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DISSERTATION

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ABSTRACT

The purpose of this study is to determine if gender differentiates financial decision-making among Portuguese individual investors. We investigate gender differences in financial literacy, risk preferences, and in three relevant investors' behavioral biases: overconfidence, disposition effect, and loss aversion.

For this purpose, we use data from a questionnaire-based survey conducted by CMVM as our data set for the period of June 2018 to August 2018. A total of 2282 participants responded, of which 81.81% were men and 18.19% were women. In the empirical work, to measure the significant association of the gender differences in the context of the mentioned variables, we have used non-parametric tests.

The results confirm significant differences between men and women. Findings suggest that men have a higher level of financial literacy, while women reveal more risk aversion than men. The predisposition of exhibit disposition effect is only relevant when other characteristics are considered, in that case, women are more prone to present it than men. When it comes to overconfidence, we find gender differences, but the results depend on the dimension studied.

KEYWORDS: Behavioral Finance; Decision Making; Gender; Behavioral Biases; Probit.

JEL CODES: G11; G41; J16, D14

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Finally, to my parents and sister, for all the love and unconditional support. Thank you for motivating me in moments of anguish and stress and for always believing in me. None of this would be possible without you.

1. INTRODUCTION

Portugal appears in the 22nd position in the *Global Gender Gap Report 2021* conducted by World Economic Forum, a ranking of the most gender-equal countries in the world in a total of 156 countries, having risen 13 positions concerning to the ranking for the year 2020. The gender inequality is a real problem that has consequences and impacts women's lives every day. Gender refers to the social distinction between men and women, while sex is the biological characteristic. The current dissertation will use the respondent's sex, male or female, as a measure of gender, as no additional criteria in the data set allowed us to differentiate gender or gender identity.

Through literature review, we find that investment decision-making is influence by several factors through the lens of behavioral finance. Researchers have associated gender as one of those factors (see Graham et al., 2002). Analyzing some well-known studies, we verify that the great majority associate a conservative profile to women and an optimistic one to men. Levine et al. (2019) have shown that women have less financial literacy than men, resulting in less interest in the field and weaker money planning. Barber and Odean (2001) assumed that women have lower levels of confidence when compared to men. Furthermore, males are also more prone to riskier attitudes than females and less averse to losses. However, the scope of these mentioned studies considered data from other countries, which makes it insufficient to assume that the same results will occur among Portuguese individual investors.

Thereby, using a large CMVM's database enriched by an adequately constructed questionnaire, we have the unique opportunity to extend previous studies by now exploring the behaviors of Portuguese individual investors. Firstly, it collected data from each participant on their socio-demographic characteristics (gender, age, household dimension, academic and professional background, income, among others). Then, it covered questions to assess financial literacy, risk preferences and investigate potential behavioral biases.

Taking these data into account, we tested five different hypotheses, using multiple linear and probit regression models. Our results show gender differences in financial literacy and risk preferences and in the three tested behavioral biases: overconfidence, disposition effect, and loss aversion. More precisely, women are less financially literate and more risk-averse than men. At the same time, females are more prone to disposition effect and are more averse to loss than males. Lastly, in the overconfidence, the results differ according to the dimension studied.

The remaining part of this dissertation proceeds as follows: Chapter 2 reviews the relevant literature that disclosures gender stereotypes and differences, going further in the risk preferences and financial literacy; Chapter 3 reviews the behavioral finance research, which includes a short introduction of prospect theory and covers the three behavioral biases in the analysis; Chapter 4 presents the research questions and describes the data and methodology implemented in the study; Chapter 5 contains the empirical findings, and Chapter 6 presents the conclusions and limitations of the study.

2. Gender stereotypes, risk preferences and financial literacy markets

The perception of society about gender is changing. The rules that dictate what is proper for girls and boys are becoming more fluid and less straightforward. Even so, gender inequality is still a contemporary social issue and is not an individual matter. Therefore, it is incredibly ingrained in the structure of societies, existing in relevant dimensions related to well-being, such as health, education, employment, or even salary.

First, it would be relevant to understand how stereotypes towards gender are taking control of the game. Stereotypes are shared beliefs about the characteristics, attributes, and behaviors of members of certain groups and are sometimes used to simplify the demands of the perceiver (see Powell et al., 2002). According to Eagly et al. (2020), gender stereotypes are prevalent since the social category sex, which separates most humans into two categories based on their reproductive function, is central to human cognition and social organization. Individuals gain extensive knowledge about women and men during their lives from people's direct and indirect observations through social sharing and cultural representations.

In general, research on gender stereotypes reveals that society considers women to have more communal qualities, as gentler, kind, compassionate, and expressive, and men more agentic virtues, like are more competitive, independent, courageous, and brave (see Pérez-Quintana & Hormiga, 2015).

Despite significant changes in jobs and education and the democratic attitudinal reforms that have followed them, gender stereotypes still exist because of persistent occupational discrimination and the unequal distribution of wage labor and domestic work between men and women (see Eagly et al., 2020). Nowadays, women are still stereotyped as fragile, emotional, sensitive, and with weaker leadership skills. Along with that, women suffer from the stigma that they are more focused on their families than on their careers, leading to fewer hires and scarce job opportunities (see von Hippel et al., 2015).

There is ample evidence that financial literacy and risk preferences are inescapable variables that differentiate the financial performance of an individual (see Bucher-Koenen et al., 2016). Substantial evidence affirms that financially literate individuals are less risk-averse than individuals with lower financial literacy. Bannier and Neubert (2016) investigated the relationship between risk tolerance and financial literacy. The authors concluded that perceived knowledge is relevant for taking the risk of investing in sophisticated financial products. Summing that to reduce the gender gap in investments, it is crucial to raise women's literacy and risk tolerance. Society will only achieve gender equality when women and men have the same opportunities, conditions, and rights. While the gender gap may seem like an abstract concept, its implications affect women daily.

2.1 Gender and risk preferences

Risk preferences are a fundamental element in any discussion regarding finance and investment. Ackert and Deaves (2010) describe it as the predisposition of an agent to choose between alternatives with an equal expected return but different variability. Financial risk tolerance is the particular level of discomfort that an individual investor is disposed to accept while risking current wealth for imminent growth (Gibson et al., 2013).

Differences in findings suggest that men are not necessarily intrinsically more risk-taking than women but disparities, arrive through the environment or cultural pressures, which may differ across countries as demographic variables are associated with risk tolerance. There are several explanations for these differences with risk attitude: one of the most common holds is that in primitive societies, men had to fight to achieve status and compete for positions of power (see Wilson & Daly, 1985). Cupples et al. (2013)

found that women present a risk-averse profile, with education playing an important role and reducing the gender difference in risk tolerance. As men and women differ in their emotional reactions to uncertain situations, they can react differently in their risk attitudes.

The study of the relationship between gender and risk is not recent, and considerable literature documents gender differences in risk-taking. Most researchers argue that women are more risk-averse than men and invest financial resources more conservatively than men. This variation in their emotional response to unpredictable circumstances is an interesting matter of study. Affection may lead women investors to invest less in risky assets (see Beckmann & Menkhoff, 2008; Martenson, 2008). Thus, as women are less willing to assume the risk when compared to men, this can also influence their results in the labor market (see Charness & Gneezy, 2012).

In a well-known study, Andersen et al. (2013) investigated the influence of culture in determining gender disparities in competitive behavior. The authors have explored two distinct societies: Tanzania's patriarchal Maasai tribe and India's matrilineal Khasi tribe in India. They have found that although women are less competitive than men in the patriarchal society, the opposite happens in the matrilineal society. Interestingly, they have found no evidence that, on average, there is a gender gap in risk attitudes within either society, instead related the low propensity to competition to weak levels of self-confidence.

The gender gap in risk-taking propensity can be related to the gender composition of the experimental group. Booth and Nolen (2012) find that among children, boys have a higher susceptibility to take risks when compared to girls in mixed-sex schools but find no differences between girls and boys who attend single-sex schools. Thus, the influence of gender socialization on competitive preferences can be related to the need to affirm gender identity in mixed schools.

Previous evidence has shown that women allocate their portfolios differently than men, which may be related to their distinctive attitudes towards risk. Others link this different gender behavior with precaution with financial well-being (see Bajtelsmit & Bernasek, 1997). In relatively recent research, Fisher and Yao (2017) have demonstrated that the gender difference in risk tolerance results from differences in the relationship between the independent variables, like economic and demographic characteristics and risk tolerance for men and women. At the same time that men are more prone to interpret a risky situation as a challenge, women are more likely to perceive it as a threat (Croson & Gneezy, 2009).

2.2 Gender differences in financial literacy

Financial literacy combines knowledge, awareness, skill, attitude, and behavior required to make clever financial decisions and attain individual financial well-being. Thus, an individual's characteristics such as cognitive capacity, preferences, and personality can impact it (see OECD, 2020).

Financial knowledge helps to grow and properly manage finances. It is also a critical determinant of investment decisions, portfolio selection, retirement saving, and debt management. At the same time, the more educated, knowledgeable, and more financially capable people are, the better to manage their finances because of better decision-making.

Financially literate women have the tools they need to build their wealth and use those assets to contribute and help to causes they believe in and guarantee their future, which involves taking a higher stake in political and social movements. Once women tend to live longer and earn less than men, they are more likely to experience financial difficulty in old age, so they have unique financial literacy needs. Closing this gap is the key to ensuring economic and social equality.

Along with studies that pretended to investigate differences in financial behavior of consumers and investors, economists have also been studying gender gaps in financial literacy. According to Levine (2019), women have less knowledge about finances in general, particularly in investment processes; as a result, they are less interested in the investment industry and may have poor money management. Cupák et al. (2018) conducted a study across 12 countries and have found that, on average, women present lower financial literacy, with this gap being higher in more developed countries. Other researchers share that conclusion and can affect their portfolio choices.

Usually, women are more likely than men to answer that they "don't know" the answer to financial literacy questions. In fact, and according to Bucher-Koenen, F. et al.

(2021), women know less than men but know more than they think. The gender gap in financial literacy continues even when the investigators include education, income, marital status, and socioeconomic characteristics. Women are also not likely to consult financial advisors to get help and smooth the lack of financial knowledge (see Bucher-Koenen et al., 2016). Beckmann and Menkhoff (2008) have investigated female fund managers and suggested that even considering that financial expertise decreases the gender gap in investment behavior, the differences do not entirely disappear, even among experts.

Even though the evidence of persistent gender disparities in financial knowledge and behavior is undeniable, the causes are still hard to understand. So far, there is little evidence on what leads to these gaps, especially on what could explain that.

3. Individual Investors Behavioral Biases

Behavioral finance incorporates psychological aspects into the decision-making process while focusing on financial decisions and the financial market (see Shefrin, 2009). Kahneman and Tversky gained attention with the conduction of a series of experiments showing participants making misguided emotional decisions. After that, in 1979[1], the authors created prospect theory assuming that gains and losses are valued differently by each investor. The final choice perceives values of gains and losses instead of the outcome, explaining that the decisions are related to a personal reference point, independent of the state of wealth of the decision-maker. Thaler (1993) defines it as "simply open-minded finance".

As the study and analysis of the influence of psychology on the behavior of investors or financial analysts, behavioral finance acknowledges that investors have limits to their self-control and are influenced by their emotions, assumptions, and perceptions (see Ackert & Deaves, 2010). According to Bortoli et al. (2019), results from neoclassical economics creating theories and methodologies to explain the real-life irrational behavior of the *homo economicus*[2]. The research embraces both observation and analysis of the

[1] See Kahneman and Tversky, 1979.

[2] Is the basis of most economic and financial models, assuming agents are rational, self-interested, and pursue the maximization of their wealth.

behavior of financial markets with their participants in real situations and the observation in experimental settings.

Statman (2014) clarified that behavioral finance substitutes “normal” people for the perfectly rational presupposed in traditional finance, evidencing four main aspects: rationality versus normality; efficiency of financial markets; portfolio design following mean-variance portfolio theory (or behavioral portfolio theory); asset pricing theory and its determinants.

3.1 Prospect theory, the alternative theory of value under risk

John von Neumann and Oskar Morgenstern (1944) had developed expected utility theory to define rational behavior when people face uncertainty. Arguing that individuals should act in a particular way when confronted with decision-making under uncertainty. Harsh axiomatic treatment is a normative[3] model of economic behavior (see Ackert & Deaves, 2010). Kahneman and Tversky (1979) created prospect theory to be an alternative to expected utility theory, a theory of decision under risk to illustrate that people do not follow the expected utility theory systematically as they select risky assets. Prospect theory is, on the other hand, positive and based on how people behave.

Psychologists observed, through many studies, equivalent responses to decision problems that were inconsistent with expected utility theory. Firstly, changes in risk attitude may depend on the nature of the prospect[4] and the situation. People are not persistently risk-averse; moreover, they are risk-averse in gains but exhibit risk-seeking in losses. Also, individuals seem to be more concerned with gains and losses than with their final wealth, so their valuation of prospects is based on the gains and losses relative to a reference point (usually the status quo) rather than the ultimate wealth. In line with the previous two aspects of decision-making, individuals experience a loss more strongly than an equivalent gain, being averse to losses.

[3] According to normative theory, rational individuals should behave in a specific way. On the other hand, positive theory examines what individuals do and develops a model on these observations.

[4] A prospect $P(pr, x, y)$is a gamble where you have a probability pr of obtaining x and a probability $1 - pr$ of obtaining y.

The value function replaces the utility function in the expected utility theory. While the utility is considered in the level of wealth, value is measured by gains and losses relative to a reference point. The three overmentioned aspects influence the value function characteristics: concave in the positive domain and convex in the negative; the argument is the change in wealth, instead of wealth; and is steeper for losses than gains due to loss aversion (see Ackert & Deaves, 2010).

Buying lottery tickets and, at the same time, insurance may seem incompatible, but the prospect theory explains it by overweighting low-probability events. The discoveries of Kahneman and Tversky (1992) had a high impact on the value and weighting function. The probability function of the expected utility theory was "replaced" by the weighting function due to heuristic simplifications related to representativeness[5]. This function measures the impact of the probability of an event on the desirability of a prospect. This function is nonlinear since individuals attribute more weight to low probability events and less weight to the higher probabilities (certainty effect). The probability weighting function is then an inverse S-shape, favoring risk aversion for small probabilities of loss and risk-seeking for small chances of gains.

Agents use mental accounting to organize, assess, and manage financial matters. The theory distinguishes it in two phases: editing (or framing) and evaluation (see Kahneman & Tversky, 1979). In the first phase, an individual organizes and reformulates the available options to simplify the choice. The operations are the following: coding; combination; segregation; cancellation; simplification; and detection of dominance. In the following evaluation phase, the decision-maker examines all the edited prospects and chooses the one with the highest value, expressed in term two scales, one that reflects the impact of the probability on the possible result on the corresponding evaluation, and other that reflects the subjective value of the proposed alternatives.

3.2 Heuristics and behavioral biases

Behavioral finance describes the relationship between heuristics and individual investment performance. A heuristic is a decision rule that uses a subset of the information

[5] Representativeness explained in the next chapter.

set, providing strategies to scrutinize and resolve a limited number of signals in decision making, particularly in complicated and problematic conditions (see Ackert & Deaves, 2010; Ritter, 2003). There are different types of heuristics, namely representativeness, availability, and anchoring. Occurring during different situations, each one plays a part in decision-making, sometimes misapplied, which leads in some cases to probability judgment error.

Firstly, representativeness is one of the most significant classes of heuristics involving decisions by comparing the current situation to the most representative mental example and often leads to the propensity to ignore the base rate and to put too much weight on sample data. It causes investors to believe that a good company is a good investment, while known that positive characteristics should already be pounded in the price of a stock. In this specific heuristic, investors tend to buy hot stock and escape those that recently performed poorly.

Availability, along with recency and salience, leads people to overestimate probabilities of events as entangles making decisions based on intuitive memories or recent events. It happens when investors tend to buy stocks influenced by expectations and rapidly available information (see Pompian, 2006). Due to availability, risk perception may be mistaken, distorting accurate risk understanding, sometimes leading to fatal impacts.

The anchoring occurs when an individual allows specific information to guide his cognitive decision-making process. It entangles the predisposition to be excessively influenced by the first bit of information we hear or learn (see Ackert & Deaves, 2010). In investing, participants that exhibit this heuristic may tend to hold investments with a lower price as they "anchor" their reasonable estimation value at the initial purchase price for today's stock price rather than their internal value.

Defined as "systematic errors in judgment" by Pompian (2006), biases are an inclination to make decisions affected by some underlying beliefs. Some behavioral and psychological biases affect investment decision-making and limit the rationality of assessing alternatives based on investment fundamentals. Mitroi (2014) agrees with the idea that if such biases are significantly regular, quantifiable, and predictable, it is possible to see them as arbitrage opportunities. Various studies in different countries have led to understanding these biases and quantifying their quantitative effect on investors' financial decision-making. Even though the relevance of behavioral finance has been increasing in the last few years, the gender gaps in behavioral biases between individual investors are shortly studied.

3.2.1 Overconfidence

It is probably the most widely studied and well-established bias. Generally defined as people's tendency to overestimate their knowledge, abilities, and the precision of their information, as well as their capacity to estimate and control future events (see Ackert & Deaves, 2010). Overconfidence led investors to trade in an aggressive way reducing their welfare. It is also a common trait for investors when picking investments and deciding to enter or exit a position.

Investigators typically divide overconfidence into three distinct dimensions. Firstly, miscalibration (or overestimation) is the tendency for individuals to overestimate the accuracy of their knowledge. Economists usually associate miscalibration with weaker trading, which the actual inability to measure miscalibration could also explain (see Barber & Odean, 2008). Then, over placement, usually known as the "better than average", is a condition where individuals perceive their knowledge and abilities as better than others. Lastly, the illusion of control (or over precision) describes the propensity for people to behave as that they have more control, even though this is not happening. Commonly linked with an excessive optimist, it can persuade us to make irrational judgments, resulting in adverse outcomes that could have been prevented easily (see Pompian, 2006).

Possible gender differences in overconfidence are a potential explanation for observable gender gaps in wage bargaining and entrepreneurial practices, leading to potential enlightenment for why women have significantly lower average wages than men.

Barber and Odean (2001) have examined the investment behavior based on the concept of gender bias for a sample of 35.000 client accounts over a six-year investment horizon. The findings[6] suggest that gender plays a vital role in the individual's decision-making and concluded that men are more overconfident than women in their investment abilities. Because of that, men present a higher trading frequency, higher transaction costs, and overall worse performance over the long term.

Most researchers consider that both men and women are often overconfident, with men being more in their triumph in undefined situations than women (see Croson & Gneezy, 2009). Women are usually less confident than men and shy away from the competition (see Beckmann & Menkhoff, 2008; Powell & Ansic, 1997). Abreu (2019) highlighted reservations regarding the ability of overconfidence investors who opt to overestimate their influence on consequences. However, Deaves et al. (2009) discovered that overconfidence fuels trade but obtained no gender-based differences in either excess of confidence or trading activity.

The truth is that minor gaps in confidence might lead to enormous differences in overall financial literacy and financial well-being, especially in long-term investments, retirement saving plans, and personal savings. All of this could be associated with the fact that females, on average, have a higher life expectancy than males.

3.2.2 Disposition Effect

The disposition effect is an essential feature of the trading of individual investors. Kahneman and Tversky (1979) presented that individuals evaluate gambles by considering the gains and losses and not the final wealth levels. Later, in a research paper by Shefrin and Statman (1985), the authors described it as the tendency that investors have to sell securities whose price is rising, the so-called winners, while keeping in portfolio securities whose price is falling, the losers. They divided their explanations into two categories: prospect theory (related to mental accounting) and regret[7] aversion (tied with self-control problems) to explain why even proficient investors misjudge their investment moves. The principle is that subjects' utility is determined by an *S-shaped* value function associated with changes in wealth. This function is convex in the loss

[6] The study also shows that not only women but also married and older investors have lower risk tolerance.
[7] Defined as "an emotional feeling associated with ex-post knowledge that a different past decision would have fared better than the one chosen" by Shefrin and Statman (1985).

domain, where investors increase their risk tolerance and concave in the gains where they become risk averse. The *S-shape* indicated that subjects behave in a reference-dependent manner (see Rau, 2015).

Abreu (2019) discussed how biased the behavior of the special effects is in warrants, emphasizing that the disposition effect is a fundamental bias in finance. A study conducted by Duxbury and Summers (2012) demonstrates that emotional responses as regret and rejoice can amplify the disposition effect. When investors realize that they have invested in a weak stock, they hold capital losses to avoid the feeling of regret.

After some experiments, economists have concluded that there is no disposition effect when subjects do not deliberately select the stocks in their portfolios. Meaning that if individuals do not feel responsible for decisions that result in gains and losses, they do not sell winners more readily than losers (see Ackert & Deaves, 2010; Duxbury & Summers, 2007).

Empirical research is frequently limited to the demographic profiles of investors and is often even contradictory. While Fischbacher et al. (2017) find that men are less prone to the disposition effect, Da Costa et al. (2008) examined the role of gender and find that the disposition effect is similar for both genders when controlling for other factors, with the results dependent on the reference price adopted. They have found no gap based on the original purchase price, with both female and male demonstrating a disposition effect. However, when the reference price is the most recent paid, the results are different; males continue to exhibit the bias, and females do not.

Rau (2014) examined the influence of gender on disposition effect and loss aversion using an experiment based on pioneering research. The author concluded that even though both men and women succumb to the disposition effect, this bias is more evident in women because of their higher unwillingness to recognize capital losses.

3.2.3 Loss Aversion

The principle that losses outweigh gains is one of the most generally held beliefs in the social sciences. In a simple description, loss aversion implies that losses are felt with superior psychological intensity than gains in the same absolute amount as investors position themselves on a short-term investment. That is, whereas risk aversion explains the willingness to take a risk as a function of the probabilities of gains and losses, loss aversion describes the disposition to take a risk as a function of the relationship between gains and losses (see Thielman & Hilbig, 2015). Kahneman and Tversky (1979) initially introduced loss aversion by observing that people are typically hesitant to play a lottery with a 50-50 probability of gaining or losing the same amount of money. Thus, in line with prospect theory and according to the authors, the loss of X is more aversive than the gain of X is attractive, which implies that the value function is steeper for losses than for profits.

According to Kahneman (2011), this concept was the "most useful contribution to the study of decision making". Most publications assume it as a fundamental and generalizable concept rather than a subjective phenomenon, independent of any particular psychological process that account for what triggers it. Loss aversion can be associated with feelings of fear, guilt, and anguish. Considered a framing bias, it refers to the distinct level of perceptual biases individuals experience when comparing size profits and losses (see Barberis and Thaler, 2003).

The degree to which gender effects occur for loss aversion is often studied. Research finding effects exist in various directions – no effect at all, women being more loss aversion than men or the opposite. According to Rau (2014), females are more loss averse than males, which is negatively correlated with the propensity to realize capital losses and linked with the gender gaps in the disposition effect.

3.3 Gender differences in behavioral finance

Gender gaps occur in several aspects of life, from pay inequalities to the challenges in gaining high management positions. The majority of gender equality research focuses on wage disparities and labor force participation. Some authors assume that the influence of gender roles on behavior is related to the fact that men and women obtain different skills and principles through their involvement in gender-segregated roles throughout their lives (see Buchan et al., 2008).

Therefore, it is interesting to look at them from the financial behavior perspective. Questions of gender have a significant role in terms of investment decision making, and it is, after age and income, considered one of the most relevant factors (see Graham et al., 2002). Usually, women have lower levels of income on average. Moreover, they are also more conservative in investing, meaning they are less inclined to invest in stocks and more likely to prefer fixed-income securities (see von Hippel et al., 2015; Lusardi & Mitchell, 2008).

It is not easy to identify an accurate explanation about gender differences in investing since studies provide different outcomes which can influence the whole figure when associated with the average of women or men.

3.3.1 Research on gender gaps in behavioral biases

The literature that connects behavioral and psychological attributes to gender inequality is relatively recent and limited. The obtained results in the experiments can be affected by a series of factors, as the incentives given to the participants (money payments or gifts) can affect the propensity to competition and the experiment design. Furthermore, the highest percentage of the studies is conducted in occidental cultures where the patriarchal society is much larger (see Croson and Gneezy, 2009).

The first empirical study investigating the investment behaviors of women and men in an emerging country was on the Turkish economy. Bayyurt et al. (2013) used a discriminant analysis and a logistic regression to examine gender differences in investment preferences. The survey had over 2036 participants and reported that while men prefer to invest in common stocks and real estate, women invest in funds, time deposits, and gold, indicating that women in Turkey are more risk-averse than men.

Hassan et al. (2014) investigated the effects of gender and age on two behavioral biases in Pakistan, loss aversion, and overconfidence with a questionnaire-based survey with 391 respondents. The models were estimated with Chi-square, OLS, and correlation analysis. Gender had a significant influence on the two biases. The results indicated that men are more overconfident, and women have a higher degree of loss aversion. Also, they affirmed that those who prefer risk are more likely to be overconfident.

Recently, OECD's economists (2020) carried out the second international survey of *Adult Financial Literacy* covering 26 countries and economies. On average, men appear to have statistically higher financial knowledge and well-being scores. Investment behavior and attitude ratings appear to differ in their gender split. Not only is there variability among economies, but a significant number of disparities appear to be where women have higher behavior and attitude[8] scores. In the international comparison, Portugal was in seventh place in the global indicator of financial literacy, recording above-average results in this global indicator. The report of the last survey to the financial literacy of the Portuguese population, conducted by CNSF in 2021, allows concluding, through Kruskal-Wallis tests, that the medians of the financial knowledge indicator are statistically different between gender, the same verified among the global financial literacy indicator. In aggregate terms, the groups that perform best are employed men aged between 25 and 54 years with at least high school completed.

4. Research question, Data, and Methodology

4.1. Research Questions

The main goal is to investigate the existence of gender differences among Portuguese individual investors. Therefore, and based on the above mentioned, the research hypotheses are the following:

H1: There is a significant association between gender and financial literacy.

H2: There is a significant association between gender and risk preferences.

H3: There is a significant association between gender and overconfidence.

H4: There is a significant association between gender and disposition effect.

H5: There is a significant association between gender and loss aversion.

4.2. Data

The data from the 2018 CMVM online survey to Portuguese individual investors supported the analysis. This survey contained a total of 44 questions, divided into four distinct parts (Appendix 5). The information provided by the database includes a wide

[8] The views of respondents regarding money and future planning. A higher score was for those with have more positive attitudes towards the “long-term perspectives” and saving.

range of variables relating to the profile of the participants. In addition to the socioeconomic characterization of respondents, it covered questions that had the purpose of identifying financial literacy, risk preferences, and other behavioral biases.

In the second part, the first two questions are about the level of financial literacy. Firstly, they self-assessed concerning financial knowledge and then compared it with the average of the Portuguese population. After that, some questions to test the true financial literacy of the participants. The principal ambition of the risk preferences portion in the third part of the survey is to understand how much risk the participant is willing to take. First, each respondent had to evaluate their attitude towards risk. Then the questions were to determine the different levels of risk when dealing with the financial applications. Most of the questions that measure the risk include a hypothetical monetary gain that the respondent must gamble. Loss aversion, disposition effect, and overconfidence were the three investigated biases in questions in the context of investment decision-making. The excess of importance that each investor gives to the losses (concerning the earnings) is the loss aversion, and question 13 appears intending to analyze the existence of this bias. The questionnaire had the question 8 and 14 with the attempt of testing the presence of disposition effect, in the domain of losses and gains, respectively. Another characteristic found in both men and women is overconfidence. An easy method to explore the possible overconfidence of each respondent is to inquire if they are better than average at something they all share. That can be capture by using general assessment questions.

The participants that did not answer the gender question were excluded (29 fewer respondents, 1,25% of the initial raw sample) so, the final data contains 2282 respondents (instead of 2311). Table I reports the summary statistics for the socio-demographic characterization of the participants. The sample consists of 81,81% men, aging between 40 and 54, 43.9% have a bachelor's degree, and 38.6% have a degree with financial background. Then, Table II presents the correlation matrix including the relevant variables and allows concluding that gender presents statistical significance with almost every variable, excluding major, work status, and the disposition effect. Furthermore, financial literacy is correlated with all variables, except for age. The data will be tested and analyzed using SPSS software.

Table I: Socio-demographic characterization of the participants

Variables	Descriptive Measures
Gender (N=2282)	Females: 415 (18.19%); Males: 1867 (81.81%)
Age	Minimum: 16; Maximum: 94; Mean: 46.44; Standard deviation: 13.951
by groups (N=2282; F=415, M=1867)	Up to 24: F (6.02%), M (4.12%); Between 25 and 39: F (33.01%), M (30.48%); Between 40 and 54: F (40.72%), M (36.05%); Between 55 and 69: F (15.18%), M (22.12%); Over 70: F (5.06%), M (7.23%)
Education Level (N=2274; F=413, M=1861)	Up to Middle School: F (6.06%), M (8.17%); High School: F (17.43%), M (24.72%); Bachelor's Degree: F (50.12%), M (42.50%); Master/MBA/PhD: F (26.39%), M (24.61%)
Major's Area (N=1422; F=278, M=1144)	Economics, Management, Finance (…): F (42.45%), M (37.67%); Other areas: F (57.55%), M (62.33%)
Work Status (N=2212; F=402, M=1810)	Self-employed: F (12.19%), M (16.91%); Employee: F (68.91%), M (62.49%); Unemployed: F (4.98%), M (3.31%); Retired: F (10.7%), M (15.47%); Student: F (3.23%), M (1.82%)
Household (N=2109; F=378, M=1731)	Minimum: 1; Maximum: 10; Mean: 2.71; Standard deviation: 1.225
Monthly Net Income/ Household (N=1605; F=239, M=1366)	Minimum: 1; Maximum: 5; Mean: 3.34; Standard deviation: 1.030
	Up to €500: F (9.21%), M (4.76%); Between €501 and €1000: F (15.06%), M (10.76%); Between €1001 and €2500: F (35.56%), M (42.39%); Between €2501 and €4000: F (24.27%), M (28.26%); Over €4000: F (15.90%), M (13.84%)

Obs.: F stands for Females, and M stands for Males. The description and construction of all relevant variables can be found in Appendix 1 – Table V.

Table II: Correlation Matrix

	Gender	Age	Education	Major	Work Status	Household	Income	Financial Literacy Score	Risk Assessment	OC: Better than average	OC: Miscalibration	Disposition Effect	Loss Aversion
Gender	1	.066**	-.059**	-.027	-.004	.052*	.045	.216**	.255**	-.120**	-.119**	-.003	-.166**
Age	.066**	1	-.263**	-.115**	.398**	-.021	.164**	-.037	-.134**	.085**	-.067**	-.037	.042
Education	-.059**	-.263**	1	.688**	-.221**	.007	.222**	.219**	.058*	-.216**	-.039	.033	-.076**
Major	-.027	-.115**	.688**	1	-.140**	.021	.169**	.124**	-.020	-.118**	-.077**	.032	-.052*
Work Status	-.004	.398**	-.221**	-.140**	1	-.175**	-.058*	-.079**	-.103**	.090**	-.002	.042*	.008
Household	.052*	-.021	.007	.021	-.175**	1	.229**	.074**	-.001	-.060**	-.031	-.044*	-.002
Income	.045	.164**	.222**	.169**	-.058*	.229**	1	.212**	.071**	-.146**	-.061*	-.019	-.066**
Financial Literacy Score	.216**	-.037	.219**	.124**	-.079**	.074**	.212**	1	.221**	-.191**	-.655**	-.091**	-.163**
Risk Assessment	.255**	-.134**	.058*	-.020	-.103**	-.001	.071**	.221**	1	-.198**	.039	.120**	-.424**
OC: Better than average	-.120**	.085**	-.216**	-.118**	.090**	-.060**	-.146**	-.191**	-.198**	1	-.028	.045*	.073**
OC: Miscalibration	-.119**	-.067**	-.039	-.077**	-.002	-.031	-.061*	-.655**	.039	-.028	1	.046*	.041
Disposition Effect	-.003	-.037	.033	.032	.042*	-.044*	-.019	-.091**	.120**	.045*	.046*	1	-.130**
Loss Aversion	-.166**	.042	-.076**	-.052*	.008	-.002	-.066**	-.163**	-.424**	.073**	.041	-.130**	1

Obs.: **. Correlation is significant at the 0.01 level (2-tailed); *. Correlation is significant at the 0.05 level (2-tailed). OC stands for Overconfidence.

5. EMPIRICAL FINDINGS

5.1 Profile of Women Investor

Once women represented only 18.19% of participants and are usually forget in studies and investor profile's representation, it is relevant to draw the report of the potential Portuguese woman investor. With ages between 40 and 54 years, a bachelor's degree in non-financial related areas, and employee. Her household has two people, and their available monthly income is between €1001 and €2500.

When measuring their technological knowledge, women consider themselves below the population average (44.7%). In the investment decision, information consulted via the internet (including YouTube and other means, but not on social media) is not very important among women but still more relevant than the one obtained on social media. Concerning financial products, they consider themselves moderately knowledgeable (36%) but below the average of the Portuguese population (39.5%). The survey included five questions to assess the respondents' level of financial literacy. On average, women get 2.6 questions right, but on the other hand, almost 30% answer correctly at least 4 of 5.

In the decision-making process, not all sources of information have equal importance to the investors. Between women, the information obtained through counseling at the institution where they purchase the product is cogitated very or extremely important by almost 60%, whereas 78.4% consider the advice of a financial advisor to be very or extremely important. On another perspective, unsolicited information received by mail is unimportant by almost half of the women. Understanding the elements (income, risk level, and advantages) is extremely important when deciding to invest, alongside knowing that CMVM has registered the financial intermediary.

Retirement savings plans are the most frequent type of investment, followed by investment funds and stocks. The women investors classify their profitability as nor excellent neither bad. Their portfolio securities, as a percentage of total wealth, are usually up to 25%. There is no apparent significance between the female attitude towards risk and retirement saving plans but with stocks and investment funds. Also, women did not present a relation between their choice of becoming an investor and their risk attitude, nor their financial literacy score.

5.2 Financial literacy

Measuring financial literacy is essential to understand investment behavior. Table III presents the descriptive statistics to the two questions where respondents evaluate their financial understanding. First, the respondents ranked their financial knowledge on a scale from 1 (not knowledgeable) to 5 (very knowledgeable). After, they classified the self-perception of their compared financial knowledge on a scale from 1 (quite above) to 5 (quite below). Results show that women tend to classify their financial literacy with lower values than men.

Table III: Descriptive Statistics to the financial literacy questions: self-assessment and knowledge compared to the average of the population

	Min	Max	Mean	Standard Deviation
Self-Assessment				
Females	1	5	2.90	1.118
Males	1	5	3.30	.932
Both	1	5	3.22	.980
Knowledge revealed				
Females	1	5	3.44	.932
Males	1	5	3.81	.831
Both	1	5	3.74	.861

Table VI, in appendix 1, presents the answers to the five financial literacy questions and their financial literacy score, separately for men and women. The empty spaces, that is, the choice of not answering the question was higher among women. At the same time, men demonstrated a higher financial knowledge in every topic. The average financial literacy score[9] is 3.14 out of 5, with 14.6% answering all questions correctly. The percentage of respondents with five correct answers is higher among men. Participants

[9] The financial literacy score is the number of correct answers to the five questions.

that choose not to answer the questions are 12.05% of women compared to only 4.23% of men.

The analysis to test the hypothesis mentioning a significant association between gender and financial literacy will be divided into two models and estimated in multiple linear regression. The first one will test financial literacy with only one predictor, gender. Whereas the second will test if other (independent) socioeconomic variables can predict financial literacy.

(1) $FL_i = \beta_0 + \beta_1(Gender),$

(2) $FL_i = \beta_0 + \beta_1(Gender) + \beta_2(Age\ Groups) + \beta_3(Education) + \beta_4(Major) + \beta_5(Work\ Status) + \beta_6(Household) + \beta_7(Income)$

The results, presented in Appendix 2 show that, even though both models are significant, the second model is more accurate in predicting the dependent variable, financial literacy ($F(7, 1458) = 33.491,\ p =< 001,\ R^2 = .139$), with the independent variables explaining about 13,4% of the total variation of the dependent variable ($Adjusted\ R^2 = .134$). The variable representing gender proved to be a positive and statistically significant predictor ($\beta = .168; t = 6.876; p =< 001$) of financial literacy score. Among all the independent variables used to control and predict the second model, only work status proved to be insignificant.

As mentioned above, researchers share the idea (and data) that women are less financially literate than men (see Bucher-Koenen et al., 2021; Levine, 2019; Cupák et al., 2018). The same is verified in our data analysis as Portuguese women present a weaker financial knowledge and left more “blank spaces”, opting not to respond to the question. We can conclude that hypothesis 1, stating a significant existing association between gender and financial literacy, is then validated. Nonetheless, this variable cannot be considered isolated and urges more research and public attention to fix this problem.

5.3 Risk

The results in Table IV show how the respondents assess their risk propensity. As was expected, it seems to be a tendency among Portuguese male respondents to see themselves as more prone to take a risk when compared to females' predisposition. Additionally, women present the highest percentage in the risk-averse's group.

Table IV: Risk Assessment

Self-Assessed Risk	**Men**	**Women**	**All**
1. Very Risk Averse	7.56	23.35	9.98
2. Risk Averse	23.45	41.25	26.18
3. Neutral to Risk	27.33	17.51	25.82
4. Risk Prone	39.19	16.73	35.74
5. Very Risk Prone	2.47	1.17	2.27

Note: Data from the CMVM online survey. The values are reported in percentages of the total number of respondents. The number of observations, excluding blank answers: Men: 1416, Women: 257, Total: 1673. Risk Assessment: Minimum: 1; Maximum: 5; Mean: 2.94; Std. dev: 1.052.

Two models will test the effect of gender on risk assessment, the hypothesis 2. The first equation includes only one independent variable, gender, and the second, seven other predictors, helping to monitor the strongest.

(3) $R_i = \beta_0 + \beta_1(Gender),$

(4) $R_i = \beta_0 + \beta_1(Gender) + \beta_2(Age\ Groups) + \beta_3(Education) + \beta_4(Major) + \beta_5(Work\ Status) + \beta_6(Household) + \beta_7(Income) + \beta_8(Financial\ Literacy)$

Considering the tables attached in appendix 3, both models revealed statistical significance, but it is possible to conclude that the second model can better predict risk assessment, $F(8, 1511) = 26.584,\ p = .000,\ R^2 = .123$. The independent variables presented significance accounting for more than 12% of the variance of risk assessment ($Adjusted\ R^2 = .125$). Considering all the independent variables, gender and financial literacy score are the most relevant, with $\beta = .245; t = 9.980; p = .000$ and $\beta = .148; t = 5.733; p = .000$, respectively. With that, hypothesis 2 referring to a significant association between gender and risk preferences is valid.

Researchers are almost unanimous in the gender gap when it comes to the assumption that women are more risk-averse than men. But some of them have linked the gender gap in risk-taking propensity with different cultural environments and demographic characteristics (see Fisher & Yao, 2017; Booth & Nolen, 2012; Croson & Gneezy, 2009). This study aligns with their research, as Portuguese women tend to show more risk aversion than their male counterparts. Furthermore, we cannot look at our data separately. The independent variables included in the second model proved to influence the risk attitude. Cultural reasons and even differences in financial comprehension can also explain this difference between men and women.

5.4 Behavioral Biases

5.4.1 Overconfidence

As was previously mentioned, researchers analyze overconfidence from different points of view. Usually, respondents who are confident with themselves and their knowledge tend to feel superior to the average. To test the presence of that behavioral bias, was used a binary variable called "Overconfidence – Better than Average", equal to one if the answer the question "How do you rate your knowledge of financial products and markets when compared to the average of the Portuguese population?" was either above average, or well above average, and zero otherwise. Additionally, we can examine another dimension, miscalibration, where the participant had evaluated the knowledge with a more notable "score" than later had in the financial literacy questions. The binary variable called "Overconfidence – Miscalibration" is equal to one if the participant's self-assessment was higher than the proven financial literacy score and zero otherwise. Models (5) and (6) will investigate the effect of gender on the better than average dimension, and the following (7) and (8) represent the effect of gender on the miscalibration dimension of overconfidence.

(5) $Obta_i = \beta_0 + \beta_1(Gender),$

(6) $Obta_i = \beta_0 + \beta_1(Gender) + \beta_2(Age) + \beta_3(Education) +$
$\beta_4(Major) + \beta_5(Work\ Status) + \beta_6(Household) + \beta_7(Income) +$
$\beta_8(Financial\ Literacy)$

(7) $Om_i = \beta_0 + \beta_1(Gender),$

(8) $Om_i = \beta_0 + \beta_1(Gender) + \beta_2(Age) + \beta_3(Education) + \beta_4(Major) + \beta_5(Work\ Status) + \beta_6(Household) + \beta_7(Income) + \beta_8(Financial\ Literacy)$

The four models were estimated using a probit regression model with (5) and (7) including only the variable gender as the predictor, and (6) and (8) with the supplement of seven other predictors.[10]

When it comes to the better than average and analyzing the results of the first estimation (5), gender has a positive and statistically significant coefficient $\beta_1 = .485; p =< .001$, indicating that ceteris paribus, women are more likely to exhibit an overconfidence behavior than men, at least when it concerns their financial knowledge. The second model is statistically significant as well, $LRT^{11} = 134.497,\ p = .000$ with women, once again, more likely to exhibit this excess of confidence than men. Essentially, gender, the degree in a financial area, and financial literacy are the better independent variables predicting overconfidence.

Related to the miscalibration, the effect of gender is similar to model (5), with a positive and statistically significant coefficient $\beta_1 = .385; p =< .001$, demonstrating that if we take into consideration only the gender to predict this bias, women are more likely than men to self-assess with a financial literacy score higher than the knowledge they demonstrated. However, and although the second model (8) also presents statistical significance, $LRT = 606.883,\ p = .000$, the gender now presents a negative (and statistically significant) coefficient, $\beta_1 = -.245; p =< .001$. This means that when other socio-demographic variables are considered to predict the miscalibration bias, men demonstrate a higher self-evaluation than their demonstrated financial knowledge. The variables financial literacy score, major, age, income, and gender proved statistical significance with p-values<0.06.

While Deaves et al. (2009) find no gender differences in overconfidence, some researchers presented data demonstrating the existence of the gender gap in overconfidence, with men being more confident than women (see Beckmann & Menkhoff, 2008; Barber & Odean, 2001). Somehow surprisingly, in our database, the

[10] Complete results are presented in Appendix 4, Table XI, Columns (5) to (8).
[11] Likelihood Ratio

"better than average" dimension reveals more confidence among women than men. Interestingly, the results on the "miscalibration" vary with the predictors. To sum up, it is true that gender influences the overconfidence bias, validating hypothesis 3 as there is a significant association between gender and overconfidence. Nevertheless, these tendencies must be seen and treated, always considering the different dimensions and socio-characteristics of the target group. It is also possible that if participants had an "I do not know" option, the results could be different.

5.4.2 Disposition Effect

To an accurate prediction and exclude some presumed mistakes, the disposition effect became narrowed to those who displayed it both in gains and losses. So, the dependent variable "disposition effect on both gains and losses" is binary, equal to one if the participant exhibits disposition behavior and zero otherwise. Two models estimate the disposition effect, one only with gender as a predictor and the second adding seven other independent variables.

(9) $DE_i = \beta_0 + \beta_1(Gender),$

(10) $DE_i = \beta_0 + \beta_1(Gender) + \beta_2(Age) + \beta_3(Education) + \beta_4(Major) + \beta_5(Work\ Status) + \beta_6(Household) + \beta_7(Income) + \beta_8(Financial\ Literacy)$

The probit model[12] related to the first equation disclosures that there was no evidence of a statistically significant influence of gender on disposition effect. Nonetheless, the second model is more accurate and robust, as includes other predictors, and reveals statistical significance in matters of gender, $LRT = 35.007,\ p = .05$.

Previously reviewed investigations have not reached a consensus regarding the disposition effect. Some researchers finding no gender differences (see Da Costa et al., 2008), and others stating that, under their data, women had exhibited more disposition effect when compared to men (see Fischbacher et al., 2017; Rau, 2014). The findings from this analysis suggest that if we consider variable socio-demographic (as age, work status, and financial literacy score) gender may influence the exhibition of the disposition

[12] Results are presented in Appendix 4, Table XI.

effect. Accordingly, Portuguese women are 34 percentage points more likely to exhibit it than men. Thus, proving a behavioral gender gap and validating Hypothesis 4 as "there is a significant association between gender and disposition effect."

5.4.3 Loss Aversion

Question 13 of the second part of the survey allows checking the presence of this behavioral bias. The dependent variable tested is loss aversion, binary equal to one if the participant decided "not invest in the product, as it is associated with the probability of losing money", and zero otherwise.

As previously done, two specifications of the regression equation estimate the dependent variable: the first one only includes gender as the variable of interest, and the second one including other socioeconomic variables and financial literacy.

(11) $LA_i = \beta_0 + \beta_1(Gender)$,

(12) $LA_i = \beta_0 + \beta_1(Gender) + \beta_2(Age) + \beta_3(Education) + \beta_4(Major) + \beta_5(Work\ Status) + \beta_6(Household) + \beta_7(Income) + \beta_8(Financial\ Literacy)$

A probit regression was used to test the hypothesis that gender affects loss aversion. After analyzing the results, the independent variables of (11) and (12) can predict the dependent variable, and there is a statistical significance, $LRT = 49.722,\ p = .000$, and $LRT = 109.824,\ p = .000$, respectively[13]. Gender assumed a positive and statistically significant coefficient in the two models, but the values of the second model are more robust and precise. However, gender is not the only relevant tested variable influencing loss aversion, with financial literacy score presenting a p-value<0.001.

According to Rau (2014) and Hassan et al. (2014), loss aversion is more felt among women. As expected, the same was verified among Portuguese individual investors, where females are more likely to be averse to lose in 61.8 percentage points. The hypothesis H5, which states the existence of a significant association between gender and loss aversion, is then accepted.

[13] Further results are presented in Appendix 4, Table XI.

6. CONCLUSION

The purpose of this dissertation was to establish whether individual Portuguese investors presented gender differences in their investment decision-making. To analyze it, we tested the possible existence of gender differences on financial literacy, risk preferences, and in three behavioral biases: overconfidence, disposition effect, and loss aversion. The findings evidenced the existing gaps in all the studied dimensions.

Concerning financial literacy, the results of this study are in line with the ones presented by OECD (2020) and CNSF (2021), as men have revealed a higher financial literacy in all the assessed topics compared to women. In the analysis of our results, we found that women present a higher aversion to risk than men, being more conservative. The results on the risk preferences are following Beckmann and Menkhoff's (2008) previous research discussed in the literature review.

Our analysis has shown the existence of gender gaps in the studied behavioral biases. It allows us to conclude in accordance with Rau (2014), that Portuguese males feel less loss aversion than females. The literature review presented different perspectives in the possible gender disparities on disposition effect: Da Costa et al. (2008) found no differences, while Fischbacher et al. (2017) demonstrated that men are less prone to exhibit this bias than women. In our analysis, this relation is only relevant when other characteristics are considered, with females being also more prone to present disposition effect than males. In this study, gender has proven statistical significance towards overconfidence, but those effects depend on the dimension studied. Literature regarding the excess of confidence has shown distinct scenarios: Barber and Odean (2001) concluded that men are more confident than women, leading males to a higher trading frequency and transaction costs and worse performance, while Deaves et al. (2009) found no gender-based differences.

Additionally, the results of this study have shown that gender is not alone in explaining behavioral differences in investment decision-making. Characteristics such as age, income, education, and financial literacy can be vital in predicting the investment behaviors of Portuguese individual investors. It became clear that financial literacy may influence risk preferences, overconfidence, and loss aversion. Moreover, according to our data, Portuguese women are less financially knowledgeable than men, which is relevant for this thesis and future investigations related to economic behavior, such as wealth accumulation and retirement planning. Overall, women and those with weak financial literacy may have difficulty making financial decisions, which can severely affect their financial well-being (see Lusardi & Mitchell, 2008).

Further research should try to get a more representative sample, with a better distribution of men and women. Additionally, it would be interesting to add an option to "do not know" instead of the permission of left the question without an answer. With that, we could exclude the uninteresting participants and get more accurate results. Lastly, more investigation is needed not only to understand the causes that somehow push away half of the society from financial matters but also to identify what can be done to make women more financially knowledgeable.

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APPENDICES

Appendix 1 – Tables

Table V: Descriptive Summary

Variable	Definition
Gender	Organized as follows: [1] Female; [2] Male.
Age	Age of respondent in years.
Age groups	Organize ages by groups as follows: [1] Below or equal to 24; [2] Between 25 and 39; [3] Between 40 and 54; [4] Between 55 and 69; [5] More or equal than 70.
Education	Is the level of education. Six categories are considered: [1] No primary school; [2] Elementary school; [3] Middle school; [4] High school; [5] Higher education; [6] Master/MBA/PhD
Major	Divides the specialization of the major into three groups: [1] Financial Area (Management, Economics, Finance or similar; [2] otherwise; [0] Do not have a degree or blank answer
Work Status	Represents the occupation of the participant. Answers are divided into 5 groups: [1] "self-employed"; [2] "employee"; [3] "unemployed"; [4] "retired"; [5] "student"
Household	The number of household elements
Income	Available monthly income (after-tax) for the household. Divided into 5 groups: [1] Up to €500; [2] Between €501 and €1000; [3] Between €1001 and €2500; [4] Between €2501 and €4000; [5] More than €4001.
Financial Literacy Score	Number of correct answers to the 5 financial literacy questions listed in Appendix 1 – Table VI. Ranging from 0 to 5.
Disposition Effect (both)	Disposition Effect on both gains and losses: [1] when the answers of the two questions suggest the presence of the disposition effect; [2] otherwise.
Loss Aversion	(Part II – Question 13) [1] if there is the existence of loss aversion; [0] otherwise.
Financial Knowledge (compared)	Measuring overconfidence, self-assessment ranging from [1] "well above average" to [5] "much lower than average" on the following question "How do you rate your knowledge of financial products and markets when compared to the average of the Portuguese population". [0] related to the blank answers.

Financial Knowledge (self-evaluation)	Measuring financial knowledge ranging from [1] "nothing knowledgeable" to [5] "very knowledgeable" on the following question "How do you rate your knowledge of financial products and markets". [0] related to the blank answers.
Overconfidence – Better than average	Divide the financial knowledge (compared) into two: [1] If the answer was "above average" or "well above average"; [0] otherwise.
Overconfidence - Miscalibration	Use to test the to compare the financial knowledge self-evaluated with the financial literacy score: [1] If self-assessed financial knowledge was higher than the financial literacy score; [0] otherwise.
Risk Preferences	Self-rating ranging from [1] "totally agree" to [5] "totally disagree" on the following expression "I generally prefer to play it safe than risk"
Risk Assessment	Self-rating ranging from [1] "very risk-averse" to [5] "very risk-prone" on the following question "How would you rate your degree of risk when investing?"

Table VI: Answers to the financial literacy questions

A. Compound Interest Concept	**Men**	**Women**	**All**
Correct	67.97	43.61	63.54
Incorrect	27.32	44.10	30.37
Did not answer	4.71	12.29	6.09
Standard Deviation	.519	.681	.553
B. Relationship between inflation and cost of living	**Men**	**Women**	**All**
Correct	91.75	79.52	89.53
Incorrect	3.43	6.99	4.08
Did not answer	4.82	13.49	6.40
Standard Deviation	.287	.448	.323
C. Relationship between interest rate and bond price	**Men**	**Women**	**All**
Correct	54.20	37.83	51.23
Incorrect	36.26	42.17	37.34
Did not answer	9.53	20	11.44
Standard Deviation	.622	.758	.649

D. Safer Return: Stocks or Equity Funds?	**Men**	**Women**	**All**
Correct	83.88	71.81	81.68
Incorrect	6.91	8.43	7.19
Did not answer	9.21	19.76	11.13
Standard Deviation	.401	.519	.426
E. Definition of Capital Guarantee	**Men**	**Women**	**All**
Correct	29.94	18.07	27.78
Incorrect	45.69	43.86	45.35
Did not answer	24.37	38.07	26.86
Standard Deviation	.810	.904	.830
F. No. of correct answers:	**Men**	**Women**	**All**
0	0.54	1.93	0.70
1	5.95	10.12	6.70
2	13.23	23.61	15.12
3	24.85	24.34	24.76
4	35.24	19.28	32.34
5	15.96	8.67	14.64
Without Answer	4.23	12.05	5.65
Standard Deviation	1.309	1.484	1.375

Note: Data from the CMVM online survey. The values are reported in percentages of the total number of respondents. The number of observations: Men: 1867, Women: 415, Total: 2282. Financial Literacy Score is measured by F.: Minimum: 0; Maximum: 5; Mean: 3.14; Std. dev: 1.375.

Appendix 2 – Financial Literacy: Linear Regression Results

Table VII**:** H1 – OLS Regression - Model Summary

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**F**	**df1**	**df2**	**Sig**
1	.160[a]	.026	.025	1.053	38.560	1	1.464	<001

2	.372[b]	.139	.134	.992	33.491	6	1.458	<001

a. Predictors: (Constant), Gender

b. Predictors: (Constant), Gender, Work Status, Income, Major, Household, Age Groups, Education

c. Dependent Variable: Financial Literacy Score

Table VIII: H1 - OLS Regression – Coefficients

		Unstandardized Coefficients		Standardized Coefficients		
	Model	B	Std. Error	Beta	**t**	**Sig.**
1	(Constant)	2.699	.146		18.438	<001
	Gender	.482	.078	.160	6.210	<001
2	(Constant)	.781	.273		2.860	.004
	Gender	.506	.074	.168	6.876	<001
	Age Groups	-.076	.030	-.069	-2.508	.012
	Education	.338	.043	.278	7.873	<001
	Major	-.119	.042	-.096	-2.855	.004
	Work Status	-.042	.030	-.037	-1.391	.165
	Household	.047	.023	.053	2.064	.039
	Income	.161	.027	.154	5.840	<001

a. Dependent Variable: Financial Literacy Score

Appendix 3 – Risk: Linear Regression Results

Table IX: H2 – OLS Regression - Model Summary

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**	**F**	**df1**	**df2**	**Sig**
1[a]	.266	.071	.070	1.005	111.176	1	1.460	.000
2[b]	.361	.130	.125	.974	27.167	7	1.453	.000

a. Predictors: (Constant), Gender

b. Predictors: (Constant), Gender, Work Status, Income, Major, Household, Age Groups, Education

c. Dependent Variable: Risk Assessment

Table X: H2 – OLS Regression - Coefficients

		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	**Sig.**
1	(Constant)	1.516	.140		10.853	.000
	Gender	.781	.074	.266	10.544	.000
2	(Constant)	1.411	.270		5.227	.000
	Gender	.729	.073	.248	9.928	.000
	Age Groups	-.119	.030	-.110	-3.966	.000
	Education	.040	.043	.034	.934	.350
	Major	-.127	.041	-.105	-3.103	.002
	Work Status	-.065	.030	-.058	-2.144	.032
	Household	-.053	.022	-.062	-2.404	.016
	Income	.069	.027	.068	2.527	.012
	Financial Literacy Score	.154	.026	.157	5.973	.000

Obs.: Table shows the multiple linear regressions estimates. a. Dependent Variable: Risk Assessment

Appendix 4 – Behavioral Biases

Table XI: Estimates of the effects on three behavioral biases

	Overconfidence				**Disposition Effect**		**Loss Aversion**	
	Better than average		Miscalibration					
	(5)	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
Female	.485*** (.0897)	.549*** (.1509)	.385*** (.0693)	-.245** (.1305)	-.012 (.0721)	.341*** (.0989)	.560*** (.0790)	.618*** (.1013)
Age		.017*** (.0067)		-.016*** (.0051)		.007** (.0038)		.006* (.0041)
Household		-.028 (.0579)		.007 (.0418)		.002 (.0311)		.042 (.0331)

Elementary School		1.311*** (.5160)		-.712 (.5524)		.073 (.4075)		.459 (.4190)
Middle School		.622* (.3815)		-.508 (.3543)		-.054 (.2360)		.117 (.2515)
High School		.020 (.3392)		.009 (.2703)		-.085 (.1889)		.079 (.2015)
Higher Education		.199 (.2005)		-.167 (.1252)		.096 (.0920)		.169* (.1016)
Financial Area Major		-.495*** (.2193)		.820*** (.1250)		.009 (.0902)		-.015 (.0992)
Self-employed		-.082 (.6275)		.583 (.4557)		-.001 (.2837)		.179 (.3315)
Employee		.330 (.5904)		.788* (.4360)		-.056 (.2693)		.303 (.3156)
Unemployed		.100 (.6669)		1.055** (.5044)		-.023 (.3311)		.340 (.3733)
Retired		-.204 (.6421)		.928** (.4869)		-.312 (.3172)		.113 (.3618)
FLS: 0 (All wrong)		1.871*** (.2761)		14.695 (15973.88)		-6.019 (15896.57)		.196 (.7632)
FLS: 1 (right)		1.279*** (.3254)		9.221 (1522.84)		.172 (.2087)		.470** (.2144)
FLS: 2 (right)		.848*** (.2735)		8.064 (1522.84)		.132 (.1322)		.549*** (.1380)
FLS: 3 (right)		.562** (.2640)		6.756 (1522.84)		.083 (.1082)		.264*** (.1167)
FLS: 4 (right)		.335 (.2658)		5.792 (1522.84)		.127 (.0977)		.003 (.1098)
Income: Up to €500		.615** (.2829)		-.649*** (.2554)		-.215 (.1889)		-.004 (.2014)
Income: €501-€1000		.379 (.2829)		-.410** (.2162)		-.150 (.1537)		.240 (.1627)
Income: €1001-€2500		.064 (.2214)		-.095 (.1636)		-.042 (.1120)		.201* (.1237)
Income: €2501-€4001		-.119 (.2375)		.036 (.1656)		-.081 (.1134)		.026 (.1269)
Nº of obs. with Y=1	169	78	747	322	662	452	496	346
Nº of obs.	2274	1452	2249	1440	2282	1453	1961	1449
LR stat	27.996	134.497	30.610	606.883	.028	35.007	49.722	109.824

Sig	.000	.000	.000	.000	.868	.052	.000	.000

Obs.: The table shows the results of different probit estimations for the models (5), (6), (7), (8), (9), and (10) abovementioned. FLS stands for Financial Literacy Score. Standard Errors are reported in parentheses. *, ** and *** denote statistical significance at 10%, 5%. and 1% respectively; the models include a constant as well. Y stands for the dependent variable.

Table XII: Test of Model Effects (Type III) – Likelihood Ratio Chi-Square

	Overconfidence				**Disposition Effect**		**Loss Aversion**	
	Better than average		Miscalibration					
	(5)	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**
(Intercept)	1122.635*** (1)	15.367*** (1)	83.310*** (1)	0 (1)	253.150*** (1)	8.059*** (1)	155.220*** (1)	4.037** (1)
Gender	27.966*** (1)	12.726*** (1)	30.610*** (1)	3.582** (1)	.028 (1)	11.848*** (1)	49.722*** (1)	36.745*** (1)
Age		6.238*** (1)		10.236*** (1)		3.621** (1)		2.483 (1)
Household		.236 (1)		.028 (1)		.005 (1)		1.609 (1)
Education		14.806*** (5)		7.525 (5)		3.122 (5)		4.218 (5)
Major		6.605** (2)		47.788*** (2)		3.335 (2)		.613 (2)
Work Status		7.270 (4)		7.284 (4)		4.405 (4)		3.622 (4)
Income		11.284*** (4)		13.247*** (4)		2.115 (4)		6.028 (4)
Financial Literacy		26.056*** (5)		559.110*** (5)		4.378 (5)		26.388*** (5)

Obs.: Df are reported in parentheses. *, ** and *** denote statistical significance at 10%, 5%. and 1% respectively.

Appendix 5– CMVM Online Survey

Parte I

1. Por favor indique a sua idade, em anos: ___.

2. Por favor indique o seu género: __ Feminino; __ Masculino.

3. Por favor indique os sete dígitos do código postal da sua residência habitual: _____.

4. Qual o seu nível máximo de escolaridade concluído? _ Não concluiu a instrução primaria _ Instrução primária completa (4ºano) _ Ensino básico completo (9º ano) _ Ensino secundário completo (12º ano) _ Ensino superior (politécnico ou universitário) completo _ Mestrado ou MBA ou Doutoramento

5. Se tem ensino superior ou Mestrado/MBA/PhD, indique a sua área principal de formação académica ________

6. Em que situação laboral ou ocupacional se encontra? __Trabalhador por conta própria; __Trabalhador por conta de outrem; __Desempregado; __Aposentado/Reformado; __Estudante; __Outro (especifique) __________

7. Contando consigo, quantas pessoas tem o seu agregado familiar? ________

Parte II

1. Como classifica os seus conhecimentos sobre produtos e mercados financeiros? Nada conhecedor |__| |__| |__| |__| |__| Muito conhecedor

2. Como avalia os seus conhecimentos sobre produtos e mercados financeiros quando comparado com a média da população portuguesa? _Muito inferiores; _Inferiores; _Iguais; _Superiores; _Muito superiores

3. Como avalia a rentabilidade média do mercado financeiro no último ano? Péssima |__| |__| |__| |__| |__| Excelente

4. Qual é a sua expectativa para a rentabilidade média do mercado financeiro no próximo ano? Muito pessimista |__| |__| |__| |__| |__| Muito otimista

5. Como avalia os seus conhecimentos da Internet e das novas tecnologias quando comparado com a média da população portuguesa? _Muito inferiores; _Inferiores; _Iguais; _Superiores; _Muito superiores

6. Suponha que tem €100 numa conta bancária cuja taxa de juro é 1% ao ano. Após 5 anos, quanto será o saldo da conta se não retirar de lá nenhum dinheiro, nem existirem comissões ou impostos associados (ou seja, no fim de cada ano deixa ficar o valor dos juros nessa conta bancária)? _ Mais do que €105 _ Exatamente €105 _ Menos do que €105

7. Suponha que tem €100 numa conta bancária cuja taxa de juro é de 1% ao ano e que a inflação é 2% ao ano. Daqui a um ano o que acha que conseguiria comprar com o dinheiro dessa conta? _ Compraria mais coisas do que hoje _ Compraria exatamente as mesmas coisas do que hoje _ Compraria menos coisas do que hoje

8. Suponha que fez uma aplicação num produto financeiro com risco de perda do dinheiro investido. No final de 1 ano essa aplicação apresenta ganhos face ao dinheiro investido inicialmente. Tem agora duas opções: Opção A: Manter o investimento por mais um ano. No final desse ano, poderá ter ganhos ou perdas face ao dinheiro investido inicialmente. Opção B: Liquidar o investimento agora e receber os ganhos. Qual a sua escolha? |__| Opção A |__| Opção B

9. Indique a frequência com que utiliza as ferramentas digitais (internet, app no telemóvel) nas seguintes situações.

10. Indique por favor se a seguinte afirmação é verdadeira ou falsa: "O investimento numa ação de uma empresa normalmente proporciona um retorno mais seguro do que o investimento num fundo de ações." |__| V |__| F

11. Investiu numa obrigação que paga uma taxa de juro fixa. Entretanto as taxas de juro do mercado diminuíram. Se vender essa obrigação após esta diminuição, o preço desta obrigação deve ser: |__| Menor do que o preço a que a comprou |__| Igual ao preço a que a comprou |__| Maior do que o preço a que a comprou

12. Suponha que lança 10 vezes uma 'moeda ao ar'. Se nos primeiros 9 lançamentos saírem sempre 'coroas', qual é a probabilidade de sair 'coroa' no décimo lançamento? __%

13. O seu gestor/consultor financeiro sugere que aplique parte das suas poupanças num produto financeiro que, com igual probabilidade, lhe permite ganhar €80 ou perder €50. Qual das seguintes opções escolheria? |__| Investir parte das poupanças neste produto que, com igual probabilidade, lhe permite ganhar €80 ou perder €50 |__| Não investir neste produto, pois não entendi bem as consequências do mesmo |__| Não investir neste produto, pois tem associado a possibilidade de perder dinheiro |__| Não investir neste produto, pois é muito arriscado

14. Suponha que fez uma aplicação num produto financeiro com risco de perda do dinheiro investido. No final de 1 ano essa aplicação apresenta perdas face ao dinheiro investido inicialmente. Tem agora duas opções: Opção A: Manter o investimento por mais um ano. No final desse ano, poderá ter ganhos ou perdas face ao dinheiro investido inicialmente. Opção B: Liquidar o investimento agora e receber o dinheiro que ainda resta após a perda. Qual a sua escolha? |__| Opção A |__| Opção B

Parte III

1. Pensando no momento em que decide investir, qual o grau de importância dos seguintes elementos nessa decisão?

2. Suponha que irá comprar os seguintes produtos financeiros. Por favor, escolha a opção que mais se aplica a si.

3. Indique o grau de importância das seguintes fontes de informação na escolha do(s) seu(s) investimento(s)?

4. Antes de contratar um produto financeiro, lê a informação que a desse produto? |__| Sim, leio com muito detalhe |__| Sim, leio com algum detalhe |__| Sim, leio, mas com pouco detalhe |__| Não leio, confio no que me transmitem oralmente |__| Não leio, não dou muita importância

5. Compara as taxas de juro/rentabilidade antes de fazer uma aplicação de poupança/investimento? |__| Sim, mas só entre os bancos de que sou cliente |__| Sim, comparo as taxas oferecidas entre os bancos de que sou cliente e as praticadas noutros bancos |__| Não, utilizo sempre o mesmo banco |__| Não, não comparo

6. Classifique as seguintes aplicações financeiras por grau de risco, relativamente a reaver o dinheiro investido

7. Por favor indique o quanto concorda ou discorda com as seguintes afirmações.

8. Indique o grau de importância dos seguintes elementos na escolha dos seus investimentos em valores mobiliários?

9. Indique o grau de importância dos seguintes riscos quando está a pensar em fazer investimentos em valores mobiliários.

10. O que significa um valor mobiliário ter capital garantido na data de vencimento? |__| Tenho direito a receber o dinheiro investido, em qualquer momento |__| Na data de vencimento recebo sempre o dinheiro investido |__| O emitente do valor mobiliário reembolsa o dinheiro investido na data de vencimento, desde que tenha condições financeiras para o fazer

11. Como se classificaria quanto ao seu grau de risco quando investe em valores mobiliários? |__| Muito avesso ao risco / Não gosto mesmo nada de arriscar |__| Avesso ao risco / Não gosto de arriscar |__| Neutro face ao risco / Não gosto, nem desgosto de arriscar |__| Propenso ao risco / Gosto de arriscar |__| Muito propenso ao risco / Gosto muito de arriscar

12. Habitualmente como é que financia os seus investimentos em valores mobiliários? |__| Poupanças próprias |__| Recurso ao crédito |__| Os dois, poupanças próprias e crédito

13. Alguma vez perdeu dinheiro com investimentos realizados nos mercados de valores mobiliários?

14. A que atribui a perda de dinheiro com investimentos realizados nos mercados de valores mobiliários? Pode escolher mais do que uma razão. |__| Vicissitudes de mercado |__| Pouca experiência |__| Sorte ou falta dela |__| Mau aconselhamento |__| Falta de conhecimento técnico sobre estes mercados |__| Outro (especifique por favor)

Parte IV

1. Indique quais dos seguintes produtos financeiros detém presentemente. |__| Depósitos à ordem |__| Depósitos a prazo |__| Certificados de aforro / Certificados do tesouro / Obrigações do tesouro |__| Ações |__| Obrigações de empresas |__| Papel comercial |__| Fundos de investimento |__| Produtos financeiros complexos |__| Planos de poupança para a reforma (não considere contribuições obrigatórias para a segurança social ou outros regimes contributivos obrigatórios) |__| Seguros de vida ou de saúde |__| Cartão de crédito |__| Descoberto bancário |__| Crédito habitação ou créditos com garantia hipotecária |__| Outros créditos (incluindo, por exemplo, crédito pessoal, automóvel, lar, etc.) |__| Microcrédito (para financiamento profissional / comercial) |__| Investimentos em Crowdfunding |__| Investimentos em Bitcoins, ICOs, e outras moedas digitais

2. Qual é o peso (percentagem aproximada) de cada um dos seguintes investimentos mobiliários na sua carteira de investimento (se não tem, pense como seria se os tivesse)? (soma=100%) Obrigações do tesouro, certificados de aforro, certificados do tesouro, obrigações de estados estrangeiros___; Ações__; Fundos de investimento__; Obrigações de empresas__; Papel comercial___; Produtos complexos, incluindo, CFDs, opções, futuros, *warrants*, *swaps*, derivados, entre outros___; Bitcoins, ICOs e outras moedas digitais ___

3. Qual a frequência com que consulta a sua carteira de valores mobiliários:

4. Como avalia a rentabilidade da sua carteira de valores mobiliários no último ano? Péssima |__| |__| |__| |__| |__| Excelente

5. Qual é a sua expectativa para a rentabilidade da sua carteira de valores mobiliários no próximo ano? Muito pessimista |__| |__| |__| |__| |__| Muito otimista

6. A sua carteira atual de valores mobiliários representa que percentagem do seu património total? __ Não tenho atualmente; __ Até 10%; __ de 10%-25%; __ de 25%-50%; __ Mais de 50%.

7. Qual o rendimento mensal disponível (depois de impostos e descontos) do seu agregado familiar? __ Até 500€; __Entre 501€-1000€; __Entre 1001€-2500€; __Entre 2501€-4000€; __ Mais de 4000€.