mechanisms help individuals better assess financial risks. However, one must be cautious with self-assessments. Anderson et al. (2017) identified a discrepancy between individuals' perceived and actual levels of financial literacy. Kramer (2016) argued that self-assessment alone is insufficient to determine the need for advice or the most suitable financial product. While self-assessment can serve as a useful starting point, further reflection with objective data provides a more accurate understanding of one’s financial knowledge. This view aligns with Wahab and Bunyamin (2023), who noted that self-reported financial knowledge is often influenced by bias, though it can still serve as a valuable tool for quantitatively measuring

financial knowledge. This body of research collectively emphasizes the unreliability of self-assessments, as individuals tend to overestimate their financial knowledge.

2.3 Models for Evaluating Financial Risk Tolerance and Creating Risk Profiles

There are various methodologies available for assessing the financial risk tolerance of individuals in the field of financial planning and advisory. This paper aims to review the models, using questionnaires as the chosen methodological approach for this assessment. Within the scope of these models, the two main methods gain particular attention. The first one implies the use of a single-question measure, which reflects an instrument originating from the Survey of Consumer Finances (SCF): the respondents are required to select the statement among the provided ones that better describes their way of saving or investing by taking risks. Despite its widespread use, the first measure continues to face numerous critiques. For instance, Hanna and Chen (1998) suggest that, as it is context dependent, it does not reflect people's inherent preferences. Chen and Finke (1996) argue that it may reflect the respondents' financial situation rather than their risk aversion. Nevertheless, Gilliam et al., (2010) argue that the SCF measure continues to be widely used because it is based on a direct assessment of risk attitudes and has been frequently analyzed in personal finance consumer or household portfolio research.

To test the premise that the assessment of financial risk is not simply an answer to one generic question, Grable and Lytton (2001) developed a multidimensional risk tolerance scale. As a result, the authors created a 13-item questionnaire to measure investment risk and other risk constructs, such as risk comfort, risk experience, and speculative risk. The scores range from 13 to 47, with higher numbers indicating greater financial risk tolerance. Since its creation in 2001, the Grable and Lytton (G&L) risk tolerance scale has become widely used among consumers, educators, and researchers. The available research reports imply that the measure has excellent psychometric qualities. In a study, Kuzniak et al. (2015) tested the risk tolerance scale on the data of more than 160,000 respondents and found the Cronbach's alpha estimate to be 0.77, which implies excellent reliability. In addition, reliability assessment by several dividing characteristics resulted in estimates in the range between 0.73 and 0.90. The validity test shows a positive relationship with equity ownership, while negative ones are with cash and bond ownership. The test demonstrates the ability to distinguish between different populations of those willing to invest risky sums. Further research supports the idea of a multidimensional questionnaire for the test of financial risk tolerance. There are several factors of such an attitude,

which claims multiple dimensions, but the models and respective factors may vary. The G&L Scale has significantly influenced the assessment of financial risk tolerance.

The 20-item version of the G&L scale was reduced to a 13-item questionnaire. The 13-item G&L test is designed to measure respondents' financial knowledge and self-assessment. The financial knowledge of people without financial education needs to be assessed, and its impact on their behavior in daily living expenses needs to be examined; therefore, the G&L test is a very suitable instrument. To eliminate the self-assessment bias, some financial literacy questions were included in this survey to test the assessment of one's financial knowledge. The entire survey includes the original 13-item questionnaire, self-assessment questions, and three questions from the financial literacy list.

3 Methodology

The study followed a quantitative methodology and used self-administered questionnaires incorporated in online surveys for data collection. This approach is also in line with how Doutor Finanças' goal of providing a seamless user experience for financial profile assessments and ensuring easy access to their clients.

Online surveys, free from geographic and socio-demographic constraints, have enhanced the validity and generalizability of the results. By eliminating the need for face-to-face interaction, this method has enabled large-scale data collection, with participants conveniently responding through devices such as computers and smartphones. This accessibility has also enabled the research to include a larger and more diverse group of participants within a short period of time. Existing research on financial risk tolerance and financial literacy has consistently supported questionnaires as the most effective tool for collecting quantitative data (Grable & Lytton, 1998; Hermansson & Jonsson, 2021; Kramer, 2016; Anderson et al., 2017). To investigate whether personality traits and the level of financial literacy influence a person's willingness to take financial risks and to contribute to the development of a financial profile test, the following hypotheses were formulated:

H1: Personality traits have a significant impact on financial risk tolerance.
- H1a: Extraversion has a positive relationship with risk tolerance.
- H1b: Conscientiousness is negatively related to risk tolerance.
- H1c: Agreeableness has a negative correlation with risk tolerance.
- H1d: Neuroticism is negatively related to risk tolerance.
- H1e: Openness to experience is positively related to risk tolerance.

H2: Financial literacy has a significant impact on financial risk tolerance.

The hypotheses are deduced from the existing literature and psychological theories; hence, they can be tested with strong statistical methods. A survey with three sets of questionnaires was created to test these hypotheses on the respondents' financial risk tolerance, Big Five personality traits, and financial literacy. A quality control question was also included to ensure that participants were paying attention during the survey and to increase the reliability of the survey through its increased statistical strength.

The questionnaire is referenced in the Appendix of this paper and is available in German, English, and Portuguese. Overall, to ensure accessibility without any financial knowledge,

questions that required such knowledge were excluded. Additionally, some questions were modified to suit the Euro currency, reflecting the survey's Europeanness.

The first block of questions that assesses the respondents' financial risk tolerance was adapted from Grable and Lytton's (1999) survey, as their consistency and statistical validity have been previously established. The risk tolerance answer was assigned a score according to the number by adding up each response to questions about financial risks. These scores range from 1, meaning low, all the way up there to a high of 2, 3, and 4 for people with greater financial resilience. The scores from each risk tolerance question were then summed. In particular, the scores fell in the 8 to 27 range. Then, the respondents are categorized into different levels of financial risk tolerance. In particular, the latter varies utilizing a five-point scale ranging from low to high risk tolerance.

The questions of the financial literacy part of the survey are about investments, savings, and debt which is based on the original Survey on Financial Literacy by Moore (2003), but shortened by three questions to control overall survey length. Based on the number of correct answers, respondents were categorized into different levels of financial knowledge: no correct answers indicate "no financial literacy," one to three correct answers suggest "low financial literacy," four to six correct answers imply "medium financial literacy," and seven to nine correct answers denote "high financial literacy." The self-assessment question was adapted from Kramer (2016), who successfully utilized it alongside a financial literacy test. For this purpose, respondents were requested to assess their financial knowledge using a scale ranging from zero (indicating low knowledge) to five (indicating high knowledge).

The third block of the survey consists of ten questions about the respondents' Big Five personality traits: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. Initially, the comprehensive 44-item Big Five Inventory (BFI) was considered; however, for this research paper, a more concise 10-item version was selected. To give the participants a thorough but feasible survey, which they could complete relatively quickly, an abbreviated version by Rammstedt and John (2007) was handed down. This practice of adopting the brief Big Five personality measure is a common one in research to comprehensively tap into the dimensions while keeping surveys at an acceptable length. The Big Five personality traits have been widely utilized in research examining the impact of personality traits on risk tolerance.

4 Data Analysis and Results

After completion and analysis, 327 responses from the survey were obtained. After excluding incomplete questionnaires, 267 valid responses for further processing were kept.

4.1 Financial Risk Tolerance score

Following the methodology described earlier in this chapter, a financial risk tolerance score is computed for all survey respondents based on how they had responded to these questions. We then used this score to rate respondents on a five-point risk tolerance scale (from low to high).
The results in figure 1 show that only a small proportion of 0.7% of respondents had a low risk tolerance, indicating a tendency towards caution and a more conservative risk strategy, including a lower number of risk situations explored using this approach. The remaining participants had a lower than average risk tolerance of 4.9% overall and favored safer or more predictable outcomes. In contrast, we classified a clear majority of participants, 55.8%, as having an average risk tolerance. This implies that they take a moderate level of risk, not overly cautious but also not seizing every market opportunity. Another finding is that 21.7% of participants have an above-average risk appetite, meaning that they are more willing to take certain risks in order to realize potential gains. A minority of survey participants (16.9%) have a high risk tolerance, describing their attitude to risk-taking for high gains as highly positive and showing a willingness to engage in activities with increased risks.
Taken together, these results indicate a wide range of risk attitudes in people. Moderate risk preferences (which a significant proportion of the sample exhibit) are balanced by attitudes ranging from little to no desire for taking risks on one end and high levels of preference toward wanting to take on higher levels of risks on another. Individuals range from those who prioritize caution and risk minimization to those who lean towards taking on higher levels of risk.

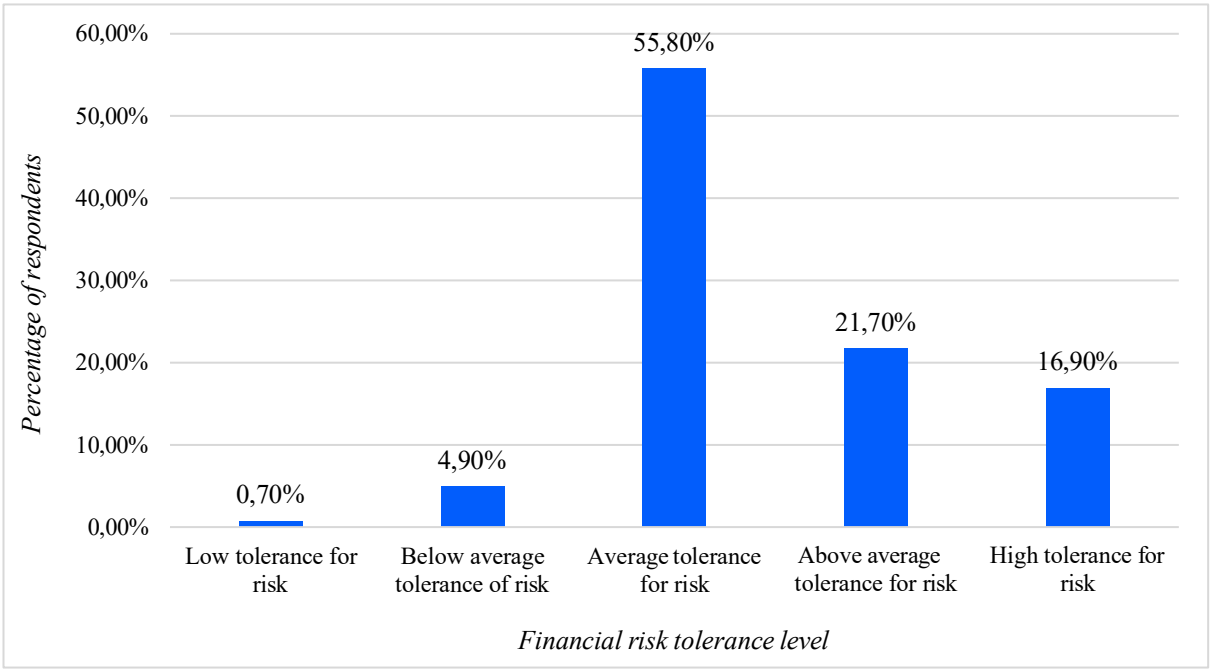

Figure 1. Distribution of financial risk tolerance levels (Source: survey data)

4.2 Financial Literacy Assessment

In addition to asking participants questions about their financial risk tolerance, their financial literacy was also assessed, allowing to assign each respondent into one of four categories: “no financial literacy,” “low financial literacy,” “medium-level financial literacy,” or "high financial literacy." Participants were asked to rate their level of finance knowledge on a scale from zero (indicating little knowledge) to five (indicating a high level of proficiency).

The results of the self-assessment indicate that knowledge spread across the spectrum, as shown in Figure 2. Only about 5.2% of the respondents did not feel they had the necessary level of financial knowledge. 10.5% thought they had only a basic understanding of the topic. Furthermore, 20.6% of the surveyed individuals assessed their knowledge as moderate, indicating a relatively limited comprehension of financial matters. 30% of the respondents made up the most significant group, classifying themselves as having average knowledge, or a reasonable understanding of the topic. Finally, 24.7% of the respondents considered themselves knowledgeable, which refers to a solid understanding of financial concepts. 9% evaluated their knowledge as high, which can be related to advanced expertise in the sphere of finance.

In general, the data show that self-perceived financial literacy levels are distributed across a continuum from basic to advanced, and the largest share of respondents would place themselves in our moderate category.

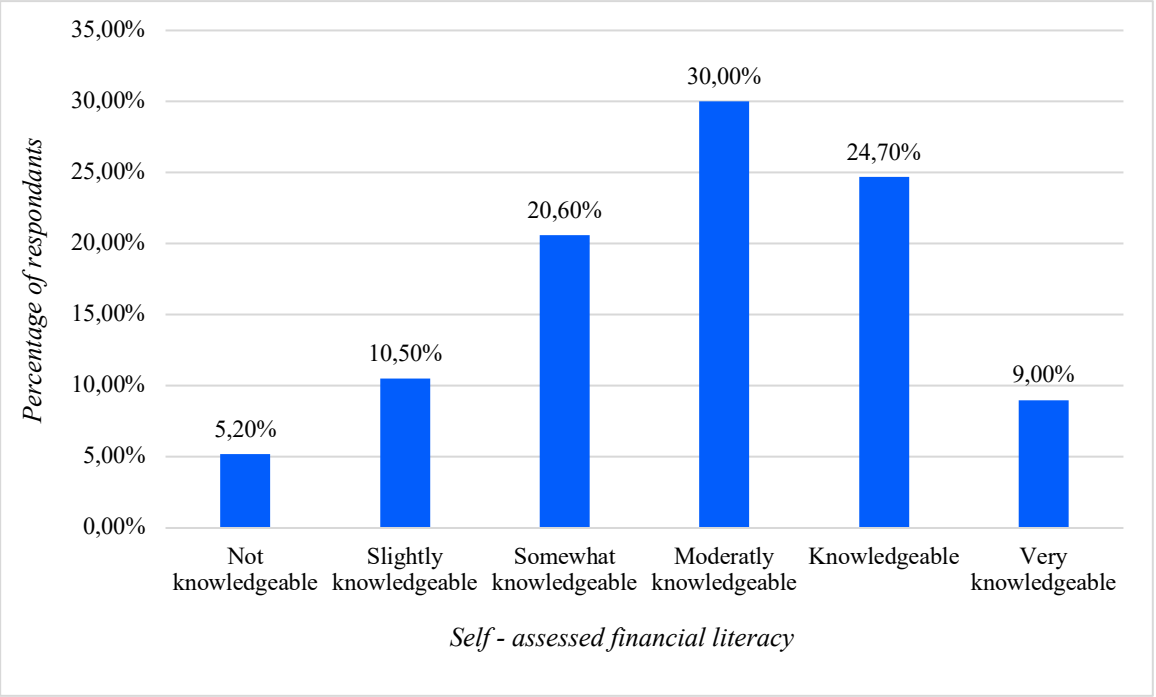

Figure 2. Distribution of self-assessed financial literacy (Source: survey data)

Figure 3 illustrates the results of the financial literacy test. A small part of the respondents, 3.4%, received zero points for correct answers, which indicates a significant deficit in financial knowledge. Additionally, we classified 15% of participants as having low literacy, indicating a basic understanding. The majority of respondents, 46.1%, have a medium level of competence, and a significant part, 35.6%, belong to high financial literacy.

The respondents' level of education is the reason for this distribution of indicators. There are many students among the survey participants, and accordingly, it is likely that the education level is above average.

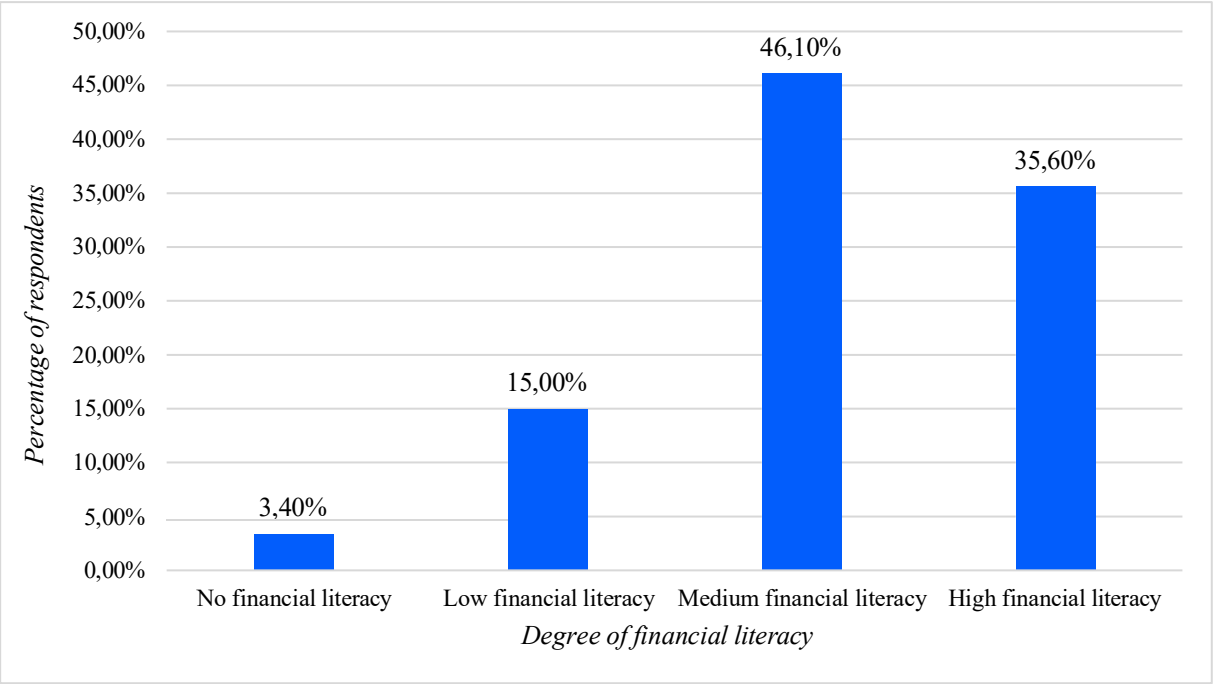

Figure 3. Distribution of financial literacy levels (Source: survey data)

To investigate the assumed correlation of individuals' self-assessed financial knowledge to their actual level of knowledge, a regression analysis was conducted in R. The results of the analysis are presented in figure 4.

The results show that if a person declares they have no financial knowledge, a financial literacy score of 2.02 would predict their actual level of knowledge. This is a low level of financial knowledge, and it could be utilized as the base for determining the level of financial knowledge that an individual possesses. With each one-unit increase in self-assessed financial literacy, a 0.29-unit increase in the actual financial literacy level can be expected. This implies that there is a positive correlation between the two concepts and that if an individual has higher self-assessed financial knowledge, they will have higher levels of actual financial knowledge. The fact that non-financial people performed better than expected in this test is surprising. Similarly, it is surprising that individuals who expected to score highly in the test also performed poorly. The two observations are especially visible in the lower and upper ends of the self-assessed financial knowledge scale.

Both the slope and the intercept have a p-value of less than 0.05, implying that the findings are statistically significant. The multiple R-squared value is only 0.2282, implying that self-assessed knowledge only explains 22.82% of the differences in actual financial knowledge.

```
Residuals:
    Min      1Q  Median      3Q     Max
-1.7614 -0.4712  0.1093  0.5288  1.6897

Coefficients:
                              Estimate Std. Error t value Pr(>|t|)
(Intercept)                    2.02002    0.13334  15.149   <2e-16 ***
self_assessed_financial_literacy  0.29024    0.03279   8.851   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.6951 on 265 degrees of freedom
Multiple R-squared:  0.2282,    Adjusted R-squared:  0.2253
F-statistic: 78.34 on 1 and 265 DF,  p-value: < 2.2e-16
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Figure 4. The effect of self-assessment on the actual financial literacy level - linear regression analysis (Source: survey data)

4.3 Personality traits

This section provides an analysis of personality traits, including extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience.

According to the survey findings, the analysis of extraversion shows that 38.29% of participants were categorized as 'Quite Extraverted', 29.37% as 'High Extraversion', and 26.02% as 'Average Extraversion', with 5.95% showing 'Slightly Extraverted' tendencies.

The mean of the score was 3.69 and the standard deviation was 0.85. This indicates a tendency towards higher extraversion among participants. The range of values was between 1.5 and 5, the variance was 0.72, and the quartiles Q1, Q2, and Q3 were 3.0, 3.7, and 4.4, respectively. This indicates that most respondents were highly to moderately extraverted.

In terms of agreeableness, 40.15% of respondents were categorized as 'Quite Agreeable', 32.71% as 'Average Agreeableness', and 15.99% as 'High Agreeableness', with smaller portions categorized as 'Slightly Agreeable' (9.29%) and 'Low Agreeable' (1.49%). The mean score was 3.37 with a standard deviation of 0.87. This reflects a moderate agreement. The range was 2 to 4.5, the variance was 0.76, and the quartiles Q1, Q2, and Q3 were 2.9, 3.4, and 3.9, respectively. This indicates that most participants fell within the middle to high agreeableness range.

Survey findings indicate that 43.49% of participants were categorized as 'Quite Conscientious', 25.28% as 'High Conscientiousness', and 27.51% as 'Average Conscientious', with 3.35% categorized as 'Slightly Conscientious'. The mean was 3.71, the standard deviation was 0.78, and the scores ranged from 2.3 to 5. The variance was 0.61, showing less variability, and the quartiles were 3.2 (Q1), 3.7 (Q2), and 4.2 (Q3), highlighting that a significant number of respondents consistently demonstrated high conscientious behavior.

When it comes to neuroticism, 37.92% of participants were categorized as 'Average Neurotic', 35.32% as 'Slightly Neurotic', and 20.82% as 'Quite Neurotic', with lower values shown by 3.35% as 'Low Neurotic' and 2.23% as 'High Neurotic'. The mean was 2.65 with a standard deviation of 0.82, ranging from 1 to 4.5. The variance was 0.67, with quartiles at 2 (Q1), 2.7 (Q2), and 3.3 (Q3), showing a general trend towards lower neuroticism, suggesting that most of the respondents possessed a relatively stable emotional disposition.

In terms of openness to experience, 37.55% were rated as 'Quite Open to Experience', 32.71% as 'Average Openness to Experience', and 18.96% as 'High Openness to Experience', with 8.92% as 'Slightly Open to Experience' and 1.12% as 'Low Openness to Experience'. The mean was 3.47, the standard deviation was 0.92, and scores ranged from 2 to 5. The variance was

0.85, with quartiles at 2.9 (Q1), 3.5 (Q2), and 4.0 (Q3), indicating a prevalent openness among respondents that might foster creativity and adaptability in diverse environments.

Personality Trait	Category	Frequency	Percentage
Extraversion	Quite Extraverted	102	38.29%
	High Extraversion	78	29.37%
	Average Extraversion	70	26.02%
	Slightly Extraverted	16	5.95%
Agreeableness	Quite Agreeable	107	40.15%
	Average Agreeableness	87	32.71%
	High Agreeableness	43	15.99%
	Slightly Agreeable	25	9.29%
	Low Agreeableness	4	1.49%
Conscientiousness	Quite Conscientious	116	43.49%
	Average Conscientiousness	73	27.51%
	High Conscientiousness	68	25.28%
	Slightly Conscientious	9	3.35%
Neuroticiscm	Average Neuroticism	101	37.92%
	Slightly Neurotic	94	35.32%
	Quite Neurotic	56	20.82%
	Low Neuroticism	9	3.35%
	High Neuroticism	6	2.23%
Openness to Experience	Quite Open to Experience	100	37.55%
	Average Openness to Experience	87	32.71%
	High Openness to Experience	51	18.96%
	Slightly Open to Experience	24	8.92%
	Low Openness to Experience	3	1.12%

Figure 5: Distribution of personality trait data (Source: survey data)

4.4 Influence of Personality Traits on Individuals' Financial Risk Tolerance

In the course of this analysis, five hypotheses are tested in order to gain further insight into how personality traits affect the willingness of representatives to take risks in a financial context. The first hypothesis states that extraversion is positively related to risk tolerance, meaning that individuals with a higher level of extroversion are more willing to take financial risks. The second, negative hypothesis describes the opposite case; due to their more conscientious nature, a higher level of this trait means that these individuals avoid risks and take fewer risks when it comes to financial decisions. A third hypothesis states that there is a negative relationship between agreeableness and risk-taking, indicating that highly agreeable individuals may shy away from financial risks. The fourth hypothesis on the importance of neuroticism for risk tolerance suggests that individuals high in this trait are hypothesized to be less tolerant towards risk. The fifth hypothesis states that openness to experience is positively related to risk tolerance. This suggests that people with high openness are more likely to take financially risky opportunities. All hypotheses are tested using data-specific statistical tests that ensure the accuracy and reliability of the results. As a result, this method provides fundamentally new insights into the impact of certain personality traits on financial risk-taking behavior.

The relationships between personality traits and financial risk tolerance were analyzed using software R to perform a multiple linear regression analysis. Here, multiple linear regression shows how much of the dependent variable (risk tolerance) can be explained by each independent variable (personality trait). The power of this lies in its ability to reveal whether the data contradicts the original hypotheses, as well as the extent to which each of these component hypotheses receives support from the associated coefficients and their statistical significance level. It helps to determine the coefficients that indicate both the strength and direction of each relationship, as well as the p-values that indicate the statistical significance of these relationships. These elements are essential for validating or rejecting the proposed hypotheses. Coefficients are estimates of how much the dependent variable is expected to increase if the predictor increases by one unit and everything else in your model remains unchanged. In contrast, bias coefficients reduce, while p-values provide an estimate of how significantly the formulators differ from zero. A sufficiently low p-value (typically < 0.05) says that the effect of that specific predictor on the outcome is significant and most likely not induced by chance.

The finding of the analysis indicated a positive and statistically significant relationship between extraversion and risk tolerance, testing the hypothesis H1a. This is inferred from the fact that

the coefficient of 0.5774 and a p-value less than 0.001 are significantly lower than the significance level of 0.05. This indicates that individuals who are more extroverted are more likely to engage in financial risks.

The hypothesis H1b proposed a negative relationship between conscientiousness and risk tolerance. However, the results contradicted this hypothesis, as indicated by a positive coefficient of 0.4515 with a p-value of 0.002. This p-value is also significantly lower than the significance level of 0.05, suggesting that conscientious individuals might be inclined towards taking financial risks, challenging the traditional view that links conscientiousness with cautious behavior.This p-value is much lower than the critical value of 0.05, which indicates potentially that conscientious people may be more disposed to taking risks in financial matters and provides a rebuttal against the stereotype associating conscientiousness with cautious behavior.

The findings confirm the hypothesis H1c, which suggests a negative relationship between agreeableness and risk tolerance. The coefficient of -0.6166 is negative, and the p-value is less than 0.001, below the significance level of 0.05. This is in line with literature that agrees that high agreeableness should prevent financial risks.

The analysis revealed a strong negative correlation when testing the hypothesis H1d, which suggests a negative relationship between neuroticism and risk tolerance. This hypothesis is supported by a coefficient of -0.6287 and a p-value less than 0.001, which is lower than the significance level of 0.05. This indicates that neurotic individuals are less likely to engage in risky financial behaviors.

Lastly, hypothesis H1e suggested that risk tolerance is positively related to openness. The results instead showed a negative coefficient of -0.1184 with a p-value of 0.358. Thus, the p-value greater than 0.05 provides no significant evidence in favor of a positive association between openness to experience and risk tolerance based on the data available. Consequently, there is not enough proof to nullify the zero-hypothesis, which explains that openness does not affect financial risk tolerance significantly.

4.5 Influence of Financial Literacy on Individuals' Financial Risk Tolerance

Investigating the relationship between individuals' financial literacy and their level of financial risk tolerance, an ordinal logistic regression analysis was conducted to test the hypothesis that "financial literacy has a significant impact on financial risk tolerance."

Results from figure 9 reveal several key insights. The coefficient of 1.38417, with a standard error of 0.5473 and a t-value of 2.5289, signifies that there is a positive correlation between financial literacy and the degree of financial risk tolerance. This implies that as financial literacy levels rise, individuals are more inclined to demonstrate increased levels of risk tolerance, thereby lending support to the hypothesis.

Furthermore, the coefficient of 0.01554 and the corresponding t-value of 0.0352 indicate that the quadratic term is not statistically significant. This implies that there is not enough proof to support a quadratic deviation from a linear trend between the two variables. Similarly, the cubic term's coefficient of 0.18571, with a t-value of 0.5668, is also deemed statistically insignificant, indicating the absence of a significant cubic component in the relationship.

Therefore, nonsignificance on the quadratic and cubic terms shows that the data describes a linear relationship between people's financial literacy levels and their risk tolerance with not much deviation or ability of capturing turning points.

```
Coefficients:
          Value Std. Error t value
...50.L  1.38417     0.5473  2.5289
...50.Q -0.01554     0.4414 -0.0352
...50.C  0.18571     0.3277  0.5668
```

Figure 6: *The influence of individuals' financial literacy on their financial risk tolerance - ordinal logistic regression analysis (Source: survey data)*

4.6 Development of Financial Profiles

To develop financial profiles based on the existing dataset, a k-mode cluster analysis was performed using R. This analysis segmented the data into seven distinct clusters, each differentiated by characteristics such as financial risk tolerance, financial literacy, and personality traits. While not all variables showed statistical signifi-cance for the correlation with financial risk tolerance in this study, they were taken into account based on past literature review where some variable can be correlated to dependency variable of research result. The minimum cluster contains 8.99 % of the sample, and the maximum is 19.10 %.

Cluster	1	2	3	4	5	6	7
Size	19.10%	12.36%	14.98%	11.98%	8.99%	17.60%	14.98%
Financial risk tolerance	High	Average	Average	Average	Average	Average	Average
Financial literacy	High	Medium	Medium	Medium	Medium	Medium	High
Extraversion	High	Average	Quite	Quite	High	Average	Quite
Agreeableness	Quite	Average	Average	Quite	Average	Average	Quite
Conscientiousness	High	Quite	Quite	High	High	Average	Average
Neuroticism	Slightly	Quite	Slightly	Slightly	Quite	Average	Average
Openness to Experience	Quite	Quite	Average	Quite	High	Average	Quite

Figure 7. Financial profiles - k-modes cluster analysis (Source: survey data

Cluster one, which makes up 19.10% of the sample, is characterized by high financial risk tolerance and advanced financial literacy. In addition to those characteristics, cluster one members have significantly high levels of extraversion and conscientiousness. These members can be identified as proactive individuals who are knowledgeable and comfortable with financial risks.

Cluster two includes 12.36% of respondents and shows moderate financial risk tolerance. These respondents tend to have a moderate approach to financial risk-taking, given that the rest of the dimensions are approximately medium for them.

Cluster three included 14.98% of participants and exhibited an average financial risk tolerance and moderate financial literacy. It is worth noting their high openness to experience. This trait suggests a willingness to explore new financial opportunities despite an overall moderate risk profile.

Cluster four included 11.98% of participants and therefore may be considered similar to cluster three in terms of financial risk tolerance and literacy. However, the degree of conscientiousness in the personality was higher. This indicates a more methodical and disciplined approach to financial risk-taking.

Cluster five included 8.99% of respondents. In terms of personality dimensions, these people have high levels of extraversion and openness to experience, but their financial risk tolerance and literacy are moderate. This suggests that these individuals are engaging and adventurous yet cautious in their financial practices.

Cluster six, comprising the largest group at 17.60%, presents a balanced profile with average scores across all traits, indicative of generalized financial behavior that avoids extremes in risk-taking.

Finally, cluster seven included 14.98% of respondents and demonstrated high financial literacy. In addition to that high score, their consciousness was also higher than the average score. Cluster seven thus includes meticulous and conservative people who, while knowledgeable about finance, are conservative in their risk-taking.

The clustering analysis reveals a prevailing trend towards average risk tolerance among the surveyed respondents, as already depicted in figure 1. The majority (80.9%) exhibit a level of average risk tolerance, followed by those with high-risk tolerance (19.1%).

5 Discussion

5.1 Personality Traits Influencing Individuals' Financial Risk Tolerance

When evaluating the relationship between personality traits and individuals' financial risk-taking, it is important to examine the elements described in the literature review and contrast them with the findings of this study. This discussion examines how certain personality traits correlate with financial risk-taking and highlights cases where the findings either support or challenge the established literature.

Consistent with the literature, this study found that extraversion positively influences financial risk-taking. This is consistent with the findings of Oehler et al. (2018), who found that extroverted individuals are more likely to engage in risk-taking behavior. Extraverts' sociability and desire for stimulation, as discussed by Cooper (2003) and Pak and Mahmood (2015), support their propensity for financial risk-taking and confirm the established relationship between extraversion and proactive financial risk-taking.

The findings regarding agreeableness are also consistent with established research indicating that highly agreeable individuals are less likely to take financial risks (Pak & Mahmood, 2015; Chitra & Sreedevi, 2011). This study confirms that agreeableness, with its inherent preference for harmony and conflict avoidance, correlates with lower financial risk tolerance.

Similarly, neuroticism has been confirmed to negatively influence financial risk tolerance, supporting the literature linking this trait to risk aversion due to increased anxiety and emotional instability (Costa et al., 2001; Young et al., 2012). This study supports the resilience of neuroticism as an indicator of conservative financial behavior.

Conversely, the relationship between conscientiousness and financial risk tolerance represented a departure from traditional expectations derived from the literature. While conscientious individuals generally prefer cautious and planned approaches, thereby reducing the likelihood of engaging in risky financial behavior (Vazifehdoost et al., 2012; Jackson et al., 2010), this study found that conscientious individuals may be more willing to take calculated financial risks. Conscientious individuals often apply their disciplined and careful planning traits to financial decisions and may take calculated risks when the risks are deemed reasonable and justified. This suggests a shift in the understanding of the dynamic nature of conscientiousness in financial risk-taking and calls into question the relationship between this trait and risk aversion.

The results on openness to experience refuted the established literature that this trait is positively correlated with financial risk tolerance (Mayfield et al., 2008; Nandan & Saurabh, 2016).

Contrary to these expectations, this study did not find a significant positive relationship. This discrepancy may indicate that the influence of openness on financial decisions is more complex, suggesting an evolving understanding of the impact of openness on financial risk-taking. Several factors may contribute to the lack of a significant positive association. While openness typically promotes curiosity and a willingness to explore new experiences and ideas, this trait does not necessarily translate into a direct propensity for financial risk. It is possible that open individuals are more discerning or selective in choosing the types of risk they take, perhaps preferring innovative or unconventional investment opportunities.

When comparing these results with the existing literature, some personality traits, such as extraversion and agreeableness, show that they predict financial risk tolerance in expected ways, while others, such as conscientiousness and openness to experience, challenge previous studies. This discrepancy suggests that financial risk tolerance is shaped by a complex set of factors, including changing trends and individual circumstances. The study thus provides a more nuanced understanding of the relationship between personality traits and financial risk tolerance and shows that this relationship is shaped by the complexity of personality itself. These findings underscore the importance of considering a wide range of psychological and situational contexts when assessing individual financial behavior and highlight the role of current socioeconomic trends and personal circumstances.

5.2 Financial Literacy Influencing Individual's Financial Risk Tolerance

The study aligns with previous research on the influence of financial knowledge on individual risk tolerance. Prior research has suggested that higher levels of financial literacy are positively associated with increased risk tolerance (Grable, 2000; Brooks et al., 2019). Those who are more financially literate have higher levels of confidence in their own financial decision-making and are therefore more likely to invest, especially when it comes to riskier types of investments. This study demonstrates a strong correlation between financial literacy and risk tolerance in Chapter 4.5. More financially literate people would be able to assess and deal with the complexity of financial risks on their own. This skill allows them to navigate the more nuanced environmental factors that influence choice in high-stakes risk contexts. We need to understand that even though financial literacy is a major component, it does not totally explain why someone will dare take the risks associated with money. The multidimensional nature of financial decision-making, involving perceptions and behaviors that interact in complex ways to shape our willingness to take risks, is further complicated by additional forms of external influence such as personal experiences and socioeconomic backgrounds.

5.3 Created Financial Profiles

The k-mode cluster analysis performed in this study identified seven distinct financial profiles. This segmentation largely aligns with the theoretical insights derived from extensive literature. Cluster One shows the correlation between high financial literacy and high-risk tolerance, aligning with studies by Brooks et al. (2019) and Grable (2000) that associate higher financial knowledge with increased risk-taking behaviors. Groups two to six exhibit consistent financial behavior, with an average financial risk tolerance and medium financial knowledge. This consistency emphasizes the fundamental role of financial knowledge in facilitating moderate risk-taking, which is consistent with the findings of Hermansson and Jonsson (2021), who found that financial knowledge positively influences risk tolerance. Cluster Seven was unique in that it displayed medium risk tolerance but high financial literacy. This result suggests that economic environment or individual risk preferences may have an impact on the number of risks individuals are willing to take, regardless of how informed they are in regard to financial literacy. This illustrates the complex relationship between financial literacy and risk tolerance behaviors. Such findings underscore the necessity of a holistic finance education that encompasses not only information but also equips individuals with appropriate behavior when it comes to risk. According to Lusardi (2015), including financial literacy in educational curricula can help build the capacity necessary for navigate monetary risks effectively.

When examining the impact of personality traits on financial risk tolerance within the identified clusters, the findings only partially correspond with existing studies. Cluster One showed high financial risk tolerance coupled with high levels of extraversion and conscientiousness, aligning with studies of Oehler et al. (2018) and Sadi et al. (2011), that associate extraversion with risk-seeking behavior. The presence of high conscientiousness suggests that the risks are well-calculated, challenging the view that this trait solely correlates with risk aversion (Durand et al., 2013), as mentioned before.

Clusters two to six demonstrate average risk tolerance and varied personality traits, supporting the idea that moderate levels of traits like neuroticism or openness to experience contribute to balanced financial behavior (Pak & Mahmood, 2015). This indicates that personality contributes to financial decision-making in a nuanced manner, influenced by the balance of multiple traits.

Cluster seven, with high financial literacy but average risk tolerance, illustrates that high Openness doesn't always lead to increased risk-taking. This is possibly due to a sophisticated

understanding of financial risks or personal aversion to risk despite openness to new experiences (Mayfield et al., 2008).

These distributions expose the variability in financial behavior and underline the need for individualized advice, depending on the personality traits of a particular investor or an overall level of understanding finance. These clusters offer a more refined perspective on the joint moderating role of personality traits and financial literacy in predicting financial risk-taking, tapping into findings from prior research on different personality constructs affecting engagement to risky investment.

6 Strategic Considerations for Doutor Finanças

6.1 Creation of a Financial Profile

To improve the precision of Doutor Finanças' financial advice, a financial profile test must be developed. This test should begin with an acknowledgment that personality traits, financial risk tolerance, and financial literacy are complex, multifaceted concepts. This study used a modified version of Grable and Lytton's (1999) 13-item risk tolerance scale as the questionnaire to assess individual risk tolerance, enabling a thorough assessment of financial risk tolerance across various aspects. As they have proven to be reliable in previous research (Kramer, 2016) and in this study, it is recommended that these questions be used in a future financial profile test. The questionnaire needs to be reviewed and updated periodically so that it is applicable for the current market conditions and changing consumer trends. Moreover, assessing financial literacy through both self-assessment and specific test questions covering various financial topics is essential, as relying solely on self-assessment is insufficient for accurately predicting individuals' actual financial literacy. It is advisable to utilize the Big Five personality traits questionnaire for assessing personality traits, as researchers and psychologists have established a consensus on the five fundamental dimensions of personality. However, Doutor Finanças may consider using the longer version of the Big Five personality traits questionnaire to fully capture the personality traits of its clients. Despite the lack of a statistically significant relationship between openness to experience and financial risk tolerance in this study, it is advisable to integrate this trait into the profiling tool, nonetheless. This inclusion recognizes that personality traits play a crucial role in financial decisions, and their impact might evolve or become clearer in different economic contexts or with varied demographic compositions. It is recommended to also include demographic factors in Doutor Finanças' profiling tool. Importantly, while the financial profile test offers a structured method for understanding clients' predispositions and behaviors, it cannot entirely replace the nuances captured through personal interactions. The insights from cluster analysis in this research highlight the value of personal conversations in capturing unique personal circumstances and preferences not fully covered by generalized financial profiling.

6.2 Implementation of Financial Profile

The financial profile test should be considered an actionable strategic recommendation for Doutor Finanças to be available as a direct part of the customer onboarding process. The test then enables the financial advice and product recommendations to be customized from the outset, ultimately improving customer satisfaction. Doutor Finanças can continue the backend to update a client's financial profile over time as their life changes significantly or the economic environment shifts, creating a dynamic and ever-changing outline of their personal finances and keeping advice relevant. By using this test, Doutor Finanças can further refine its messaging with clients and offer more personalized financial products. The information gathered by the financial profile test does allow Doutor Finanças to tailor its interactions and communication styles with clients. Those with a high neuroticism propensity would, for example, have communication types that stress security and stability, which could reduce the anxiety they feel towards financial risks. Instead, optimistic communication that focuses on possible gains or opportunities for social interaction via investment options may be the most effective with clients who are extraverted. In terms of product offerings, aligning with detailed profiles ensures that each client receives offerings that are most compatible with their individual financial profile outcomes, thus tailoring to their levels of varying risk tolerance, financial literacy, and personality traits. This focused strategy enables Doutor Finanças to enhance its results and customer satisfaction, serving as an instrument that consistently aligns client investments with their personal and financial capabilities. Doutor Finanças can specifically evaluate which of its product offerings are a fit or not with the profiles identified. As demonstrated by previous studies and this research, education is crucial. Thus, Doutor Finanças should provide its customers with personalized workshops that converge effectively by providing practical education, understanding, and involving their clients in financial decisions. By working in the most complete way possible with this test and perfecting it over time, Doutor Finanças can further refine its service offering to provide highly personalized, accurate financial advice that is also more proactive regarding individual customer-specific needs.

7 Limitations and Future Research Suggestions

The main limitation stems from the non-representative nature of the respondents, which limited the sample to a specific part of society. The sample focuses on individuals with medium to high risk tolerance and financial literacy, which might be biased by the fact that many of the respondents have higher levels of education. The financial profiles also show this selection bias, as all seven clusters have similar risk tolerance and financial literacy levels and differ only minimally from each other. This suggests that there may not be a satisfactory representation of the broader societal differences. Future studies should address this by conducting the survey in a broader setting and extending it over a longer period of time. Furthermore, the financial literacy assessment could be expanded to cover the broader range of topics and reflect current trends in the financial field. This would allow for a more accurate assessment of respondents' knowledge. In addition, the 10-item questionnaire, which was designed to easily and quickly assess personality traits, may not be sensitive enough for a comprehensive investigation of each dimension of personality. In addition, the reliance on self-administered surveys cannot preclude a mixed methods approach using qualitative data and quantitative laboratory measures. This methodology can provide a more complete and complex representation of personality traits, financial literacy, as well as an individual's aversion to financial risk behavior. Expanding to include other psychological and personal characteristics that influence financial risk-taking, overconfidence, loss aversion, and cognitive biases, could give us new insights into this relationship. Recognizing these limitations and identifying areas for future research are critical to deepening our understanding of the role that personality traits and financial literacy, among other traits, may play in predicting individual differences in risk-taking. But more than just deepening our understanding, it is important for us to maximize the opportunities we have in developing financial profiles and to develop better and more personalized financial advice tools. Future research should address these gaps to develop more robust and generalizable financial models that support better financial planning and risk management strategies for diverse populations.

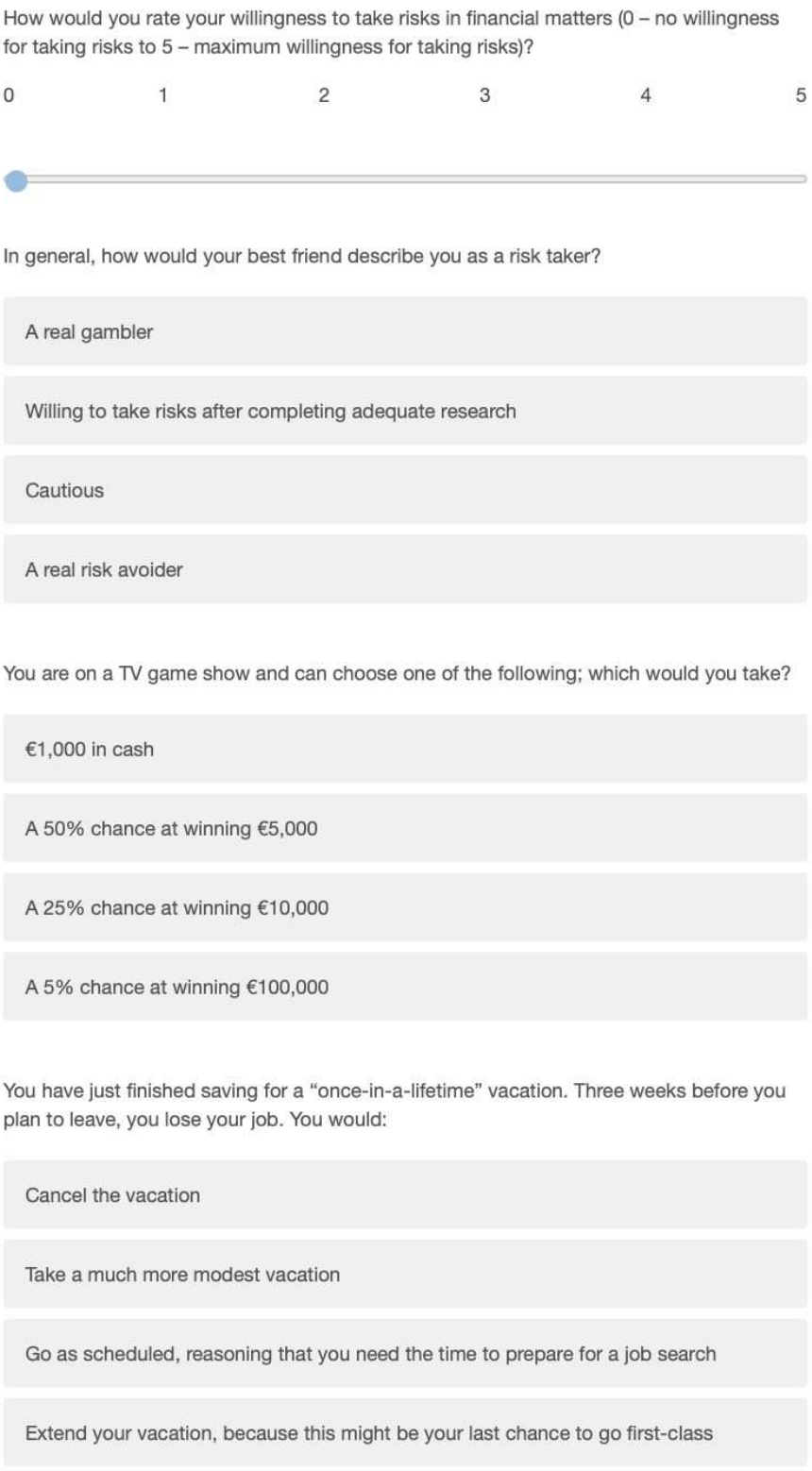
8 Conclusion

This study advances our understanding of how personality traits and financial knowledge influence financial risk tolerance. Utilizing the Big Five personality traits questionnaire and a comprehensive financial knowledge assessment, the study identifies seven distinct financial profiles that can inform more tailored and effective financial advising strategies. In particular, the study provides new insights into the factors that influence financial risk tolerance and challenges previous assumptions about the role of conscientiousness and openness to experience. Unlike previous studies, this study finds that conscientiousness positively influences risk tolerance, which implies that individuals who exhibit diligence, responsibility, and organization are more likely to take calculated financial risks. This finding challenges the traditional view that equates conscientiousness with risk aversion. In contrast, the study shows that openness to experience does not have a significant impact on financial risk tolerance, which is in contrast to previous literature that associates higher levels of openness with a greater propensity for risky financial behavior. These findings highlight the complexity of personality traits as predictors of financial behavior and emphasize the need for a differentiated approach in financial advice and risk assessment. Consistent with previous research, the study confirms a clear positive correlation between financial knowledge and greater financial risk tolerance and highlights the importance of comprehensive financial education to empower individuals to make informed investment decisions. Therefore, promoting financial education and providing targeted educational programs are critical. Despite its findings, the study acknowledges certain limitations, such as the homogeneity of the sample and the scope of the Big Five personality traits questionnaire. Future research should aim to fill these gaps by including a broader demographic and expanding the number of personality trait questions to gain a more comprehensive understanding of how different factors influence financial risk tolerance. The results of this study serve as a reference for Doutor ao Finanças in developing a financial profile test that enables more accurate financial advice based on individual clients' unique characteristics and needs. In summary, this study extends the investigation into how personality traits and financial literacy influence financial risk-taking and provides a framework for Doutor Finanças to develop tailored financial profiles. This groundwork serves to enhance Doutor Finanças' advisory services and provide individual clients with personalized financial advice. Consequently, individuals can use the acquired knowledge and recommendations to make better choices that enhance their private financial situations, which can also contribute to the overall economic well-being of Portugal.

Appendix

Survey Script

Questions on Financial Risk Tolerance



In terms of experience, how comfortable are you investing in stocks or stock mutual funds?

- Not at all comfortable
- Somewhat comfortable
- Very Comfortable

When you think of the word “risk,” which of the following words comes to your mind first?

- Loss
- Uncertainty
- Opportunity
- Thrill

Given the best and worst case returns of the four investment choices below, which would you prefer?

- €200 gain best case; €0 gain/loss worst case
- €800 gain best case, €200 loss worst case
- €2,600 gain best case, €800 loss worst case
- €4,800 gain best case, €2,400 loss worst case

In addition to whatever you own, you have been given €1,000. You are now asked to choose between:

- A sure gain of €500
- A 50% chance to gain €1,000 and a 50% chance to gain nothing

Please select number 4 for quality purposes

0 1 2 3 4 5

Questions on Financial Literacy

How would you assess your own financial literacy on a scale of 0 (not knowledgeable) to 5 (very knowledgeable)?

0 1 2 3 4 5

Making late payments on you bills can make it more difficult for you to take out a loan.

- True
- False
- Don't know

You could save money in interest costs by choosing a 15 year rather than a 30 year mortgage.

- True
- False
- Don't know

Repeatedly financing loans over time results in added fees.

- True
- False
- Don't know

The Annual Percentage Rate is the most important thing to look at when comparing credit card offers.

- True
- False
- Don't know

Over a 40-year period which had the highest variation in returns?

- Savings acccounts
- Bonds
- Stocks
- Don't know

When an investor diversifies his investments, does the risk of losing money increase or decrease?

- Decreases
- Stays the same
- Increases
- Don't know

Over a 40-year period which do you think gave the highest returns?

- Savings accounts
- Bonds
- Stocks
- Don't know

A no load mutual fund involves no sales charges or other fees.

- True
- False
- Don't know

What happens to bond prices when interest rates go up?

- Bond prices fall
- Bond prices stay the same
- Bond prices rise
- Don't know

Questions on Personality Traits

How well do the following statements describe your personality?

I see myself as someone who ...

	Disagree strongly	Disagree a little	Neither agree nor disagree	Agree a little	Agree strongly
... is reserved	○	○	○	○	○
... is generally trusting	○	○	○	○	○
... tends to be lazy	○	○	○	○	○
... is relaxed, handles stress well	○	○	○	○	○
... has few artistic interests	○	○	○	○	○
... is outgoing, sociable	○	○	○	○	○
... tends to find fault with others	○	○	○	○	○
... does a thorough job	○	○	○	○	○
... gets nervous easily	○	○	○	○	○
... has an active imagination	○	○	○	○	○

R Output k-mode cluster analysis

```
> # Print the summary table to view the mode of each cluster and their sizes in percentages
> print(summary_table)
                              1                          2                          3
Cluster 1 High Tolerence for risk Average tolerence for risk Average tolerence for risk
Cluster 2 High financial literacy  Medium financial literacy  Medium financial literacy
Cluster 3       High Extraversion       Average Extraversion          Quite Extraverted
Cluster 4         Quite Agreeable      Average Agreeableness      Average Agreeableness
Cluster 5  High Conscientiousness        Quite Conscientious        Quite Conscientious
Cluster 6       Slightly Neurotic             Quite Neurotic          Slightly Neurotic
Cluster 7              Quite Open                 Quite Open           Average Openness
                              4                          5                          6
Cluster 1 Average tolerence for risk Average tolerence for risk Average tolerence for risk
Cluster 2  Medium financial literacy  Medium financial literacy  Medium financial literacy
Cluster 3          Quite Extraverted          High Extraversion       Average Extraversion
Cluster 4            Quite Agreeable      Average Agreeableness      Average Agreeableness
Cluster 5     High Conscientiousness     High Conscientiousness  Average Conscientiousness
Cluster 6          Slightly Neurotic             Quite Neurotic        Average Neuroticism
Cluster 7                Quite Open              High Openness           Average Openness
                              7 Size_Percentage
Cluster 1 Average tolerence for risk       19.101124
Cluster 2    High financial literacy       12.359551
Cluster 3          Quite Extraverted       14.981273
Cluster 4            Quite Agreeable       11.985019
Cluster 5  Average Conscientiousness        8.988764
Cluster 6        Average Neuroticism       17.602996
Cluster 7                Quite Open       14.981273
>
```

References

Afaf, G. & Sarwar, A. (2016). A comparison between psychological and economic factors affecting individual investor's decision-making behavior. Cogent Business & Management, 3(1), 1232907.

Anderson, A., Baker, F., & Robinson, D. T. (2017). Precautionary savings, retirement planning and misperceptions of financial literacy. Journal of Financial Economics, 126, pp. 383-398.

Bajo, E., Barbi, M., & Sandri, S. (2015). Financial Literacy, Households' Investment Behavior, and Risk Propensity. Journal of Financial Management, Markets and Institutions, 3(1), 157-174.

Bonoma, T. V., & Schlenker, B. R. (1978). The SEU calculus: Effects of response mode, sex, and sex role on uncertain decisions. Decision Sciences, 9, pp. 206–227.

Brooks, C., & Williams, L. (2021). The impact of personality traits on attitude to financial risk. *Research in International Business and Finance, 58*, 101501.

Brooks, C., Sangiorgi, I., Hillenbrand, C., & Money, K. (2019). Experience wears the trousers: Exploring gender and attitude to financial risk. Journal of Economic Behavior & Organization, 163, pp. 483-515.

Brown, S., & Taylor, K. (2011). Household finances and the 'Big Five' personality traits. IZA Institute of Labor Economics No. 6191.

Bye, R., & Lamvik, G. M. (2007). Organizational culture and risk perception. Zagadnienia Eksploatacji Maszyn, 42(2), 131-146.

Chen, P., & Finke, M. (1996). Negative net worth and the life cycle hypothesis. Journal of Financial Counseling and Planning, 7.

Chitra, K. & Sreedevi, V. (2011). Does personality traits influence the choice of investment. The IUP Journal of Behavioral Finance, 8(2), 47-57.

Cooper, D. (2003). Understanding how personality & perception can influence risk-taking. The Journal for Occupational Safety and Health Professionals, pp. 39-46.

Costa, P. T., Terracciano, A., & McCrae, R. R. (2001). Gender differences in personality traits across cultures: Robust and surprising findings. Journal of Personality and Social Psychology, 81(2), 322–331.

Crysel, L. C., Crosier, B. S., & Webster, G. D. (2013). The dark triad and risk behavior. Personality and Individual Differences, 54(1), 35–40.

Deniz, M. E., & Satici, S. A. (2017). The relationships between big five personality traits and subjective vitality. Anales de Psicología/Annals of Psychology, 33(2), 218-224.

Digman, J. M. (1990). Personality structure: Emergence of the five-factor model. Annual Review of Psychology, 41(1), 417-440.

Donnelly, G., Iyer, R., & Howell, R. T. (2012). The Big Five personality traits, material values, and financial well-being of self-described money managers. Journal of Economic Psychology, 33(6), 1129–1142.

Dr. M. Babu, C. D. (2018). Impact Of Personality Traits On Investment Decision In Stock Market. Excel International Journal Of Multidisciplinary Management Studies, 43-53.

Doutor Finanças. (n.d.). Retrieved from https://www.doutorfinancas.pt/

Dutta, M., Halder, A. K., & Singh, S. Anic, G. (2010). The association between personality and risktaking. B. (2010). Morphology and properties of hot-dip Zn–Mg and Zn–Mg–Al alloy coatings on steel sheet. Surface and Coatings Technology, 205(7), 2578-2584.

European Comission. (n.d.). Financial literacy. Retrieved from https://finance.ec.europa.eu/consumer-finance-and-payments/financial-literacy_en

Fiske, D. W. (1949). Consistency of the factorial structures of personality ratings from different sources. Journal of Abnormal and Social Psychology, 44(3), 329–344.

Fisher, P., & Yao, R. (2017). Gender differences in financial risk tolerance. Journal of Economic Psychology, 61, pp. 191-202.

Gilliam, J., Chatterjee, S., & Grable, J. (2010). Measuring the perception of financial risk tolerance: A tale of two measures. Journal of Financial Counseling and Planning, 21.

Goldberg, L. R. (1981). Language and individual differences: The search for universals in personality lexicons. Review of Personality and Social Psychology, 2, 141–165.

Goldfayn-Frank, O. (2018). Personality traits and financial decisions of the households. Working Paper Department of Economics, Goethe University.

Grable, J. E. (2000). Financial Risk Tolerance and Additional Factors That Affect Risk Taking in Everyday Money Matters. Journal of Business and Psychology, 14, pp. 625- 630.

Grable, J. E., & Lytton, R. H. (1998). Investor risk tolerance: Testing the efficacy of demographics as differentiating and classifying factors. Journal of Financial Counseling and Planning, 9.

Grable, J. E., & Lytton, R. H. (2001). Assessing the concurrent validity of the SCF risk tolerance question. Journal of Financial Counseling and Planning, 12.

Gul, R., and Khilji, G. (2021). Exploring the need for a responsive school curriculum to cope with the Covid-19 pandemic in Pakistan. Prospects 51, 503–522 (2021).

Hanna, S., & Chen, P. (1998). Subjective And Objective Risk Tolerance: Implications For Optimal Portfolios. SSRN Electronic Journal, 8.

Hermansson, C., & Jonsson, S. (2021). The impact of financial literacy and financial interest on risk tolerance. Journal of Behavioral and Experimental Finance, 29, pp. 100-450.

Jackson, J. J., Wood, D., Bogg, T., Walton, K. E., Harms, P. D., & Roberts, B. W. (2010). What do conscientious people do? Development and validation of the behavioral indicators of conscientiousness (BIC). Journal of Research in Personality, 44(4), 501–511.

Jameel, Q., & Siddiqui, D. A. (2019). Effect of demographics, personality traits, and financial literacy on risk tolerance and behavioral biases in individual investors of the Pakistan Stock Exchange. SSRN Electronic Journal.

Jiang, Z., Peng, C. & Yan, H. (2020) Personality differences and investment decision-making. Working Paper, Kellogg School of Management, Northwestern University.

John OP, Naumann LP, Soto CJ (2008). Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues. In RWOP John, Handbook of personality: New York: Guilford Press. Theory Res. pp.114-158.

Kannadhasan, M., Aramvalarthan, S., Mitra, S. K., & Goyal, V. (2016). Relationship between Biopsychosocial Factors and Financial Risk Tolerance: An Empirical Study. Vikalpa, 41(2), 117-131.

Kourtidis, D., Chatzoglou, P., & Sevic, Z. (2017). The role of personality traits in investors trading behaviour: empirical evidence from Greek. International Journal of Social Economics, 44(11), 1402-1420.

Kowert, P. A., and Hermann, M. G. (1997). Who takes risks? Daring and caution in foreign policy making. J. Confl. Resolut. 41, 611–637.

Kramer, M. M. (2016) Financial literay, confidence, and financial advice seeking. Journal of Economic Behavior & Organization, 131, pp. 198-217

Kuzniak, S., Rabbani, A. H., Ruiz-Menjivar, J., & Grable, J. E. (2015). The Grable and Lytton risk-tolerance scale: A 15-year retrospective. Financial Services Review, 24.

Lusardi, A. (2015). “Financial literacy: Do people know the ABCs of finance?” Public understanding of science, 24(3), 260-271.

Mayfield, C., Perdue, G. & Wooten, K. (2008). Investment management and personality type. Financial Services Review, 17, 219-236.

McCrae, R. R., & Costa, P. T., Jr. (1999). A five-factor theory of personality. Handbook of Personality: Theory and Research, 2, 139–153.

McCrae, R., & Costa, P. (1996). Toward a new generation of personality theories: Theoretical contexts for the five-factor models. In J. Wiggins (Ed.), The Five-Factor Model of Personality: Theoretical Contexts.

Moore, D. (2003). Survey of Financial Literacy in Washington State: Knowledge, Behavior, Attitudes, and Experiences. Technical Report 03-39, Social and Economic Sciences Research Center, Washington State University.

Myers, S. D., Sen, S., & Alexandrov, A. (2010). The moderating effect of personality traits on attitudes toward advertisements: A contingency framework. Management & Marketing, 5(3), 3–20.

Nandan, T., & Saurabh, K. (2016). "Big-five personality traits, financial risk attitude and investment intentions: study on Generation Y." International Journal of Business Forecasting and Marketing Intelligence, 2, 128-150.

Oehler, A., Wendt, S., Wedlich, F., & Horn, M. (2018). Investors' personality influences investment decisions: Experimental evidence on extraversion and neuroticism. Journal of Behavioral Finance, 19(1), 30-48.

Pak, O., & Mahmood, M. (2015). Impact of personality on risk tolerance and investment decisions. International Journal of Commerce and Management, 25(4), 370-384.

Pan, C.H. & Statman, M. (2012) Investor personality in investor questionnaires. Working Paper, Leavey School of Business, Santa Clara University.

Pinjisakikool, T. (2017). The Influence of Personality Traits on Households' Financial Risk Tolerance and Financial Behaviour. Journal of Interdisciplinary Economics, 30(1), 32-54.

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. Journal of Research in Personality, 41(1), 203-212.

Sabri, N. A. A., & Afiqah, N. (2016). The relationship between the level of financial literacy and investment decision-making millennials in Malaysia. Taylor's Business Review, 6, 39-47.

Sadi, R., Asl, H., Rostami, M., Gholipour, A., & Gholipour, F. (2011). Behavioral finance: The explanation of investors' personality and perceptual biases effects on financial decisions. International Journal of Economics and Finance, 3(5), pp. 234-241.

Salameh, A. A., Akhtar, H., Gul, R., Omar, A. B., & Hanif, S. (2022). Personality traits and entrepreneurial intentions: Financial risk-taking as mediator. Frontiers in Psychology, 13, Article 927718.

Thanki, H. (2015). Risk tolerance dependent on what? Demographics or personality type: Findings from empirical research. Journal of Marketing and Consumer Research, 6, 48-56.

Tupes, E. C., & Christal, R. E. (1961). Recurrent personality factors based on trait ratings. USAFA-TR-61-97. United States Air Force Behavioral Sciences Laboratory.

Vazifehdoost, H., Akbari, M., & Charsted, P. (2012). The role of psychological traits in market mavenism using big five model. International Journal of Management and Business, 2(3), 243–252.

Wahab, E., & Bunyamin, S. (2022). The Influence of Financial Behaviour on Financial Risk Tolerance in Investment Decision: A Conceptual Paper

Wong, A. & Carducci, B. (2013). Does personality affect personal financial risk tolerance behavior? IUP Journal of Applied Finance, 19(3), 5

Yong A., H.-N., & Tan, K.-L. (2017). The influence of financial literacy towards risk tolerance. *International Journal of Business and Society, 18*(3), 469-484

Young, S., Gudjonsson, G., Carter, P., Terry, R & Morris, R. (2012). Simulation and risk- taking and its relationship with personality. Personality and Individual Differences, 53(3), 294-299