A Study on Choices and the Profile of the Brazilian Investor in the Decision-Making Process

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Abstract

The objective of this work was to show, through Prospect Theory (PT), a broader approach to finance and economics, which includes concepts of psychology and sociology, how agents, and particularly investors, are susceptible to deviations from rationality that directly impact their choices, making their decisions not always by the pillars that support classical theories of finance. The research was 382 Brazilian investors. Through the questionnaire, it is observed how much a behavioral effect dramatically influences the choices of economic agents who are mostly men and ill-prepared academically. One of the important verifications found evaluating the answers of the 382 interviewees was about the investors' reaction; in case of a loss, we have that the interviewees prefer probable losses to the detriment of certain losses, even if smaller, and this fact helps to eliminate any explanation that can be given to the certainty effect in the sense that the aversion to volatility. More than 68% when answering some of the questions violated the precepts of the Expected Utility Theory. People opted for the answer with a positive and more significant standard deviation, demonstrating that they are not risk averse. When the certainty of the result increases, the choice for assets with smaller standard deviation increases; in this case, we have evidence of a reduction in risk aversion.

Keywords: behavioral finance, classic finance, utility, rationality, prospect theory

1. Introduction

In life in general, at all times, we are faced with situations that involve selections and decision-making. When these "choices" are related to finances, several aspects influence the decision, and even being aware of not acting rationally in the making. Decisions, always opting for the best alternative among all those that appear to be viable. This is how traditional models describe how the individual behaves in decision-making in the face of risk situations. Furthermore, when they make judgments, we are susceptible to inputs that, in many cases, do not have an idea of where they come from and how they influence their perception of things and our way of acting.

The fact is that investors (agents) can act inconsistently, making systematic errors, even in situations they are used to and on matters they believe are under their control.

The way of evaluating and choosing a particular stock of a company (in the case of investors) is not only in the market sense through abnormal movements and impact on the wealth of investors, but it can culminate in a problem of destroying the value of companies, jobs, given that for a capital market company not to perish, it depends on investor validation.

The present study was based on quantitative research to investigate whether or not there is an asymmetry between gains and losses. For this, the behavior of preferences and choices was analyzed in the evaluation of decision-making by investors, considering a period of significant economic and political instability in the country and the world.

The general objective of the research seeks to address essential concepts of Behavioral Finance, Prospect Theory and to investigate the behavior of preferences and choices in the decision-making of individual investors in Brazil.

Prospect Theory was used for the investigation to evaluate the respondents' decision-making through a questionnaire.

Prospect Theory begins to be built under the so-called "certainty effect," which attributes more significant weight to certain events at the expense of probable events, even with the possibility of making quick calculations on the expected utility of each option. The certainty effect is also shown in non-monetary matters. The Prospect Theory is one of the bases of Behavioral Finance and models investor behavior differently than von Neumann and Morgenstern's Utility Theory. Behavioral characteristics are evaluated for different control groups, validating the violation of Utility Theory Axioms (Ribeiro, 2010).

Behavioral finance is the study through which investors interpret and act on information to decide on investments. It is also considered to be *open-minded* finance, as it is believed that agents do not act all the time rationally. According to Oliveira e Krauter (2015), behavioral finance aims to build a more detailed model of human behavior in financial markets, based basically on the idea that human agents are subject to biases that often distance them from a focused decision on rationality.

The important point is that the Prospect Theory details how individuals behave in the face of risk, describing investor behavior, and suggests that depending on the probability associated with the outcome of the event, the same agents can be prone or averse to risk. . This article investigated the behavior of preferences and choices in decision-making by individual investors in Brazil through the application of a questionnaire. The analysis was limited to individual investors in Brazil through an applied questionnaire (collection between the years 2019 and 2020).

The questionnaire used probability theory and concepts common to economics, finance, psychology, and sociology. the present paper attempted to test the decisions of agents and investors and how they might be exposed to deviations from rationality that directly affect their choices. Although the respondents are mostly individuals and investors who are academically well-equipped, the study notes that their behavior significantly impacts economic agents' choices.

This article is divided into four sections. The first session was used to introduce the theme and main objectives of the research. The second contains the theoretical framework and the methodologies adopted; the third analyzes the questionnaire applied to investors residing in Brazil from 2019 to 2020 and, finally, the conclusions.

2. Theoretical Reference

The Method section describes in detail how the study was conducted, including conceptual and operational definitions of the variables used in the study, Different types of studies will rely on different methodologies; however, a complete description of the methods used enables the reader to evaluate the appropriateness of your methods and the reliability and the validity of your results, It also permits experienced investigators to replicate the study, If your manuscript is an update of an ongoing or earlier study and the method has been published in detail elsewhere, you may refer the reader to that source and give a brief synopsis of the method in this section.

Regarding Behavioural Finance, it is believed that information is not available to everyone (information asymmetry) and that it has a cost, which may be through acquisition or research, and may have conflicting interpretations. In any market segment, correct decisions are made based on minimal information but information that is highly relevant to the decision being taken (MOSCA, Aquiles 2009).

A highlight is that even having several definitions or typifications of Behavioural Finance, there is a certain similarity between them. From the application developed by Kahneman and Tversky (1979), it was identified that the adequate decision of individuals is often not consistent with the decision expected from the theoretical model of maximization of expected utility.

In financial decisions (in the case of investment), there is a divergent discussion between modern finance theory and behavioral finance (Walter *et al.,* 2010) on the behavior and rationality of the individual as an economic agent. In this case, there is no formula or method for the perfect decision. Since the way the individual behaves and perceives the world around him impacts the quality of his choices, agents must be well-prepared to perform their role in the exposed situations.

In their work, Rosales-Perez *et al.* (2021) analyze financial behavior. They indicate that emotional factors assessed by tests such as emotional intelligence and personality traits influence bias in economic decision-making. In the study, university students and individuals from the financial sector were examined, and the result was that several students showed deficits associated with empathy, and emotion regulation, among others. This deficit can increase the spread of biases such as risk tolerance, optimism, and loss aversion.

In this sense, this article was developed in the light of behavioral finance Prospect theory analyses how cognitive biases interfere with the economic agent's decisions and often have limited rationality. Behavioral finance is a recent area of finance based on prospect theory, which aims to explain irrational investor decisions caused by emotional factors that modern finance theory cannot resolve.

Kahneman and Tversky's (1979) Prospect Theory is based on psychological phenomena that motivate assumptions about how people react to gains and losses and how they weigh outcomes with probabilities.

In the area of Behavioral Finance (FC), one of the most relevant research was the work published by Kahneman and Tversky entitled "Prospect theory: An analysis of decision under risk" in 1979. The article in question presents the behavioral results of 16 problems. Of choice is designed to demonstrate how human decision-making, under risk, violates the Expected Utility Theory (EU) assumptions. The researchers point out that psychological phenomena were, in turn, used to motivate decisions in the form of nonlinear reactions to value and probability and differential reactions to gains and losses of equal magnitude.

The rationality of risk-taking decision-making is a central concern in psychology and other behavioral sciences. In real life, information relevant to a decision usually arrives sequentially or changes over time, implying non-trivial demands on memory. (Millroth *et. al.* 2019)

Given the Theory above, it is proposed that decision-makers become risk averse in choices involving the probability of safe gains and risk takers when the exact possibilities present themselves in potential losses. The risk aversion tendency of increases (Domain of Gains), combined with the propensity to the risk of losses (Domain of Losses), is called the reflection effect and demonstrates an asymmetry in the way decisions are made involving possibilities of gains or losses. According to the theory in question, agents estimate the lower weight of probable results than those obtained with certainty. This trend was defined as the certainty effect.

The critical point is that Prospect Theory details how individuals behave in the face of risk, describing investor behavior, and suggests that depending on the probability associated with the event's outcome, the same agents may be risk-prone or risk-averse. To better exemplify this theory and the behavior of individuals, tests from Bernoulli's theory are used, tables 1 and 2 (the basis of modern expected utility theory). According to Bernoulli, the moral value involved in a choice containing risks is not necessarily equal to the expected mathematical value, disregarding personal variables such as wealth and scarcity.

Table 1. Bernoulli's Theory - Problem 1

Problem 1: What do you prefer?	Get nine hundred dollars or a 90% chance of getting $1,000.

Source: Own elaboration based on Bernoulli's theory.

Table 2. Bernoulli's Theory - Problem 2

Problem 2: What do you prefer?	Lose nine hundred dollars or a 90% chance of losing $1,000.

Source: Own elaboration based on Bernoulli's theory.

According to Bernoulli's theory, the choices in the two proposed situations should be similar since the expected values in the two options in each problem are equivalent. In the study, most of the people interviewed who participated in the experiment were risk averse in Problem 1, Table 3. The subjective value of a gain of $900 is more than 90% of an increase of $1,000. The risk-averse choice in this problem would not have surprised Bernoulli.

In Problem 2, most people opted for the gamble: risk exposure. The explanation for this choice to pursue risk is that specific loss is very aversive, which drives people to take the risk. (KAHNEMAN, 2012).

Table 3. Bernoulli Theory Tests - Problem 1

Problem 1	The expected value is a gain of $ 900 dollars (VE: 100% x $900 = $900 or VE: 90% x $1,000 + 10% x $0 = $900).

Source: Own elaboration based on Bernoulli's theory.

However, the two problems are identical in wealth variation, but the way they are formulated (gain/loss) generates a discrepancy between the two results. In Problem 2 (in the face of loss), in table 4, individuals take risks, so they do not have to make the loss, risking a loss of more excellent value. In Problem 1 (in the face of gain), people are risk averse given a particular payment, preferring not to risk a more significant improvement.

Table 4. Bernoulli's Theory - Problem 2

Problem 2	The expected value is a loss of 900 dollars (VE: 100% x - $900 = - $900 or VE: 90% x - $1,000 + 10% x $0 = - $900).

Source: Own elaboration based on Bernoulli's theory.

The experiments suggest a weakness of the Bernoulli model regarding the evaluation of losses and gains. In Bernoulli's theory, you only need to know the state of wealth to determine its utility, but in Prospect Theory, you also need to see the reference point (KAHNEMAN, 2012). Therefore, in Utility Theory, it is enough to know the change in the current state of wealth to measure its utility.

The investor is rational and evaluates the risk according to the change he can provide in his final level of wealth without considering behavioral biases. The addition of a monetary unit adds a smaller team of value than previously received (decreasing marginal utility of wealth), as illustrated in Figure 1:
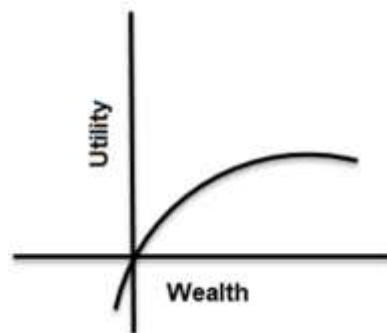

Figure 1. Utility Function according to Bernoulli

Source: Kahneman and Tversky (1979)

In the Quick and Slow Book: Two Ways of Thinking, Kahneman (2012) details the three fundamental characteristics of prospectus theory:

The valuation is relative to a neutral reference point: the usual reference point for financial results is the status quo or another one you want to establish. Results above this reference point are earned. Below the reference point are losses.

I)   Principle of decreasing sensitivity applies to both sensory dimensions and assessments of wealth change. Turning on a dim light produces a strong effect in a dark environment. Similarly, the subjective difference between nine hundred and a thousand dollars is much smaller than the difference between one hundred and two hundred dollars.

II)   Aversion to loss: Tversky and Kahneman (2012) estimated that the loss of a currency unit generates heartbreak that can only be offset by the gain two times higher. Loss aversion is based on the finding that pain from loss is greater than the pleasure obtained by an equivalent increase.

A natural unfolding of loss aversion is that people tend to retain losing assets in the investment portfolio and quickly undo those assets that bring positive returns. This is an asymmetric behavior called the disposition effect (MOSCA, 2009).

The three principles that govern the value of the results are evidenced by Graph 2, which should be analyzed in two distinct parts, to the right and the left, of a neutral reference point. A prominent feature is that an S-shape represents decreasing sensitivity for both gains and losses. It is also important to note that the two Curves of the S are not symmetrical. The tilt of the function changes at the neutral reference point. (KAHNEMAN, 2012). Contrary to the utility theory, where the investor assesses the risk of an investment according to the change it provides in its level of wealth, Tversky and Kahneman (1979) suggest a new risk-utility curve that includes psychological factors.

This new curve presented in Figure 2 has a concave shape for gains and convex for losses, taking the form of an S, representing that investors feel more the pain of loss than the pleasure of gain.
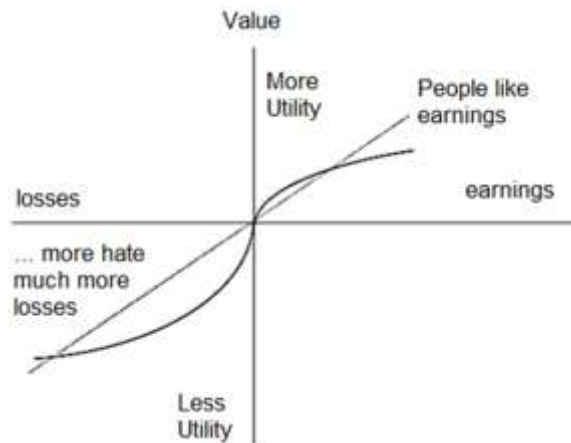
Figure 2. Prospectus Theory Value Function

Source: Adapted from Kahneman and Tversky (1979)

The Prospectus Theory is an example of a descriptive model (having the main objective of understanding the real behavior of those who make the decisions), as discussed by Sobreira (2007) in the following items:

I)   Gains and losses are assessed against variations and not at a particular level of wealth.

II)   The results are expressed about the neutral point of reference and are described in terms of gains when they exceed this point and losses when they are less than this point; the choices are governed by an "S"-shaped value function, concave (risk aversion) in the "Gain Domain" and convex (risk propensity) in the "Loss Domain."

III) The feeling associated with losing a given value is greater than gaining that same value. There is a tendency to overvalue events of little probability.

For Bernoulli and all the others who came after him and based their theories on the idea of utility, what provides utility is the "state of wealth," regardless of how the agents got to him, that is, utilities generated by movements of gains and losses are computed comparing the two states of wealth – the one from which the agent left and what is in the end. In this context, since what is analyzed is the usefulness provided by the state of wealth, gains and losses have the same impact on the individual, being impossible "[...] represent the fact that the "uselessness" of losing five hundred dollars could be greater than the usefulness of earning the same amount – though, of course, it is." (KAHNEMAN, 2011, p.347)

The alternative proposed by Kahneman and Tversky, which culminated in the development of perspective theory, is that utility is more linked to changes in wealth than to states of wealth. According to them, what matters most are the movements of gains and losses from a reference point which the authors refer to as the "level of adaptation." The level of adaptation is not necessarily the previous state, the expected result, the form of another person, and even what is found together to possess. This interpretation allows you to define different utility values for the same movement, depending on whether it is a loss or a gain. The usefulness for an investor whose state of wealth is $1,000 is different depending on whether in the previous state he had $1,100 or $900, meaning the "uselessness" of losing $100 is other (in this case, possibly greater) than the usefulness of earning $100.

Another important point of the perspective theory is that there are subjective differences between movements of the same magnitude that depend on the reference point. With this, the usefulness provided by a $100 gain is appreciably different if the individual's previous state was $50 or $5,000. Kahneman parallels this effect with sensory dimensions, such as the difference between turning on a dim light in a dark or very light environment or putting your hand in a container with standard water after dipping your hand in hot or cold water. The perception will be different, even though the weak light has the same intensity, and the water norm has the same temperature in both cases.

One last point, which will be explored further below, is the principle that investors are averse to lose and not risk, as the formulators and advocates of Theories of Expected Utility have preached. This means that the reactions to losses are more significant than reactions to gains, even in cases where the values of the losses are equal to or less than the values of the profits.

These principles make the utility function proposed by Kahneman and Tversky the same format as an "S" in the Expected Utility Theories. Still, it is non-symmetrical and has the reference point as its central element.

Figure 3 shows that sensitivity (marginal utility is decreasing for gains and that marginal disutility is decreasing for losses) to losses is theoretically higher than gains. Thus, it is found that the psychological value of losses is greater than the psychological value of corresponding increases, demonstrating how much they are averse to losing.

The fact that the utility function is concave for gains and convex for losses generates the reflection effect. In this case, the agent is risk-averse to increases and prone to risk for losses.
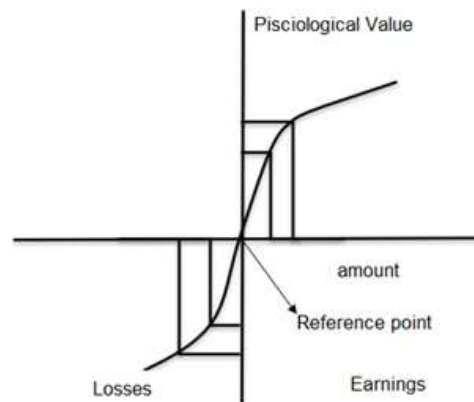

Figure 3. Curve Perspective Theory Utility

Source: Own elaboration based on the book Fast and Slow: Two Ways of Thinking (2011)

The research carried out by the authors in the work Prospect Theory: An analysis of decision under risk deconstructs the pillars that support the Expected Utility Theory demonstrating a series of phenomena that violate their principles by analyzing the answers of university students to a series of questions elaborated by the authors.

Questionnaires were applied to a sample of 404 respondents, that is, individual investors in Brazil where, according to the method proposed by Kahneman and Tversky (1979), they should make personal choices in the face of alternatives involving hypothetical questions of certainty or uncertainty (theory of the prospectus). In this way, the research considers that individuals are aware of two preferences in the face of real decisions and that they have no reason to respond to hypothetical situations different from the real ones (Cruz, Kimura, and Krauter, 2003). This point is important, as Kahneman and Tversky (1979) report possible problems regarding the validity of the method and the generalization of results due to the use of hypothetical situations. This research assumes that the choices for the issues proposed in the questionnaire reflect the decision-making process of individuals in real situations.

The questionnaire was sent via google forms, followed by a message via the WhatsApp application and e-mail with guidelines on how to fill it out. It was emphasized that the questions were answered honestly, respecting the profile, regardless of age or gender. Individuals were instructed to respond without consulting any person or source regarding the completion form. They would not have to worry about the accuracy of the answers (even because many of them did not have right or wrong answers) since they did not there was a need to identify the respondent, and the answers would serve as for academic work from July 2020 to May 2021.

The questionnaire was divided into two parts, namely.

1. First part: Contains five questions to define the profile of the person responsible for filling it out (age, gender, location, financial volume invested, training). In addition, the identification of the Region where the interviewee was located was requested (in the form, information was collected from all regions of Brazil).

2. Second part: Containing 21 objective questions (7 considered easy, 7 of medium difficulty, and seven difficult) to measure knowledge about the choice of investments, that is, the decision-making of the person responsible for filling it out (financial literacy). The questions asked present situations to analyze the heuristic biases of the interviewees in decision-making.

3. Results and Discussion

This chapter is dedicated to the analysis of the questionnaire, with the objective of profiling investors and understanding how the investment decision process of individuals, verifying the level of concentration of investors by gender, age, and region, besides ascertaining the existence of behavioral biases, and how these impact on the judgment of investors in various situations.

The first part of the questionnaire was prepared with the intention of profiling individual investors. Five questions were asked regarding age, gender, locality, invested financial volume, and training to trace this profile. The profile analysis shows that investors are predominantly men with an average age of 39 years, well-prepared academically, with 78.40% completing higher education and/or some specialization. Representatives from five regions of Brazil answered the questionnaire, especially in the Southeast, South, and Northeast regions, with 69.2%, 10.7%, and 9.2% of the questionnaire answered, respectively. Graph 1 shows the distribution by regions of the country, where it demonstrates a significant concentration in the Southeast region. The report released by B3 confirms this result. According to data released in 2021 by the Brazilian Stock Exchange, the B3, the concentration of investors is in the country's southeast region, with SP having approximately 50% of the financial volume of investors in the country. This fact can be explained by the level of education and understanding of the people in this region and SP being a reference as an investment hub in the capital market in Brazil.
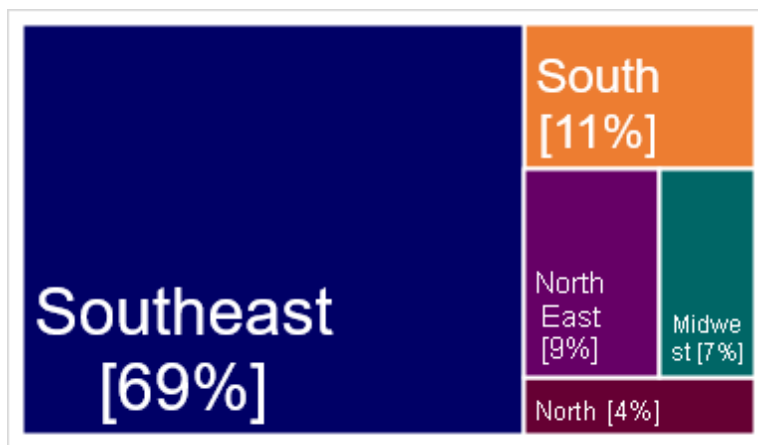

Figure 4. Distributions by regions of the country

Source: Own preparation based on the questionnaire

Table 5 shows that the average age of investors is higher than 39 years, demonstrating a profile of mature adult people, the predominance of the male public, and more than 80% have a higher level. This result shows that most investors have an advanced age and an above-average level of education.

Table 5. Respondents' profile

AGE	Middle Ages Investors	39.5 years
GENDER	Male	260 (65.2%)
	Female	139 (34.8%)
TRAINING	Elementary School	0 (0%)
	Middle school	52 (13%)
	Higher education	138 (34.6%)
	Postgraduate, Master, Doctorate	194 (48.60%)

Source: Own elaboration based on the data collected through the questionnaire

Figure 5 shows the result of the following question: Which investment range do you currently fall into? As can be seen, 64% of the people have above BRL 1 million invested. Fifty-six of the 382 people have investments in the range Between R$100,100 and R$300,000. Seven percent of the people interviewed have investments between R$300,100 and R$500,000
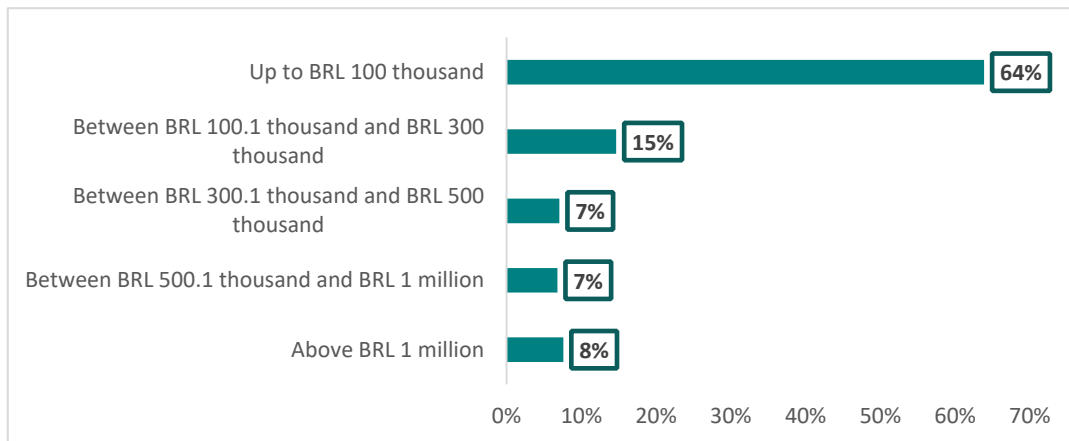
Figure 5. Amounts invested by survey respondents

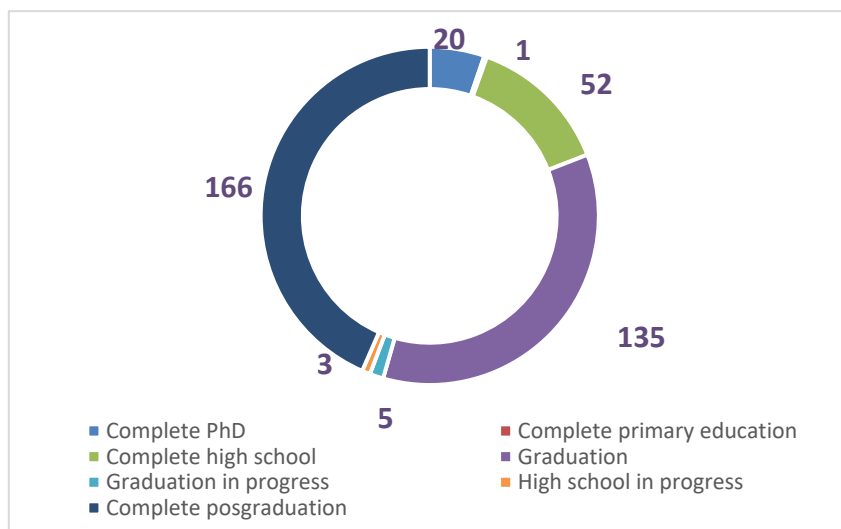Source: Own preparation based on the questionnaire

Figure 6. Level of education of the participants

Source: Own preparation based on the questionnaire

Regarding the participants' level of education, figure 6 shows that one hundred and sixty-six people have completed graduation, and one hundred and thirty-five people have completed postgraduate. This sample is considered to have an educational level higher than the school level of the country. In Brazil, according to the IBGE[1], the proportion of people aged 25 or over who completed compulsory basic education, that is, completed at least high school, increased from 47.4% in 2018 to 48.8% in 2019. Also, in 2019, 46.6% of the population aged 25 or over was concentrated in levels of education up to completing primary education or equivalent; 27.4% had completed high school or equivalent, and 17.4% had completed higher education.

As mentioned above, the second part of the questionnaire aimed to understand the investment decision process and whether there was any specific bias. Twenty-one questions were asked about the decision-making process.

Evaluating the way of acting and the behavior of people in our environment, it was identified that homo economicus is

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[1] https://educa.ibge.gov.br/jovens/conheca-o-brasil/populacao/18317-educacao.html

hardly present. There is no need for research and studies. However, they exist in droves to conclude that individuals do not have all the information available to make decisions at all times and on any matter and do not have the unlimited cognitive capacity or complete self-control. However, everyone makes decisions at all times and on all issues. The critical point is to understand how to do this and how the human brain processes data and information so that it can, good or bad, make choices and make decisions.

Always thinking with what Kahneman calls System 2, that is, analytically, checking and organizing the data with each decision, is very expensive and tiring, requiring a degree of concentration and effort out of the ordinary. Hence, people make use of heuristics in the decision-making process. In this case, we are met with irrational attitudes because if individuals use thought information, then it is not being rational, acting on impulse, as if it were an animal.

According to Kahneman, "[...] heuristics is a simple procedure that helps to find adequate, if often imperfect, answers to difficult questions" (KAHNEMAN, 2011, p. 127). Through these procedures, people can make decisions about subjects or analyze situations about something they do not know. They can, for example, decide probabilistically without understanding probability or having no notion about statistics. Somehow people can simplify a challenging task, which is undoubtedly the result of some form of information processing of some work done by their heads.

The questionnaire is used, following the structure of Kahneman's question, to elaborate on one of the questions to identify whether the people who answered the questionnaire made the same error that the researchers identified, that is, whether investors who answered the questionnaire use the same pattern of judgment when analyzing situations of the type in which they have to assign probability with inputs similarity between facts/descriptions and situations/people.

The research's objective is to identify behaviors that indicate that investors systematically act against the precepts that underpin classical finance and efficient market theory (HME). To analyze the results, we sought theoretical foundations in the assumptions of behavioral finance. Classical finance, whose decision-making model is supported by the principles of the Expected Utility Theory (EUT), is based on three pillars:

a)   Individuals will always act in a way that increases their usefulness, comparing the values of the expected utilities of each alternative presented.

b)   Individuals analyze the result of the portfolio as a whole, not individual positions.

c)   Individuals are risk averse.

Another pattern in the individuals' responses was about risk aversion; in some questions with equal expected values, people opted for the answer with a positive and more significant standard deviation, demonstrating that they are not risk averse (18,19,20 e 21). When the certainty of the result increases (options with a standard deviation equal to zero), the choice for assets with smaller standard deviation increases (questions 20 and 21); in this case, we have evidence of a reduction in risk aversion.

Table 6. Results questions 18 to 20

Issues	KIND	Standard deviation	Percentage (choice)
18	0.1	189.64	**60.8%**
	0.1	134.02	39.2%
19	0.2	189.64	**62.2%**
	0.2	134.02	37.8%
20	0.1	158.03	**54.5%**
	0.1	0	45.5%
21	0.2	158.03	**52.7%**
	0.2	0	47.3%

Source: Own elaboration based on the data collected through the questionnaire

Caption

0.1   Lottery of more significant variance has an **equal** expected value.

0.2   Lottery of more significant variance has an **equal** expected value.

Table 7 shows the answers to questions 1, 3, 5, 7, 9, and 14.   In questions 1, 7, and 4, most answers are expected: Choosing the lottery with the highest expected value and lowest variance. However, the answers to questions 3, 5, and 9 were different; most participants chose the alternatives with the lowest expected value and the highest variance. A contradiction compared to the previous questions. In this case, we have evidence of a reduction in risk aversion.

Table 7. Results questions 1, 3, 5, 7, 9 and 14

Issues	KIND	Standard deviation	Percentage (choice)
1	2.1	1,500.00	**77.0%**
	2.1	3,464.10	23.0%
3	2.1	1,299.03	**67.0%**
	2.1	3,464.10	33.0%
5	2.1	1,374.77	**68.5%**
	2.1	4,000.00	31.5%
7	2.1	535.60	**83.3%**
	2.1	1,732.05	16.7%
9	2.1	1,500.00	**85.3%**
	2.1	2,856.57	14.7%
14	2.1	1,071.2	**71.6%**
	2.1	4,000.00	28.4%

Source: Own elaboration

Caption

2.0	Lottery of higher variance has a **lower** expected value.
2.1	Lottery of higher variance has a **lower** expected value.
2.2	Lottery of higher variance has a **lower** expected value.

In table 8, questions 2, 4, 6, 8, 10, 11, 12, 13, 15, 16, and 17 of the teaching answers do not show a pattern in the responses of the individuals. In questions 2, 4, 6, 10, 13, 15, and 17, participants preferred options with less variability and lower expected value. In questions 8, 11, 1,2, and 16, most participants chose the option with the highest volatility and expected value.

Table 8. Results questions 2, 4, 6, 8, 10, 11, 12, 13, 15, 16 and 17

Issues	KIND	Standard deviation	Percentage (choice)
2	1.2	1299.03	**51.0%**
	1.2	4000.00	49.0%
4	1.1	28578.83	27.0%
	1.1	3666.06	**73.0%**
6	1.2	3000.00	39.0%
	1.2	7332.12	**61.0%**
8	1.2	1299.03	21.9%
	1.2	2856.57	**78.1%**
10	1.0	3000.00	**53.5%**
	1.0	8000.00	46.5%
11	1.2	1071.21	**50.6%**
	1.2	3666.06	49.4%
12	1.2	1833.03	39.1%
	1.2	2856.57	**60.9%**
13	1.2	15122.49	45.8%
	1.2	8227.24	54.2%
15	1.2	1374.77	**67.1%**
	1.2	3666.06	32.9%
16	1.2	4284.85	30.6%
	1.2	11426.28	**69.4%**
17	1.2	92.67	33.9%
	1.2	0	**66.1%**

Source: Own elaboration

Caption

1.0	Lottery of higher variance has a **higher** expected value.
1.1	Lottery of higher variance has a **higher** expected value.
1.2	Lottery of higher variance has a **higher** expected value.

According to the Expected Utility Theory, individuals seek to consider less the results that are likely in relation to the results that are considered correct. But when it is possible to win (right) but not likely (not sure), most opt for the option

that will maximize its usefulness. According to this principle, the agent would be indifferent to the following alternatives: a 90% chance of winning $10 or a 100% chance of winning $9, since both produce the same utility, but the results obtained by Kahneman and Tversky show that agents overestimate events that are considered right about those that are likely, which demonstrates that the subjective value of certainty (earning $9) is greater than the subjective value of probability (90% of earning $10) when the results of probability-weighted utilities are equal.

In fact, in cases of agents being more risk-averse, they agree to pay a premium to avoid uncertainty, opting for the alternative whose utility weighting result by probability is lower. This effect is called the author's "Sure Effect."

To identify this effect, in addition to other side effects resulting from this preference of individuals for certainty, we asked some questions. The responses of investors go in the same direction as those computed in the survey, including with very similar intensities.

The answer to Question 7 shows investors' preference for suitable alternatives, even when the payout is lower (R$ 5,000.00 x R$ 4,800.00); that is, they are willing to pay a premium to escape uncertainty.

Table 9. Sure Effect

Among the alternatives below, which do you prefer? N=7	Investor Responses
QUESTION 1 a) 50% chance to win R$ 7,000, 50% chance to win R$ 4,000; b) 25% chance to win R$ 10,000, 75% chance to win R$ 2,000;	**a) 76.2%** b) 23.8%
QUESTION 3 a) 25% chance to win R$ 7,000, 75% chance to win R$ 4,000; b) 25% chance to win R$ 10,000, 75% chance to win R$ 2mi;	**a) 67.2%** b) 32.8%
QUESTION 4 a) 25% chance to win R$ 7,000, 75% chance to win R$ 4,000; b) 70% chance to win R$ 10,000, 30% chance to win R$ 2,000;	a) 26.8% **b) 73.2%**
QUESTION 6 a) 50% chance to win R$ 14,000 50% chance to win R$ 8,000; b) 70% chance to win R$ 20,000 30% chance to win R$ 4,000;	a) 39.5% **b) 60.5%**
QUESTION 7 a) 85% chance to win R$ 3.5 thousand, 15% chance of winning R$ 2,000; b) 25% chance to win R$ 5,000, 75% chance to win R$ 1,000	**a) 83.8%** b) 16.22%

The same inconsistency can be verified by analyzing the answers to Questions 8,9,10, 11, 13, 14, and 16 because the alternatives are identical but arranged differently.

Analyzing the individual pattern of the choices between Questions 1 and 3, it is verified that 76.2% of investors who chose to earn R$ 7,000 in the first question decided to make R$ 7,000 with a probability of 25% and R$ 4,000 with a 75% probability in the second, which violates the precepts of the Expected Utility Theory. The same transgression is verified when analyzing the individual answers to Questions 4 and 6, with approximately 68.30% of investors making inconsistent choices.

What draws the most attention here is that investors opt for the alternative with the highest level of certainty (higher probability) when the odds of gains are substantial. On the other hand, when the chances of winning are remote, tend to choose the alternative that presents the highest value as a chance of winning (note that here the manager does not select by payout because both are equal but by the values in "game"). Again, the analysis of the individual pattern of choice attests to the inconsistency of investors since 50% of them opted for the "answer pair," which violates the principles of EUT Theory.

For the Expected Utility Theory, what matters, in terms of utility, is the state of wealth; thus, it does not matter how the level of adaptation was achieved, with gains and losses producing the same effect, which makes the symmetrical utility curve. To demonstrate that the subjective impact of losses and gains differs, Kahneman and Tversky reversed the signs of the problems formulated in their research, showing that agents behave differently in the face of risk situations involving losses.

Again, the investor responses were in line with what the researchers found. When analyzed together questions 17 and 19, for example, it was found that 65% of investors who preferred the certainty of earning R$ 2,400 in Question 17, opted for the alternative whose options were to lose R$ 3,000.00 with a probability of 0.2%, or R$ 0 with a chance of 99.8%.

Moreover, when comparing the responses in pairs, as done in the study of the sure effect, the same inconsistencies are found, with the results obtained certainly being overestimated about the merely probable results, which gives doubts. As the psychological factor generated by the loss is more significant than that generated by the gain for equal values in the

module, investors' probability of losing is certainly overestimated.

Table 10. Reflection Effect

Among the alternatives below, which do you prefer?	Investors response
QUESTION 19 a) 0.1% chance of LOSING R$ 6,000 and 99.9% chance of NOT LOSING ANYTHING; b) 0.2% chance of LOSING R$ 3,000 and 99.8% chance of NOT LOSING ANYTHING;	a) 37.8% **b) 62.8%**
QUESTION 21 a) 0.1% chance of LOSING R$5,000 and 99.9% chance of NOT LOSING ANYTHING; b) A LOSS of R$ 5 with 100% probability;	**a) 52.3%** b) 47.7%

Source: Own elaboration

This shows that investors prefer likely losses over certain losses, even if minor, and helps eliminate any explanation that can give the effect certainty in the sense that aversion to volatility is the possible cause of investors preferring the alternative (b) to Question 19 over the alternative (a), even the payout of the latter being higher. If that were the point (risk aversion), investors would likely lose $3,000 for sure to lose $6,000 with an 80% probability since the payout is higher in the first option, and the variation is smaller.

Another phenomenon analyzed is when people have to decide between varied situations. In situations where the result can be both gain and loss, individuals weigh the psychological benefit of the payment by comparing it with the psychological cost of the loss. Individuals have different risk tolerances, but usually, the relationship between the psychological cost of loss and the psychological benefit of gain is not 1 to 1, usually with people having more aversion to failure, with the fear of losing more significant than the hope of winning. This means that when they encounter situations where they must choose between losing and winning, they usually only accept the "game" if the gain is higher, on average, than two times the loss. In these cases, loss aversion causes individuals to make risk-averse decisions.

In these situations, System 2 usually analyzes the characteristics of the options responsible for the choice but is susceptible to the emotional reactions aroused by System 1. This means that as good as the individual is at analyzing the opportunities and as much as he knows that subject, there is no way to exempt himself from the emotions generated by System 1. His choices will be somehow affected by it.

These two examples, risk aversion to varied situations and aversion to loss in cases of choices between negative payouts, are the essence of the asymmetry of the utility function proposed by Kahneman and Tversky. As seen in Graph 5, the inclination of the utility function changes when losses are considered rather than gains; in this case, the equity reduces due to the outflow of investors from the asset.

4. Conclusion

The work aimed at showing a broader approach to finance and economics, which includes concepts of psychology and sociology, such as agents, and particularly investors, are susceptible to deviations of rationality that directly impact their choices and as specific objectives to answer important questions involving the profile and reaction of investors to situations of choice.

To validate this study, the specific objectives present important results, such as The first answered question of the particular goals on the profile of investors and the main region of Brazilian investors on the stock exchange (B3) at the end of 2020 presents a mainly male concentration (above 73%); Volume applied in B3 is of people with a mean age of 46 years (72.66%); concentration of young applicators (73.68% of B3's total individual accounts are from investors up to 45 years) and a well-known fact is the concentration of investors in the Southeast region (SP, RJ, and MG) with more than 69% of the volume (R$) and investors of B3.

The second question about investors' reaction to the win situation is that when the probabilities of gains are substantial, investors opt for the alternative with the highest level of certainty (highest probability). On the other hand, when the chances of winning are remote, they tend to choose the alternative that presents the highest value as a chance of winning. This confirmation is validated by table 10, where the respondents choose the answer with a lower expected value (standard deviation), which generates indications that the respondents are averse to the risk; however, when the certainty of the result increases (questions 7 and 9 item A) the choice increases due to the lower standard deviation, in this case, we have indications of a reduction in risk aversion.

Already the last response about investors' reaction in case of loss, we have that respondents prefer probable losses to the detriment of specific losses, even if minor, and helps to eliminate any explanation that can give the effect certainty in

the sense that the aversion to volatility. In Table 10, the possible cause of respondents' preferred alternative (b) to Question 19 over choice (a) is that they prefer the answer with a more significant standard deviation, which shows that they are not averse to risk. Still, when we are sure of the result (questions 20 and 21 item B), the choice increases due to standard deviation 0; in this case, we have evidence of an increased risk aversion.

It is possible to observe that the choices do not simply result from a lack of skill of investors or are influenced by specific characteristics such as gender, age, and time of experience. The triad that supports the Perspective Theory – a sure and reflection effect observed in the processes of choices, and the biases and heuristics observed in the judgment processes, provide more than enough evidence to conclude that agents are limited, inconsistent, and incur systematic and non-random errors, contributing to explain anomalies that are impossible to define when taken into account the hypotheses of classical finance theories. These choices and judgment procedures can significantly impact the portfolio of these investors, who, as mentioned earlier, will be felt not only by beneficiaries and assisted by the system but throughout society.

Finally, given the answers to the tests (analysis of the solutions of the questionnaire) and the approach of the book Fast and Slow: Two ways of thinking, by Kahneman (2012), it is difficult to control the two systems responsible for the decision-making of the agents, but understanding the mechanism of their functioning, deviations from rationality and errors may be mitigated.

Finally, man must accept that in the face of choices, or decision-making, it is not entirely rational but instead driven by behavioral and psychological components.

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Appendix A

Box 1 - There is a list of questions and % of responses from study participants.

QUESTION 1
With R$50,000 to invest, which investment do you prefer?
a) 50% chance of winning BRL 7 thousand, 50% chance of winning BRL 4 thousand.
b) 25% chance of winning BRL 10,000, 75% chance of winning BRL 2,000
QUESTION 2
Let's say that today you need to decide on one of the alternatives; which would you choose?
a) 25% chance of winning BRL 3,000, 75% chance of winning nothing.
b) 50% chance of winning BRL 6 thousand, 50% chance of LOSE BRL 2 thousand.
QUESTION 3
Let's say you have $1 million to invest. Which investment option do you prefer?
a) 25% chance of winning BRL 7 thousand, 75% chance of winning BRL 4 thousand.
b) 25% chance of winning BRL 10,000, 75% chance of winning BRL 2,000.
QUESTION 4
You receive an inheritance of R$ 150,000 under the condition that you invest the entire amount for one year. Which option would you choose?
a) 25% chance of winning BRL 7 thousand, 75% chance of winning BRL 4 thousand.
b) 70% chance of winning BRL 10,000, 30% chance of winning BRL 2,000.
QUESTION 5
With R$10,000, which investment do you prefer?
a) 70% chance to win BRL 1 thousand, 30% chance to LOSE BRL 2 thousand.
b) 50% chance to win BRL 4 thousand, 50% chance to LOSE BRL 4 thousand.
QUESTION 6
Suppose you are faced with the possibility of investing in one of the assets, A or B. Which would be your choice?
a) 50% chance of winning BRL 14 thousand and 50% chance of winning BRL 8 million.
b) 70% chance of winning BRL 20,000 and 30% chance of winning BRL 4,000.
QUESTION 7
In addition to what you own, you have been given an investment amount. You are now asked to choose between the following:
a) 85% chance of winning R$3,500 15% chance of winning R$2,000.
b) 25% chance of winning BRL 5 thousand, 75% chance of winning BRL 1 thousand.
QUESTION 8
If you unexpectedly receive R$35,000 to invest. Which asset would you choose?
a) 25% chance of winning R$7 thousand, 75% chance of winning R$4 thousand.
b) 85% chance of winning R$10,000 and 15% chance of winning R$2,000.
QUESTION 9
Let's say that today you need to decide on one of the alternatives; which would you choose?
a) 50% chance of winning BRL 7 thousand, 50% chance of winning BRL 4 thousand.
b) 15% chance of winning BRL 10,000, 85% chance of winning BRL 2,000.
QUESTION 10

| Suppose you are offered two investments with the characteristics below. Which would you choose? |
| a) 50% chance of winning R$14,000 and 50% chance of winning R$8,000. |
| b) 50% chance of winning R$20,000 and 50% chance of winning R$4,000. |
| QUESTION 11 |
| Suppose you are faced with the possibility of investing in one of the assets, A or B. Which would be your choice? |
| a) 85% chance of winning R$7 thousand and 15% chance of winning R$4 thousand. |
| b) 70% chance of winning R$10,000 and 30% chance of winning R$2,000. |
| QUESTION 12 |
| In addition to your current equity, you will make a new investment. You are now asked to choose between the following: |
| a) 70% chance of winning R$4 thousand, 30% chance of winning nothing. |
| b) 85% chance of winning BRL 7,000 and 15% chance of LOSE BRL 1,000. |
| QUESTION 13 |
| Suppose you were offered the following options to increase your net worth. Which would you choose? |
| a) 70% chance of winning R$3,500 and 30% chance of winning R$2,000. |
| b) 25% chance of winning R$20,000 and 75% chance of winning R$1,000. |
| QUESTION 14 |
| Your child was born, and you need to choose an investment to pay for their college. Which financial application do you prefer? (Application result is annual) |
| a) 85% chance of winning BRL 7 thousand and 15% chance of winning BRL 4 thousand. |
| b) 50% chance of winning BRL 10 thousand and 50% chance of winning BRL 2 thousand. |
| QUESTION 15 |
| Suppose you are now faced with the possibility of investing in one of the assets, A or B. Which would be your choice? |
| a) 70% chance of winning BRL 3 thousand, 30% chance of winning nothing. |
| b) 70% chance of winning BRL 6 thousand, 30% chance of LOSE BRL 2 thousand. |
| QUESTION 16 |
| After studying a particular sector of interest, you are faced with two possibilities: A and B. What would be your choice? |
| a) 85% chance of winning BRL 28 thousand and 15% chance of winning BRL 16 thousand. |
| b) 85% chance of winning BRL 40,000 and 15% chance of winning BRL 8,000. |
| QUESTION 17 |
| Which option do you prefer? |
| a) 33% chance of winning BRL 2,500, 66% chance of winning BRL 2,400, and 1% chance of winning nothing. |
| b) BRL 2,400 guaranteed. |
| QUESTION 18 |
| Which option do you prefer? |
| a) 0.1% chance of winning BRL 6,000 and 99.9% chance of winning nothing. |
| b) 0.2% chance of winning BRL 3,000 and 99.8% chance of winning nothing. |
| QUESTION 19 |
| Which option do you prefer? |
| a) 0.1% chance of LOSE BRL 6,000 and 99.9% chance of LOSE nothing. |
| b) 0.2% chance of LOSE BRL 3,000 and 99.8% chance of LOSE nothing. |
| QUESTION 20 |
| Which option do you prefer? |
| a) 0.1% chance of winning R$5,000 and 99.9% chance of winning nothing. |
| b) BRL 5 guaranteed. |
| QUESTION 21 |
| Which option do you prefer? |
| a) 0.1% chance to LOSE BRL 5,000 and 99.9% chance to LOSE nothing. |
| b) A BRL 5 LOSS with 100% probability. |

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