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**Mestrado em Estatística e Gestão de Informação**  
Master Program in Statistics and Information Management

## **BEHAVIORAL FINANCE**

### **AN EMPIRICAL STUDY OF THE INVESTMENT DECISION-MAKING PROCESS**

Luísa Lima

Dissertação apresentada como requisito parcial para obtenção do grau de Mestre em Estatística e Gestão de Informação

Dissertation presented as partial requirement for obtaining the Master's degree in Statistics and Information Management

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by

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Dissertation presented as partial requirement for obtaining the Master's degree in Statistics and Information Management, with a specialization in Risk Analysis and Management.

**Advisor:** Rui Alexandre Henriques Gonçalves

October 2022

## **DEDICATION**

This work is dedicated to my institution mentor Rui Gonçalves under whose constant guidance I have completed this dissertation. He not only enlightened me with academic knowledge but also gave me valuable advice whenever I needed it the most. I also dedicate to my family who have never failed to give me financial and moral support, for giving all the needs during the time of my developed. A special feeling of gratitude to my friends, especially Milena, Miguel, Isabela and Cleide, whose words of encouragement were very important to me.

## **ABSTRACT**

Behavioral research has developed a significant theoretical background for revealing behavioral biases, however these biases are still overlooked in the investment allocation process. The main objective of this work is to include psychological analysis in the investor risk profile. Investors typically take a questionnaire before starting to invest, but these questionnaires only survey preferences and risk profile disregarding attitudes towards risk. This can sabotage otherwise well-intentioned efforts to achieve stated financial goals. For that reason, this work applies a “behavioral questionnaire” to analyze behavioral bias in investors. More than maximizes expected return for a given level of risk, the investment strategy should suit the investors psychological preferences. The questionnaire has questions that analyze the investment objective and needs according to behavior. For analyzing the results, the work uses descriptive statistics. The results led to a sample of young investors with high education level. Only four cognitive biases, between eleven, were detected. There are: status quo bias, conservative bias, endowment bias, and regret aversion bias. As conclusion, although only four biases were found, the definition of them is close showing consistency in the responses.

## **KEYWORDS**

Behavioral finance; investors; questionnaire; decision-making process.

## **RESUMO**

A pesquisa comportamental desenvolveu uma base teórica significativa ao revelar vieses comportamentais, no entanto, esses vieses ainda são negligenciados no processo de alocação de investimentos. O objetivo principal deste trabalho é incluir a análise psicológica no perfil de risco do investidor. Os investidores geralmente respondem um questionário antes de começar a investir, mas esses questionários apenas pesquisam preferências e perfil de risco, desconsiderando as atitudes em relação ao risco. Isso pode sabotar os esforços bem-intencionados para atingir as metas financeiras declaradas. Por isso, este trabalho aplica um “questionário comportamental” para analisar os vieses comportamentais dos investidores. Mais do que maximizar o retorno esperado para um determinado nível de risco, a estratégia de investimento deve se adequar às preferências psicológicas dos investidores. O questionário possui perguntas que analisam o objetivo e as necessidades de investimento de acordo com o comportamento. Para análise dos resultados, o trabalho utiliza estatística descritiva. Os resultados conduziram a uma amostra de jovens investidores com alto nível de escolaridade. Apenas quatro vieses cognitivos, entre onze, foram detectados. São eles: viés de status quo, viés conservador, viés de dotação e viés de aversão ao arrependimento. Como conclusão, embora apenas quatro vieses tenham sido encontrados, a definição entre eles é próxima, mostrando consistência nas respostas.

## **PALAVRAS-CHAVE**

Finanças comportamentais; investidores; questionário; processo de tomada de decisões.

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# 1 INTRODUCTION

Financial markets have a central role to provide indicators of economic development and give a direction of savings and productive investment. This is the process of real investment and consists by moving funds between surplus and deficit units (Cuthbertson, 2008). They ensure efficient allocation of capital transferring financial resources to undertake productive investments in an economy (Asafo-Adjei, 2021). The aggregate savings and funds are allocated through financial intermediaries (Routher, 1999). They facilitate the exchange of financial instruments such as stocks, bills and bonds, foreign exchange, futures, options and swaps (Cuthbertson, 2008).

For the proper direction of the wealth management, financial intermediaries need to sell only products that are suitable for their clients. Typically, the metric used to analyze the investors' profile is the application of a questionnaire. The questions enquire investment objectives, including financial status and specific goals. Thereafter, a financial advisor develops an investment strategy that should be align with the client's perspectives. The use of questionnaires to identify investor risk profiles is inadequate and unreliable. To determine the risk profile, behavioral finance research has uncovered many systematic departures in investor decision making if we consider some assumptions from traditional research (Klement, 2015). Investors can enable better the selection of their investment if they understand their own investment behavior (Dickason, 2018).

This work begins by defining some concepts in traditional finance and how they influence the risk profile approach for many years. We still see the use of the traditional concepts in investment companies while analyzing the client profile. The theory describes the decision-making process and how individuals make choices and what are their risk preferences (Klement, 2015). In general, the finance theories have been neglected the part of risk perception comparing to risk preferences (Zeisberger, 2021). Traditional finance uses the concepts of classical decision making, modern portfolio theory, and the capital asset pricing model and they are based on the rationality of the investors, influencing the questionnaires applied for customers. Thus, the practice of using risk questionnaires underestimate the risk aversion of investors (Klement, 2015).

The work continues with a brief comparison between some concepts in the traditional theory and behavioral finance and then introduce the behavioral theory. The book "Behavioral Finance and Wealth Management" from Pompian (2012) was mainly used to defines bias and heuristics for the final analysis with complementary bibliography. A "behavioral questionnaire" was also structure according to this book and applied to investors to look for possible heuristics and biases. The contribution is a practical basis to describe and analyzing responses with the aim of to improving risk profiling instruments for the financial industry.

The investment decision is not only the search of greater satisfaction with the available choices or a simple relationship between risk and return. The perception of risk change over time and change dynamically influencing the risk profile demands (Klement, 2015). Hence this work intends to emphasize the importance of behavioral elements in approaching the risk profile. In order words the main goal is to identify the influence of psychology on the investor's behavior.

This work uses as a tool a "behavioral questionnaire" and it is applied for investors. As mentioned before questionnaires are usually the metric used to analyze the investors' profile and the decision to use behavioral finance is because it can explain anomalies when people invest. This work aggregate

sophistication in the process of identifying issues if used for financial advisors to develop an investment strategy that align client's perspectives. Furthermore, identifying biases and heuristics will turn possible to determine better risk profile and therefore a more efficient asset allocation.

## 2 LITERATURE REVIEW

### 2.1 CONCEPTUAL FRAMEWORK

When we discuss about investments, we are faced with complex decision-making that requires time, proper information, and specific knowledge. We have two types of theories used to describe that phenomenon: the first one is normative theories that describes how people should rationally behave and the second are positive theories that characterizes how people actually behave. We must consider for all the theories the uncertainty environment, limited time, and information in the decision-making process. The traditional financial literature describes the decision-making process in the normative perspective. They developed some theories and assumptions about investors' choice. The literature assumes a rational economic man that strives to maximize his economic well-being. He searches utility-optimizing goals, on the information that he possesses, and on any other postulated constraints. His choices are dictated by his utility function (Pompian, 2012). Utility function is a theory used to describe preferences. Utility is the satisfaction received from a particular outcome and are often defined in relation to wealth. Individuals should act in a particular way when confronted with uncertainty. It is useful in defining risk preferences. People are willing to assume risk if they are compensated for it. For example, when choosing between two stocks with the same expected return, you would invest in the one with the lower risk. If you are going to take on a riskier investment, you will demand a higher return to compensate the risk. That is the trade-off between risk and return (Ackert, 2010).

The investors choices reflect, for traditional finance, hypothesis about efficient markets. An efficient market is where the market price is an unbiased estimate of the true value of the investment. Errors in the market price can be greater than or less than true value if these deviations are random (Damodaran, 2012). In other words, markets are efficient because the asset prices and returns are determined as the outcome of trading between rational informed agents in a competitive market. Investors have access to the same information, and they have equal opportunities for borrowing and lending (Cuthbertson, 2008). Efficient Market Hypothesis has implications for example, when information is reflected in prices immediately, investors should only expect to obtain a normal rate of return. The awareness of information when it is released does not convert in any good for the investor. The price adjusts before the investor has time to trade on it (Hillier, 2021).

According to Andrei Shleifer (2000) we have some foundations of Market Efficiency. The rationality, the independent deviations from rationality and arbitrage. In rationality investors are rational. They adjust their share price value estimative according to the new information. In independent deviations from rationality investors have excessive optimism and, at the other times, extreme pessimism. But even here there is an assumption that will produce efficiency. For arbitrage, the markets would be efficient if the arbitrage for professionals dominates the speculation of amateurs. Arbitrage professionals are methodical and rational. Amateurs tend to carry shares either above or below their efficient prices having the believing of irrationally that an equity is undervalued and at other times thinking the opposite.

The fact of security prices properly reflect whatever information is available to investors are difficult to defend in some instances like bubbles, especially when represented by rational, unbiased assessments of intrinsic value (Bodie, 2021). People usually follow a more subjective path of

reasoning to determine a course of action consistent with their desired outcome or general preferences. Individuals usually make decisions simplify the choices using a subset of the available information and discarding some alternatives to get down a more manageable number. Too much information is difficult to deal with because people developed heuristics to come up with reasonable decisions. Heuristics is a decision rule that utilizes a subset of the information set and they are appropriated when a very quick decision must be made. Heuristics can lead to bias. People seem to prefer situations characterized by ease of processing. The result is irrational behaviors and biased decisions (Pompian, 2012).

Those irrational behaviors are better discussed in behavioral finance. This approach is about understanding how people make financial decisions, both individually and collectively and is commonly defined as the application of psychology to finance. This approach is increasingly aware that psychological factors can thwart rational analysis and prevent investors from achieving the best results (Siegel, 2014). Maurice Allais, for example, showed that the theory of maximization of expected utility, which has been accepted for many decades, did not apply to certain empirically realistic decisions under risk and uncertainty. It means that on theories or mathematical models are not enough to explain individual investor and market behavior. It has become more comment with the rupture of the tech-stock bubble in March of 2000, and later with the financial market meltdown of 2008-2009 (Pompian, 2012).

The three conditions discussed above, rationality, independent deviations from rationality and arbitrage are seen in different perspective in behavioral finance. In rationality many investors do not achieve the degree of diversification that they should. Another problem is the excess of trade that generate both commissions and taxes costs. Taxes can be handled optimally by selling losers and holding onto winners. When we talk about independent deviations from rationality psychologists have argue that people deviate from rationality in many different directions. The first is representativeness, that can be explained with draw conclusions from insufficient data. Bubbles, subprime mortgages are the perfect example of representativeness. Another principle is conservatism that means people are too slow in adjusting information. Many studies report that prices seem to adjust slowly to the information contained in earnings announcements. In arbitrage it may involves too much risk to eliminate market efficiencies. If we have amateurs were taking opposite positions, prices will adjust to correct levels only if the positions of amateurs were small relative to the professionals. Arbitrage strategies may involve too much risk to eliminate market efficiencies (Hillier, 2021).

The irrationalities that characterize individuals when they make complicated decisions are interpret as anomalies. Investors do not always process information correctly and therefore infer incorrect probability distributions about future rates of return. If they even give a probability distribution of returns, they often make inconsistent or systematically suboptimal decisions (Bodie, 2021). Below we will see some heuristics and bias developed in behavioral finance as a result of many analyses.

## 2.2 BEHAVIORAL FINANCE

Behavioral finance is considered a positive theory because it describes how people actually behave. The theory has some concepts, and the definitions of them will be used to analyze the investors behave with the responses of the questionnaire. The main discussion is about some bias and heuristic observed in the decision-making process. Irrationalities can lead to heuristics and bias. As discussed before, heuristics is a decision rule that utilizes a subset of the information set. Bias can be defined as systematic errors in judgment. Pompian (2012) separate bias in two different perspectives, cognitive bias, and emotional bias. Cognitive bias can be thought of as issues in the information processing, or memory errors that cause the decision to deviate from rationality. Emotional biases are those that arise spontaneously because of attitudes and feelings and that cause the decision to deviate from the rational decisions of traditional finance. Cognitive biases and emotional biases lead investors to make suboptimal decisions. Although in most part of this paper we use the Pompian's definitions, the two different perspective bias will not be treated separately in the final analysis.

The first concept demonstrated is going to be the Value Function. Widely discussed in Kahneman and Tversky's work (1979), Value Function is basically the risk aversion in gains (positive domain) and risk seeking for losses (negative domain). Looking through the image below, the value function is concave in the positive domain and convex in the negative domain. The decisions are made by focusing on gains and losses, which mean that the argument for the value function is not wealth, but rather changes in wealth; and people dislike losses, so the value function is steeper for losses than for gains. In the Value Function the value is defined by gains and losses relative to a reference point. Investors make decision according to a reference point and this is very important to have a fully comprehension about the decision-making process. The reference point is also represented in the image below.

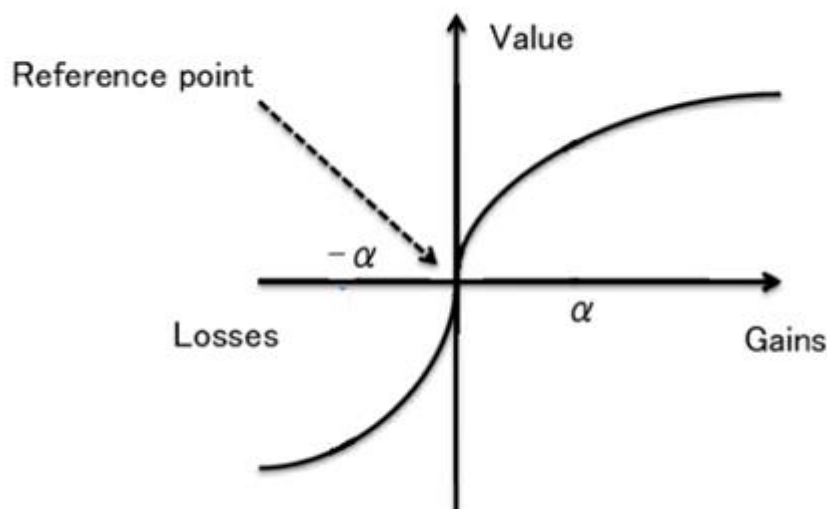


Figure 2-1 Value Function- Developed by the author

For Kahneman and Tversky, risk aversion in the positive domain and risk seeking in the negative domain represent much greater losses than gains. Value function is steeper for losses than for gains, implying that losses are felt more strongly. When the outcome probability is high, we see risk aversion for gains and risk seeking for losses and when the outcome probability is low, we see risk seeking for gains and risk aversion for losses. In the decision-maker process investors choose a reference point, and whether an outcome is perceived as positive or negative will depend on the given reference point. Decision weights are generally lower than the corresponding probabilities, except in the range of low probabilities. Overweighting of low probabilities may contribute to the attractiveness of both insurance and gambling. People apparently overweight certain outcomes versus probable ones (Ackert, 2010).

The discussion will introduce a concept that is widely connected with the Value Function which was discussed above. The first is loss aversion bias and can be defined as the general tendency that people have to avoid losses more than to acquire gains. If we were trying to quantify the possibility of a loss, on average is twice as powerful motivator as the possibility of making a gain of equal magnitude. The reference point illustrated in the Value Function is the “benchmark” for investors to weigh the potential gains and losses (Pompian, 2012),

The literature describes many behaviors such as the willingness of investors to accept risk if they evaluate their investment less frequently to obtain a high return. Another example is the investor who does not accept the unknown risk but accepts the low return with known risk due to his low financial knowledge or high loss averse. To some extent, financial knowledge decreases loss aversion (Khan, 2017). Loss aversion bias tend to instigate the exact opposite of what rational investors are looking for. In some cases, they increased risk with lower returns. In order words, loss aversion causes investors to hold their losing investments and to sell their winning ones in the fear that their profit will disappear. This behavior can cause too much trading and lead to suboptimal portfolio returns (Pompian, 2012).

We proceed with mental accounting bias which is one very common on investors. People have the tendency to categorize and evaluate economic outcomes by grouping their assets into any number of non-fungible mental accounts. In mental accounting bias people tend to imagine that their investments occupy separate accounts (Pompian, 2012). Considering only gains and losses is often referred to as particular form of “narrow framing” (Cuthbertson, 2008). Thinking about financial strategies, people include the trade-offs between consumption today and consumption in the future. Mental accounting in this decision-making process can be influence over the time. Investors draw a distinction between unrealized changes in value, papers with gains and losses and realized changes in value once an investment is sold (Zhang, 2018).

Envisioning distinct accounts to correspond with financial goals, however, can cause investors to neglect positions that offset or correlate across accounts. This can lead to suboptimal aggregate portfolio performance. People use these accounts to make decision-making manageable. Investors assume a risk-taking behavior escalating as wealth grows. They exhibit this rational behave irrationally because the fail to treat all money fungible. (Pompian, 2012). This is known as *house money effect* and refers to gamblers greater willingness to accept new bets if they currently are ahead. After a stock market run-up, individuals may view investments as largely funded out of a “capital gains account”, becoming more tolerant of risk, discounting future cash flows at a lower rate and thus further push up prices (Bodie, 2021).

Another bias tendency is the overconfidence. For some reason people have the tendency to think that they have more knowledge than average. This creates an unrealistic overestimate of their judgments, and cognitive abilities (Ackert, 2010). The past information leads investors to become overconfidence and result in more aggressively trades (Jinnah, 2014). The implication of this behavior is that investors may underestimate the downside risks to their portfolios and have emotionally charged behavior, such as excessive risk taking. They do not give the deserved attention that the negative information might have, and it maybe be an indication of warning sign. They become blind to any negative information that either a stock purchase should not take place or that was already purchased and should be sold (Pompian, 2012).

Availability bias is mental shortcut in which investors sometimes do not engage in disciplined research to verify if the asset allocation selecting is appropriated. They choose investments based on information given by advertising, friends, and suggestions from advisors. As a result, they do a mental shortcut estimating the probability of an outcome based on how prevalent or familiar that outcome appears in their lives (Pompian, 2012). They easily believe to have a greater likelihood of occurring (Ackert, 2010). The use of familiarity is represented as an unbiased indicator of statistical probability. People tend to use instances or examples that they easily remember in a short time to evaluate the likelihood of an event (Meng, 2017).

In conservatism bias investors can relate to an underlying difficulty in processing new information because they experience mental stress when presented with complex data. They tend to simply stick to a prior belief, as a result they fail to react as rational people. In this mental process individuals cling to their prior views or forecasts at the expense of acknowledging new information (Pompian, 2012). Investors usually holds on the previous affirmative information and neglects the negative information about the same subject. The result is that they take a long time to react to the market (Jain, 2019). Thus, they might initially underreact to news and so that prices will fully reflect new information only gradually. Such a bias would give rise to momentum in stock market returns (Bodie, 2011).

Confirmation bias is defined as an inclination by individuals to retain a currently favored hypothesis throughout their decision process. The framework implies that optimism originates in the hypothesis generation phase of the evaluation process (Legoux, 2014). They tend to spend too much time trying to prove themselves correct rather than searching for information that might prove that they are wrong (Hillier, 2021). Considering investors' decision-making process, that selective perception emphasizes ideas that confirm their beliefs and can cause overconcentration in a company stock. Therefore, investors hold underdiversified portfolios (Pompian, 2012).

In anchoring and adjustment bias people generate an initial guess called anchor, then they adjust their estimate away from this anchor to incorporate additional information, but the adjustment is generally insufficient (Lieder, 2018). The bias is a lack of cognitive effort and cognitive laziness (Ackert, 2010). Considering investors, they are influenced by intuit probabilities. It implies that investors perceive the new information through arbitrary "purchase points" when they have question like "Should I buy or sell this security?". They perceive the new information through a warped approach (Pompian, 2012). A practical example is a stock with unknown expected returns, in

which the investor might anchor this expected return on the S&P 500 and then make an adjustment for risk or for industry (Elton, 2014).

In framing bias, the preferences change as a function of some variation in framing. People answers questions differently based on the way in which it is framed (Sachan, 2021). For investors in the decisions-making process is also seen to be affected by how choices are structured (Bodie, 2021). It happens because the decision maker adoptions are controlled partly by the formulation of the problem and partly by the norms, habits, and personal characteristics. Thus, decision makers have the tendency to respond differently to various situations based on the context presented. Investors have a subjective conception about outcomes associates with a particular choice. Questions can be answered differently depending on how questions are asked including when is about risk tolerance. Questions that are worded in the “gain” frame, a risk-averse response is more likely. When questions are worded in the “loss” frame, risk-seeking behavior is the likely response (Pompian, 2012).

For example, an individual may reject a bet when it is posed in terms of the risk surrounding possible gains but may accept that same bet when described in terms of the risk surrounding potential losses (Bodie, 2021). Optimistically worked questions are more likely to garner affirmative responses, and optimistically worded answer choices are more likely to be selected than pessimistically phrased alternatives. Framing bias can explain excessive risk aversion and how investors who has incurred a net loss becomes likelier to select a riskier investment (Ackert, 2010). In many cases, the choice of how to frame a risky venture as involving gains or losses can be arbitrary (Bodie, 2021).

Investors can prefer to do nothing with the securities that they have. They keep things to stay relatively the same. The tendency is better seen in investors with inherited, concentrated stock positions often exhibit classic status quo bias (Pompian, 2012). Many economics and psychology experiments have found status quo and it has a significant impact on choices (Kovach, 2018). The lack of action tends to hold investments inappropriate to their own risk/return profile. In other words, investors can take excessive risks or invest too conservatively. We associate status quo bias with loss aversion bias. The combination of transaction cost and securities which they are familiar with can make investors to just hold them (Pompian, 2012). The result is that can compromise financial goals because a subjective comfort level with a security may not justify holding onto its poor performance (Bodie, 2011).

Endowment bias refers to the tendency of those who receive a good to value it more than they would otherwise. Typically, this bias is captured by loss aversion models, where preferences depend on a reference point and which losses hurt more than gains (Landry, 2016). The rational economic man, in theory, should have the same willingness to pay for the securities as the willingness to accept compensation for it. This is not the case, for example, for inherited securities, in which investors do not want to incur the transaction costs associated with selling the securities. However, these costs can be not exactly a real issue in the decision in selling the securities. Depending on the situation, the decision to not sell can result in a negative and non-calculated outcome (Pompian, 2012). The bias can be associated with the desire for familiarity. Familiarity is crucial for investors who are looking for comfort. It may not be wise to take a portfolio in any direction with which the client seems uncomfortable (Ackert, 2010).

The regret aversion bias is identified in two aspects of the decision-making process. The first one is the error of commission. The investor experienced a loss and regrets his decision in investing in that



security. The second is the error of omission and is when an investor missed an opportunity to buy something and later, he regrets when he sees the appreciation in the value of that investment. That bias is defined as the emotional pain associated with negative investment experience and outcomes. For example, is when investors became reluctant to sell a stock whose value has climbed recently because they believe the price will continue the tendency (Pompian, 2012).

People may have regrets when their decisions turn out to be the wrong even if they appeared correct at the time they were made (Dodonova, 2005). Psychologists have found that individuals who make decisions that turn out badly blame themselves more when that decision was more unconventional (Bodie, 2021). For example, investors that buy a blue-chip portfolio that turns down do not feel so painful as experiencing the same losses on an unknown start-up firm. Losses on the blue-chips stocks can be more attributed to bad luck rather than bad decision causing less regret (Bodie, 2011).

The last concept is affinity bias, and it happens when investors decide to concentrate their holdings in their home country and lose the benefits of high returns and low risk in investing elsewhere. This is the tendency to invest only in stocks of local companies for example (Elton, 2014). For the rational approach the main objective is to earn money and seek for the best opportunities available. The decision in not investing in stocks from other countries just because of a discrimination in favor of domestic stocks is not rational (Pompian, 2012). Financial research has been aware and critical of that tendency on investors. They over-weight domestic stocks in their portfolio (Elton, 2014).

Another example is when investors decide to invest in companies that reflect their environmental, social, or governance values. Those criterium may not be the best investment strategy and do not reflect the profitability purpose. Affinity bias is also seen in investors that search sophisticated investment products just to give some "status". The problem is when they do not understand exactly about the products that they are investing (Pompian, 2012).

This work will use these concepts as a tool to interpret the investors' responses via questionnaire and explain how they make decisions according to the proposed situation. As mentioned earlier, traditional theories assume that all investors act in a prescribed manner, and in line with this assumption some general equilibrium models have been constructed to determine the relevant measure of risk and guide "optimal portfolios". For the purposes of this work, behavioral theory is considered more significant to provide adequate support to identify biases and heuristics giving worth to risk profile assessment. Moreover, investment firms and advisors can be better supported in identifying and introducing a more accurate foundation for their advice.

### 3 METHODOLOGY AND DATA COLLECTION

This work is intended for investors in financial instruments namely stock markets investors. The survey is based on a sample of investors through questionnaires. Since the objective is to structure better risk profile questionnaires, we consider appropriate applying it directly to the sample. The search for the sample basically took place through social media, in investment groups and related.

The first two questions of the questionnaire are about the characteristics of the sample: age and education level. Then investors specified what is the current investment horizon (short/intermediate/long term) and investment strategy (capital at risk/ income motivated). As the research is aimed at investors, there was no great concern to explain in detail what would be “current investment horizon” and “investment strategies”. We assume that they are familiarized with the concepts.

The next questions are directly related to behavioral finance. We presented hypothetical situations and offer some answers that they consider appropriated to their thinking and beliefs. Depend on the answer a behavioral heuristics or bias was identified. A total of 16 questions were asked to approximately 900 investors, with 137 replied to us. The questionnaire was available between December of 2021 until February of 2022. Basically the questionnaire was applied through social media and this was done by looking for contacts of investment groups.

The questionnaire is quite short but very precisely to provide accuracy in the investor’s responses. Long questionnaires could discourage people from answering or answering anything because these questions somehow require a mental effort. Two papers were used as a support for the questionnaire; the first was Pompian (2012) and the second Chaffai (2014). The collected information through questionnaires entered in SPSS software for analysis. Data analysis was performed using descriptive statistics.

## 4 RESULTS

### 4.1 SAMPLE DESCRIPTION

As observed in table 1 the majority of the sample is composed of young investors and almost half of them are between 26 to 35 years old representing 48,18%. If we sum the 26-35 and the 36-50 age group, it will be approximately 70% of the total sample in this age range.

Question 1: Age	%
A. Under 25 years old	16,06%
B. 26-35 years old	48,18%
C. 36-50 years old	21,17%
D. 51-65 years old	10,95%
E. Over 65 years old	3,65%

Table 1- Age group

The next table, table 2 represents the highest degree of the sample. Surprisingly half of the total of the people that answer the questionnaire have master' degree. Considering bachelor' to doctoral degrees, 90,51% of investors have very high education level.

Question 2: Highest degree	%
A. No schooling completed.	0,73%
B. Nursery/Primary school to 9th grade.	0,73%
C. Some high school, no diploma.	0,73%
D. High school graduate, diploma or equivalent.	5,11%
E. Trade/technical/vocational training.	2,19%
F. Bachelor's degree.	32,12%
G. Master's degree.	50,36%
H. Doctorate degree.	8,03%

Table 2- Highest degree

Table 3 and table 4 represents the investors' preferences. Most part of the sample intends to invest focus on the long-term and accepting risk. These 2 questions are very important for this work because it gives a direction on how investors can answer the behavioral questions. If investors are long-term and accepting risk, they tend to respond differently compared to short-term investors.

Question 3: Investment horizon	%
A. Short-term	18,25%
B. Medium-term	37,23%
C. Long- term	44,23%

Table 3- Question 3

Question 4: Value most when making investment decisions	%
A. Building wealth by accepting risk (capital at risk).	60,58%
B. Income motivated	39,42%

Table- 4 Question 4

## 4.2. BEHAVIORAL QUESTIONS

The next tables are designed to detect signs of cognitive bias. The original and complete questions and answers are in the annex. Table 5 is related to conservatism bias. People that answer B or C tend to have conservatism bias. According to Pompian (2012), this happens because people have the difficulty in processing new information and the mental stress when presented with new facts. The conclusion is that most part of the sample about 95,62% have conservative bias.

Question 5: Bad news affects the price of the stock	%
A. I will sell immediately without confirming	4,38%
B. I will ignore the information.	54,74%
C. I will keep it because I have already made the investment.	40,88%

Table 5- Question 5

Table 6 is related to confirmation bias. People who answer B do not have confirmation bias and almost 60% of the total decided to evaluate the new changes in the price even after they made careful research. Confirmation bias was not detected in this case.

Question 6: New CEO and the share price gone up	%
A. I do nothing.	32,85%
B. I will do some research to try to understand.	58,39%
C. Have some concern, but I keep the investment.	8,76%

Table 6- Question 6

Table 7 search overconfidence bias. Investors that answer A tend to overconfidence bias and they are 36,50% of the responses. In this question investors did not create an unrealistic overestimate of their judgements, and cognitive abilities as defined Ackert (2010). They do not think that they have more knowledge than average.

Question 7: Return stock market and your portfolio	%
A. I believe my portfolio will outperform the market.	36,50%
B. I believe my portfolio will perform just like the market.	54,74%
C. I believe my portfolio will underperform the market.	8,76%

Table 7- Question 7

Table 8 are about mental accounting bias. The questions refer to the *house money effect* when gamblers greater willingness to accept new bets if they currently are ahead as Bodie (2021) mentioned. The detection of this bias will be only possible if the most part of the sample answers

would be A in both questions. In both cases B was the preference. The great number of investors did not have mental accounting bias.

Question 8- Part A	%
A. Yes	39,42%
B. No	60,58%

Question 8- Part B	%
A. Yes	48,18%
B. No	51,82%

Table 8- Question 8- Part A and B

Table 9 represents framing bias. People who answer the second question differently from the first are likely subject to framing bias. According to Sachan, (2021), questions can be answered differently depending on how questions are asked. Question 9- part A and B are the same but framed in different ways. Framing bias was not seem in these sample.

Question 9- Part A	%
A. Buy more	74,45%
B. Sell	25,55%

Question 9- Part B	%
A. Buy more	72,26%
B. Sell	27,74%

Table 9- Question 9- Part A and B

Table 10 is availability bias. Availability bias as said Pompian (2012), is a mental shortcut in which investors sometimes do not engage in disciplined research to verify if the asset allocation selecting is appropriated. For those who answer A are likely to be susceptible to availability bias. This cognitive bias was not detected.

Question 10: Friend buy stocks. What do you do?	%
A- I buy the stocks because the advice of my friend.	37,23%
B- I prefer to make my decisions based on my research.	62,77%

Table 10- Question 10

Table 11 is loss aversion bias. According to Khan (2017), loss aversion bias causes investors to hold their losing investments and to sell their winning ones in the fear that their profit will disappear. Letter A is loss aversion bias and in this example this tendency is not observable.

Question 11: Stock 15% gain and the second a 7% loss.	%
A. I sell the first and hold the second.	21,90%
B. I sell both.	8,76%
C. I do not sell any of them.	56,20%
D. I hold the first (despite the 15% gain) and sell the second.	13,14%

Table 11- Question 11

Table 12 is status quo bias. For Kovach (2018), in this bias investor can prefer to do nothing with the securities that they have. The tendency is better seen in investors with inherited as asked in the question 12. Answer B and C are status quo bias, and they represent 61,32% of the responses.

Question 12: You inherited stocks. Have to pay some capital gain tax and fees.	%
A. I sell, as recommended by my financial advisor.	38,69%
B. I do not sell.	18,25%
C. I do not know and need to think more about it.	43,07%

Table 12- Question 12

Table 13 is endowment bias. For Ackert (2010), this bias can be associated with the desire for familiarity. Some investors are looking for comfort. Answer A is endowment bias, and they are 65,59% of the responses.

Question 13: Sell stocks on NYSE and buying on London Exchange.	%
A. I do not sell, because I prefer to invest in markets that I know well.	65,69%
B. I sell some stocks and try different investment opportunities.	34,31%

Table 13- Question 13

Table 14 is regret aversion bias. Pompian (2012) argument that this bias happens when investors became reluctant in sell a stock whose value has climbed recently because they believe the price will continue the tendency. Regret aversion bias was widely seen with 85,40% of the answers in A.

Question 14: Price increases by 15%. Bank announced a buy recommendation.	%
A. I believe the stock will rise even more after the announcement. Sell later.	85,40%
B. I sell the stock regardless of the recommendation.	14,60%

Table 14- Question 14

Table 15 is question 15 and table 16 is question 16 and represents affinity bias. For Elton (2014), when investors decide to invest in companies that reflect their environmental, social, or governance values they have this bias. Question 15 answer A is affinity bias and question 16 answer A and B are also affinity bias. In both questions the number get close to the answer "indifferent". Any relevant conclusion of this bias cannot be made.

Question 15: Investment reflects social and governance values.	%
A. Yes.	38,69%
B. No.	18,25%
C. I am indifferent.	43,07%

Table 15- Question 15

Question 16: Prefer to invest in?	%
A. Popular and big companies	37,96%
B. State-owned companies	4,38%
C. Less popular and smaller companies	13,87%
D. Indifferent	43,80%

Table 16- Question 16

In these questions the goal was to apply a questionnaire with eleven possible biases to be identified. Although may part of them have not been seen, four have been verified. These biases are conservative bias, status quo bias, endowment bias and regret aversion bias. There are some assumptions that are possible to check between them.

## 5 DISCUSSION

The investor's responses lead this study to some discussions. As mentioned earlier most part of the participants are young adults between 26-35 years old and they value most building wealth by accepting risk and have long-term investment horizon. It was verified a considerable education level between the participants which is something that may influences the answers. Khan (2017) mentioned that financial knowledge, in some extent, decreases some types of bias. The results reflect this approach. The search of the sample was through social media in investment groups thereby the knowledge made the difference in the answers of the questionnaire.

Basically, four cognitive biases were verified: conservative bias, status quo bias, endowment bias and regret aversion bias. In conservative bias test people answer to not react to the news and to the recent movements in the stock price. Pompian (2012) explains that in this process individuals cling to their prior views or forecasts at the expense of acknowledging new information. Another bias verified in the analysis was status quo bias. The definition is close to conservative bias which is the lack of action that result according to Bodie (2011), holding onto poor portfolio performance. Neither the recommendation of the financial adviser was enough to influence the investors ' decision.

In endowment bias some authors like Landry (2016) says that this bias is captured by loss aversion models. This resembles the Value Function demonstrating risk aversion in gains and risk seeking for losses. Again it is possible to verify the relation between these biases. Ackert (2010) says that in the decision-maker process investors choose a reference point, and whether an outcome is perceived as positive or negative will depend on the given reference point. In the question people decided to invest in markets that they know more despite of another profitable opportunities. This is totally against the traditional financial literature that assumes a rational economic man that strives to maximize his economic well-being as Pompian (2012) explained.

The last bias is regret aversion bias. Pompian defined this bias as the emotional pain associated with negative investment experience and outcomes. People decided to hold the shares thinking about the possibility of continuing the trend and believing in the purchasing recommendation of the biggest investment bank as it was mentioned in the question 10. Dodonova (2005) argument that people may have regrets when their decisions turn out to be the wrong even if they appeared correct at the time they were made. The question lead people to believe that the recommendation is the best choice at the moment. Bodie (2021) emphasizes the studies of psychologists that have found individuals who make decisions that turn out badly blame themselves more when that decision was more unconventional. In the subjective point of view these biases have a strong connection. The concepts between these biases are very close and they suit investors psychological preferences in this paper.



## 6 CONCLUSIONS

The main goal of this work is to identify the influence of psychology on the investor's behavior. First the traditional theories were described to revealing what the financial literature has to say about the preferences of investors. In the discussion the theories assume the rationality of the investors and analyze the risk preferences based on concepts of classical decision-making process. In this work the believes is that these theories underestimate the risk aversion and preferences of investors.

For that reason, the work chooses the behavioral finance to explain and describe the decision-making process. The psychologic factors influence the investors behavior leading to irrationalities. Irrationalities in the behavioral finance can lead to heuristics and bias. The theory describes some heuristics and bias and this work treated some of them and applied these concepts in the questionnaire.

A structured questionnaire was applied with 11 cognitive biases in each question. These biases are conservatism bias, confirmation bias, overconfidence bias, mental accounting bias, framing bias, availability bias, loss aversion bias, status quo bias, endowment bias, regret aversion bias and affinity bias. The sample was quite significative around 137 responses all through social media. The questionnaire was available for three months. It was available between December of 2021 until February of 2022.

The first characteristic is the presence of young adults and a high education level. Although the level of education of the sample 90,51% (bachelor and more) the conclusion is that they are subject to behavioral biases. It was identified the presence of 4 behavioral biases. There are: status quo bias, conservative bias, endowment bias, and regret aversion bias. The definition of them are close emphasizing characteristics like the tendency to do not react on challenging situations, search for comfort and familiarity even though it may represent loss of profitability. The emotional pain associated with negative investment experience and outcomes is also perceive in the final analysis.

This means that regardless the level of education and knowledge, the factor of risk aversion is imminent in the daily life of the most qualified investors. The Value Function, discussed in the beginning is the most important concept for the conclusion of this work. It is valid that people are risk aversion in gains and tend to be risk seeking for losses. They analyze the investment according to changes in wealth. Additionally, they look for comfort and try to avoid information that they do not consider important.

These biases can explain anomalies when people invest. This work can give a proper direction for the wealth management industry. With the questionnaire financial advisors can develop an investment strategy that align with the client's perspectives, and they can anticipate some bad decisions based on the bias detected according to the answers. As a result, it is going to be possible to determine better risk profile and consequently more efficiency in the asset allocation process.

## 7 LIMITATIONS AND RECOMMENDATIONS FOR FUTURE WORKS

Considering the high education level of the sample it may not represent the reality. It is difficult to believe that most part of investors have high education. Another study is needed to identify the real education level of stock exchange investors. It may consist in developing a study in some specific market and collect official data provided for the local stock exchange. With this data set the questionnaire could have more precision in the result. Furthermore, the non-specific market or non-specific stock exchange in this work made unfeasible the use of tools to measure the degree of dispersion of the sample because in this case, it did not make sense to use them.

The survey was carried out via LinkedIn, and the sample came from different countries. Some questions treat the local market as the US market, and this can cause distortions in the conception depending on who is answering. The results could underestimate the real effort and goal to achieve better analysis. In other words, the wide range of the sample may not be the best option for identifying biases depending on which biases are involved and how it was discussed.

This work uses as a tool the application of a questionnaire. In real life we are all influence for many factors like the pression to not lose money. In the case of answering a questionnaire this pression is not real and people could response differently. If financial companies start to apply these kinds of questionnaires it could be possible to verify the effectiveness of them. The companies will have the opportunity to check if the customers answers are in accordance with investing in real market.

Another limitation of this work is to identify some bias and heuristics because some definitions are similar. Some questions can be interpreted in different ways, and we can see two or more bias in the same question because the concept of them is very close. For future works the suggestions are the many ways to use the data. If certain biases are close, there are the possibility to statistically analyze the correlation between them and the degree of this correlation. Although many studies are trying to find patterns, when we talk about investors the subjective factor is something that need to be highly considered.

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## 9 ANNEXES

### Questionnaire

This questionnaire is part of the research work leading to a master's degree at Nova Information Management School. The questions are designed to detect signs of behavioral bias when making investment decisions. To complete the questionnaire, please select the option that best characterizes your opinion. There is no 'right' or 'wrong' answer. Your answers will be anonymous and confidential. The questionnaire has 16 questions and takes about 15 minutes to answer.

I really appreciate your help.

Please answer the following questions:

Question 1: What is your age?

- A. Under 25 years old.
- B. Between 26-35 years old.
- C. Between 36-50 years old.
- D. Between 51-65 years old.
- E. Over 65 years old.

Question 2: What is the highest degree or level of school you have completed? (If currently enrolled, highest degree received.)

- A. No schooling completed.
- B. Nursery/Primary school to 9th grade.
- C. Some high school, no diploma.
- D. High school graduate, diploma or equivalent.
- E. Trade/technical/vocational training.
- F. Bachelor's degree.
- G. Master's degree.
- H. Doctorate degree.

Question 3: What is your current investment horizon?

- A. Short-term
- B. Medium-term
- C. Long-term

Question 4: What do you value most when making investment decisions?

- A. Building wealth by accepting risk (capital at risk).
- B. Building wealth, albeit smaller, without accepting risk (income motivated).



Question 5: Suppose that you have just received some bad news that potentially affects the price of the stock that you had bought. What do you do?

- A. I will sell immediately without confirming whether the information is correct or not.
- B. I will ignore the information. I analyzed the company and I believe that short-run movement prices and some bad news do not affect the real value of the company.
- C. Although I can re-evaluate the stock, I will keep it because I have already made the investment.

Question 6: Imagine that you bought a stock after doing extensive research and believe the company will growth. This morning you saw that the company has a new CEO and the share price has just gone up. What do you do?

- A. I do nothing. I am glad for the new share price, which confirms my view on the company's prospects.
- B. I will do some research to try to understand the relationship between the new price and the change in the company's board.
- C. I receive the announcement with some concern, but I keep the investment.

Question 7: How do you compare the rates of return of the stock market and of your portfolio?

- A. I believe my portfolio will outperform the market.
- B. I believe my portfolio will perform just like the market.
- C. I believe my portfolio will underperform the market.

Question 8- Part A: Imagine that you want to buy some Apple stocks and they cost 146 USD. Your broker told you that the company would make an announcement at the end of the day and the price would considerably increase. In the meantime, the price has risen to 176 USD and your chance to buy the stocks is almost gone. Will you buy the stock?

- A. Yes
- B. No

Question 8- Part B: Imagine that you bought some Apple stocks and now they cost 176 USD. Your broker told you that the price would continue to increase. In the meantime, the price

has risen to 180 USD and your chance to buy the stocks is almost gone. Will you buy the stock?

- A. Yes
- B. No

Question 9- Part A: Your stock rose 2.5% over the day. However, it dropped 1% at the close of the market. What do you do?

- A- Buy more
- B- Sell

Question 9- Part B: Your stock dropped 2.5% over the day. However, it rose 1% at the close of market. What do you do?

- A- Buy more
- B- Sell

Question 10: Imagine that you want to buy a stock and you know that a friend of yours, who has been investing for many years, is going to buy stocks of company X. What do you do?

- A- I buy the stocks because the advice of someone with investment experience is very relevant to me.
- B- I prefer to make my decisions based on my research and not on suggestions.

Question 11: Imagine you bought 2 different stocks. The first gives a 15% gain and the second a 7% loss. Which scenario would you rather have?

- A. I sell the first and hold the second.
- B. I sell both.
- C. I do not sell any of them.
- D. I hold the first (despite the 15% gain) and sell the second.

Question 12: Imagine that you inherited some stocks. Your financial advisor recommends selling some stocks and buying others to diversify your portfolio. You know that if you do this, you will have to pay some capital gain tax and fees. What do you do?

- A. I sell, as recommended by my financial advisor.
- B. I do not sell.
- C. I do not know and need to think more about it.

Question 13: Suppose that you bought some stocks on the New York Stock Exchange (NYSE). Your financial advisor recommends selling some stocks on the NYSE and buying others on

the London Stock Exchange. He explains that the returns are worth the risks, but you do not know that market. What do you do?

- A. I do not sell, because I prefer to invest in markets that I know well.
- B. I sell some stocks and try different investment opportunities.

Question 14: Suppose you make an investment and buy stock X. Over the next 2 months, the price increases by 15%. Additionally, the largest investment bank has just announced a buy recommendation. What do you do?

- A. I believe the stock will rise even more after the announcement. So, I hold it and will sell it later.
- B. I sell the stock regardless of the recommendation.

Question 15: Your investment strategy is based on a search for profit and a good portfolio selection. Additionally, the companies in which you invest need to reflect certain social and governance values. Do you agree with the statement?

- A. Yes.
- B. No.
- C. I am indifferent.

Question 16: What kind of companies do you prefer to invest in?

- A. Popular and big companies
- B. State-owned companies
- C. Less popular and smaller companies
- D. Indifferent

**Thank you! Your help is greatly appreciated!**

