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DO HEURISTICS AFFECT BRAZILIAN INVESTORS' DECISION-MAKING PROCESS?

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Introdução
Behavioral finance is a branch of studies in the Finance area, which gained strength in the late 1980s, by seeking to understand the antecedents and consequences of "irrational" investment strategies' behaviors observed in the financial market. The focus of these studies was centered on the individual's economic behavior and not on the judgment of the degree of rationality existing in their decision-making process, that is, the object of study of behavioral finance refers to the financial market investigation based on the investor's behavior and decisions made.
Problema de Pesquisa e Objetivo
Investment decision-making takes place through the evaluation of the types of assets available. In this evaluation, investors use heuristics, a mental process that attempts to alleviate the cognitive load necessary for decision-making in a complex situation. Thus, this paper aims to analyze the influence of heuristics on Brazilian investors' behavior in the decision-making process.
Fundamentação Teórica
Heuristics are understood as a mental simplification tool used in the decision-making process. Investors make constant mistakes because their decision-making is based on their experiences, which are interpreted as "pocket rules". These heuristics help in decision-making since they are mental paths that facilitate the perception and evaluation of the information one receives, being applied in a variable process of mental patterns, to deal with mechanisms that reduce complex evaluation tasks. Organizing and reducing the amount of information needed to understand a situation and take action.
Metodologia
We applied structural equation modeling by the PLS-SEM methodology. The sample is composed of 220 investors.
Análise dos Resultados
The heuristics of Overconfidence and Anchoring positively influence decision-making, while Loss Aversion influences negatively. The herd effect showed no influence.
Conclusão
The results also supported that decision-making positively influences the performance of investors. Investors feel secure in their attitudes regarding making financial decisions, even if these decisions are not always rational, as they are affected by biases.
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Palavras Chave
Investment Decision-Making, Behavioral Finance, Heuristics;

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1 INTRODUCTION

Behavioral finance is a branch of studies in the Finance area, which gained strength in the late 1980s, by seeking to understand the antecedents and consequences of "irrational" investment strategies' behaviors observed in the financial market (Olsen, 1998). The focus of these studies was centered on the individual's economic behavior and not on the judgment of the degree of rationality existing in their decision-making process, that is, the object of study of behavioral finance refers to the financial market investigation based on the investor's behavior and decisions made (Antony, 2019).

In this context, investment decision-making is defined as the process of evaluating the available options to choose in which investment one will invest one's financial resources, as well as the amount of the resources to be invested, with non-rationality occurring when it is not possible to accurately premeditate and explain investor's decision-making. For example, the scenario of economic instability generated at the beginning of the Covid-19 pandemic would lead to the prediction, from a rational point of view, of retraction and discouragement for the entry of new investors into the financial market, but what happened was an increase in the adhesion of individuals in the Brazilian stock market in the period from March to July 2020, with about 900,000 new investors (FIA, 2021).

The explanation for these phenomena occurs by understanding that the investor's behavior is not purely rational, being influenced by other issues that affect their decision-making process, with a plethora of factors that can affect this dynamic, making it more complex. In an attempt to simplify the decision-making process, our brain uses a mental simplification technique called heuristics, which works by trying to reduce the number of options presented in a complex situation. However, since heuristics are intrinsic to each individual and, therefore, based on their own experiences and knowledge, they leave room for errors and biases.

The result is a simplified model of the initial problem that is not an ideal or rational representation but relieves the cognitive load required to assess the situation and make a decision (Costa, 2017). This helps in understanding why investors can present behavior's unpredictability. As each investor will seek to maximize their investment returns with a focus on their strategy influenced by heuristics. For Kahneman and Tversky (1979), heuristics are used in the self-learning process by investors to try to understand phenomena that occur in the financial market, but that can lead to misinterpretation in decision-making.

Thus, we aim to analyze whether heuristics influence the behavior of Brazilian investors by impacting their decision-making process. Yoshinaga *et al.* (2008) exposes that brokers fail to detail the behavior and decisions made by investors in the financial market for the purchase and sale of assets, which may be linked to emotions and other cognitive factors, disregarding their own experiences, information, or/and beliefs about the values of assets. Hence, our study contributes by analyzing if heuristics influence the decision-making process of Brazilian investors and, consequently, how decision-making influences the performance of their portfolios.

This investigation contributes to expanding the analysis of the financial behavior related to the influence of heuristics, and on the perception of investors about their financial decisions. This analysis is important because it allows us to better understand the growth process in the number of individuals investing in Brasil, Bolsa e Balcão (B3), the proliferation of investment digital platforms, and the current volatility in the Brazilian market with the pandemic situation. Moreover, the provision of studies about investor behavior can help them to incorporate this information for better investment strategies, reducing the possible negative

effects that biases can cause when decision-making (Wood and Zaichkowsky, 2004) - such as fluctuations in Marketplace and higher volatility.

The structure of our paper is organized as follows - first, we briefly review the concepts of behavioral finance and heuristics and their relation to the decision-making process; subsequently, we explain the method and the instrument applied; then we present the study results, with a brief description of the participants' socio-demographic profile and the structural equation modeling outcomes; afterward, there is a chapter to discuss the results obtained; and we finish with the paper conclusions including main findings, limitations and, suggestions for future studies.

2 BEHAVIORAL FINANCE

Modern Finance Theory is the area that studies financial behavior based on neoclassical economic theories, assuming the idea of the investor's rationality as an economic agent. Some of the main models developed in this theoretical branch are the Portfolio Theory (First developed by Harry Markowitz, 1952); the Capital Asset Pricing Model (Developed by William Sharpe, 1964); the Efficient Market (Developed by Eugene Fama, 1965), among its derivations and other models.

In essence, those models converge to an analysis that is based on the behavior of a rational investor, which, as a rational economic being, would avoid risk and use his/her learning curve and available knowledge in their investment decision process to optimize future results (Iquiapaza *et al.*, 2009). This brought a new and well-accurate explanatory power to the finance area on market behavior, which was validated by subsequent studies that replicated those models.

However, some of the studies developed under the optics of the Modern Finance Theory models presented divergent results between the expected behaviors and the effectiveness (Gimenes and Famá, 2001). These contrasting results began to appear as phenomena such as economic crises and the bursting of bubbles in the stock market occurred. Thus, it was noticed that the models of Modern Finance Theory would not always be useful to explain these different phenomena, which were called anomalies, leaving some failures in the explanatory power of the models.

Opening room for debate and development of criticism of the assumptions adopted in the models, one of them being the investor's rationality. To be able to study the anomalies, researchers began to try to fit other variables into the models, with some derivative works from the Modern Finance Theory, but with some proposing new approaches and theories, risking the interface with other areas of knowledge, especially psychology. What becomes later known as Behavioral Finance.

As an example, we have the work developed by Hebert Simon that deals with the concept of Limited Rationality (Simon, 1970), who stated that the theory based on excellence is not a good governing theory as it does not foresee rules of conduct that could improve the benefits of decisions, because it is not known for sure how much is missing to reach excellence, and there may be solutions that are just better than others. Thus, Simon was undecided about the traditional financial models, questioning whether human behavior is, or should be, rational, since financial rationality needs to be compatible with access to information and the environmental characteristics of the organizations in which man is inserted. For this, he sought in psychology the answers to his questions, confronting the distance between this area and the economic and administrative theories, as to expand rationality to a larger set of human behaviors (Simon, 1970).

These studies presented an alternative, demonstrating possible reasons for the occurrence of investors' irrational attitudes, increasing the degree of explanation for some phenomena that happened in the market - that, using only the models of Modern Theory in Finance could not be explained. The point at which theories diverge and Behavioral Finance

makes its main contribution occurs in the elucidation that the idea of rationality presents flaws in being possible to identify the existence of psychological and social factors, or biases, that can deviate the investor's behavior from rational, generating market anomalies.

Therefore, Behavioral Finance Theory studies the influence of financial, psychological, and social aspects on investors' decision-making process and the subsequent effects on the market. The analysis of psychological aspects linked to human behavior has become an important field to be analyzed. To be able to identify how and why investors' decisions sometimes deviate from factors that are not economic (Lucena *et al.*, 2013). Behavioral Finance includes more realistic behavioral assumptions, taking into account aspects of human nature and theories from Psychology, developing a new paradigm.

It is noteworthy that Behavioral Finance does not reject economic principles, actually using its main concepts, but adding other knowledge to improve models of market analysis and justify the discrepancies between expected and actual behavior because it recognizes that markets tend to present results not as efficient as in theory (Olsen, 1998). The analysis of psychological aspects linked to human behavior has become an important bias to be analyzed to identify how the relationship between rationality and irrationality occurs, observing how decisions deviate from other factors that are not economic (Lucena *et al.*, 2013). Tversky and Kahneman (1981) explain that investors act irrationally and end up making biased decisions, thus causing an imbalance in the financial market.

To understand investor behavior and define how excess or lack of confidence can lead to inconsistencies in the financial market and influence financial decisions, the application of Behavioral Finance contributes to the formulation of actions that minimize the risks caused by the limited rationality of the agents acting in such markets. In the following subsections, the adverse effects of the behavior of individuals that determine non-rational decision-making are presented.

2.1 Heuristics and Decision-Making

With evidence from Behavioral Finance studies that there are non-economic factors that impact investment decisions, further investigation becomes necessary. To better understand, for example, the dynamic between irrational investment decisions and asset prices, a relationship where the variation of one will affect the other. Therefore, in addition to the economic and financial variables that need to be analyzed in the decision process, emotional biases, mental shortcuts, and social factors influence investors. So, as the number of factors engaged in the process increases, decision-making becomes a more complicated task.

Heuristics are understood as a mental simplification tool used in the decision-making process. Investors make constant mistakes because their decision-making is based on their experiences, which are interpreted as "pocket rules". These heuristics help in decision-making since they are mental paths that facilitate the perception and evaluation of the information one receives, being applied in a variable process of mental patterns, to deal with mechanisms that reduce complex evaluation tasks (Costa, 2017). Organizing and reducing the amount of information needed to understand a situation and take action.

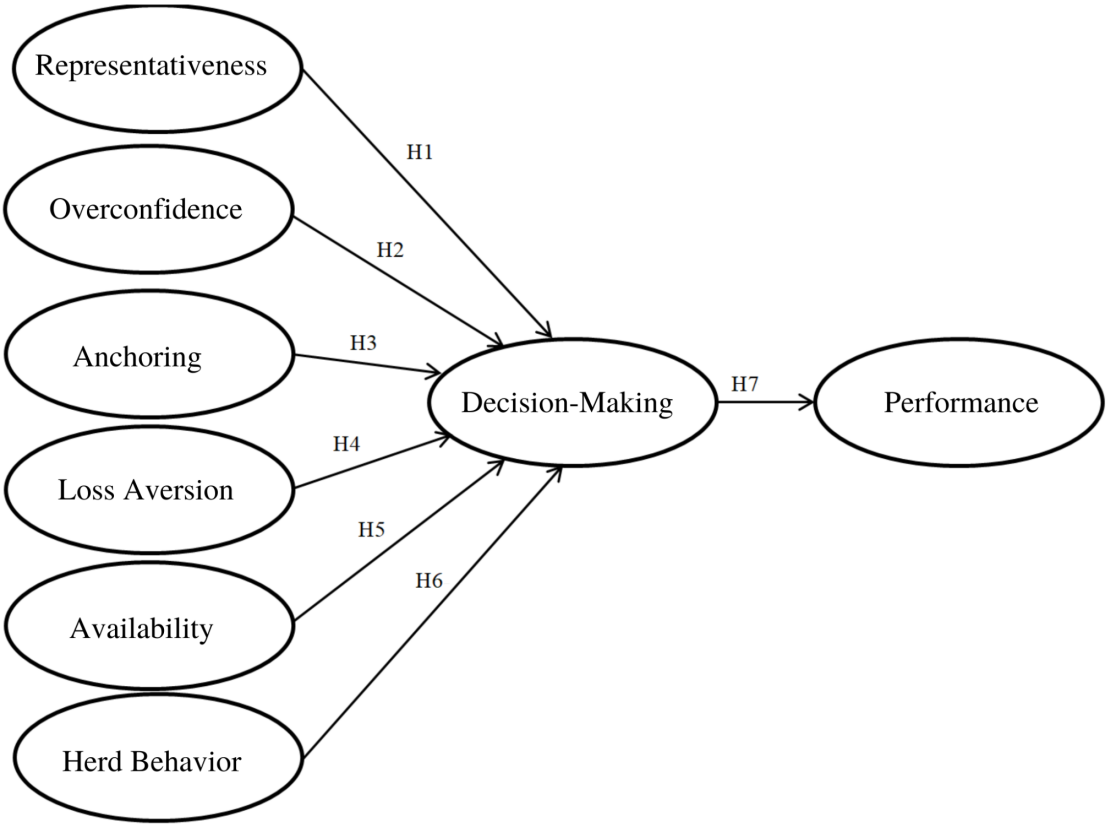
Heuristics greatly simplify the way decisions are made; however, they can lead to errors of understanding, analysis, and opinions that go beyond rationality or are in conflict with statistical and economic theories. These errors occur systematically and in a predictable way in certain scenarios and are called biases. Biases can generate errors of appreciation, which, in turn, cause a misrepresentation of reality and lead to bad decisions and the occurrence of systemic anomalies in the market (Baker and Ricciardi, 2015).

The severe and systematic errors in the investors' decisions caused by heuristics, may occur due to the trade-off needed to minimize the required cognitive load for easier problem resolution, obstructing the possibility of accessing all the probabilities involved in each

decision-making process. The limited ability of the human brain to process information limits the resources of the mindsets that simplify the decision process (Yoshinaga and Ramalho, 2014).

In our study, as analyzed heuristics in the decision-making process of individuals, we have: Representativeness, Overconfidence, Anchoring, Loss Aversion, Availability, and Herd Behavior (Metawa *et al.*, 2019; Kanojia *et al.*, 2018; Zahera and Bansal, 2018; Babajide and Adetiloye, 2012; Düring *et al.*, 2017; Kahneman and Tversky, 1979; Lobão, 2012; Thaler and Johnson, 1990; Waweru, 2008). Figure 1 presents a synthesis of the hypotheses with the structural model of heuristics, decision-making, and performance.

Figure 1 - Structural Model of Heuristics, Decision-Making, and Performance



The representativeness heuristic is a subjective probability based on similarities that leads to incorrect conceptions of events that may occur in the future since the expectation prevails that the essential characteristics of a random process are present even when this process refers to short sequences of events. For example, the individual tosses a coin at random, and three consecutive times it comes out heads (K) and makes him/her believe that on the fourth toss it will come out heads (K) again due to the previous tosses. However, there is no way to be sure of the toss because it is a game of chance that may come out heads (K) or tails (C) causing a decision error in believing that in future sequences the result of the heads (K) sequence will be repeated (Tversky and Kahneman, 1975).

This bias in the estimation of possibilities is what leads to errors (Kahneman, 2011). In the financial market, this behavior is noticed when investors analyze the price of a stock in the past, where there was a devaluation or appreciation, starting to believe in an economic upturn in the future, through a probability between values and events that affect the investor to make an irrational decision based only on his/her uncertain judgment, without analyzing the fundamentals of the chosen company (Kanojia *et al.*, 2018). As analyzed by Peters (2003), even if there is a possibility of the occurrence of a certain event, this does not mean that it will be repeated in the future, causing the investor to make a decision strongly influenced by

irrational information. Thus, the following hypothesis was developed - **H1: Representativeness influences decision-making.**

The behavior related to overconfidence occurs through the bias of overestimating our skills, knowledge, and chances of success, inducing the investor to be very secure in his/her actions and knowledge, transmitting this security to their decisions when choosing financial assets. One factor that contributes to Overconfidence is the amount of information accessible to demonstrate that their decisions will bring positive consequences, thus underestimating risks and subjecting individuals to more difficult problems, because solving tasks with a higher degree of complexity increases Overconfidence in people.

Overconfidence makes investors more secure and always positive of their results, and may make these individuals not see much risk or contrary information. According to Alsabban and Alarfaj (2020), this bias affects investors in developed markets, with an even stronger level of influence in developing countries. The Overconfidence in their information and actions makes investors willing to produce an excessive amount of buying and selling, taking risks beyond what is rationally calculated (Abdin *et al.*, 2017). Kanojia *et al.* (2018) studied the behavior of investors in the Indian stock market and found that the Overconfidence heuristic is the one that most affects investors. Alquraan *et al.* (2016) also found results that validate the influence of Overconfidence in the decision-making of investors in the Saudi Arabian stock market. Thus the following hypothesis - **H2: Overconfidence influences decision-making.**

Anchoring describes decision-making by individuals who, once in a state of indecision, are influenced by information generated by analysts or analysis houses, factors that usually impact their decision-making excessively. This effect deliberates the use of irrelevant or wrong information to understand some situation or for the estimation of some value, leaving investors stuck to this initial information. Therefore, Anchoring is considered a great challenge to the individual, strongly reflecting on his results. Because taking into account information without researching the theoretical basis of such phenomena can negatively influence a final decision since past events do not change the probability of future events. Consequently, Anchoring can generate great losses in their financial results (Kahneman, 2011). Thus, the following hypothesis is formulated - **H3: Anchoring influences decision-making.**

Loss Aversion is about human beings giving far greater weight to lose than to gain, interpreting gain and loss in different ways. In such a way, people are not afraid of taking risks but rather afraid of losing. Hence, they go through much more risk not to lose something, than to gain something, since they consider the loss a terrible pain and gain just a consequence. Thus, individuals are induced to take more risks in an attempt to repair the damage that is done (Tversky and Kahneman, 1975). Moreover, when these investors lose, they tend to hide these losses because they expect that the situation will reverse with a later gain. All this is due to a societal stigma that belittles failure. Such stigma negatively influences people's actions, generating fear of loss and accepting any gain, even when it is less than it should be. Thus, we can suggest the following hypothesis - **H4: Loss Aversion influences decision-making.**

Availability consists of making decisions based on information that is quickly available from investors' memory, thus affecting the process of financial decision-making of the individual (Tversky and Kahneman, 1975). This fact explains the frequency with which individuals prefer to negotiate with companies already known in their home country and recommended by financial houses and investors since they tend to consider that they will have positive effects and fewer chances of failure (Lobão, 2012). However, Availability, when applied to financial decisions, can lead to errors in the process of choices, given that these individuals' choices are often based only on cognitive experiences, which do not guarantee

certainty of desired outcomes (Zahera and Bansal, 2018). Thus - **H5: Availability influences decision-making.**

The Herd Behavior occurs when investors, driven by cognitive emotions, make decisions based on other investors' results, consequently, they do not examine the information for themselves, being influenced by buying and selling actions of others (Düring *et al.*, 2017). The individual ends up following the same path and the same decisions of a certain group, due to the feeling that it is better to be wrong together than alone (Passos *et al.*, 2012). Investors can also be affected by Herd Behavior when they have little financial knowledge and market understanding, so they imitate the behavior of other investors. Or due to the use of this heuristic at a specific moment as a mechanism to reduce the anxiety involved in the decision-making process (Filbeck *et al.* 2017). Bosch and Smimou (2022) studied the commodities market and found evidence that in some of them there is a tendency to Herd Behavior, with some traders exercising influence upon others' investment decisions. Ahmed *et al.* (2019) also found evidence of Herd Behavior, in the Pakistan stock market. Thus, we have the following hypothesis - **H6: Herd Behavior influences decision-making.**

Investors' decision errors in their way of investing may be influenced by psychological biases. In this sense, it is important to identify the biases present so that failures in the decision-making process can be reduced (Nofsinger, 2006). Kahneman (2012) exposes two approaches for a definition of decision-making systems and cognitive function. The first has its use in situations that do not present a need for much intellectual effort, in which the decision mechanism and all choices are made automatically and quickly. The second is based on complex situations, which require more analytical reasoning and work in a slower and more orderly manner.

Merkle (2017) reports that investors who trade excessively in an irrational way compared to the rational way in decision-making demonstrate that this high number of transactions performed can positively affect the performance of these investors. Since they perform higher amounts of transactions will probably result in higher returns than those who make fewer transactions. Besides the heuristics affecting the investors' decisions related to their performance, performance is understood as the performance or result achieved by these investors. This way we can suggest the following hypothesis - **H7: Decision-making influences investors' performance.**

3 METHOD

The study was conducted employing a descriptive investigation, with a quantitative approach. The sampling process was non-probabilistic. Data collection was carried out through the application of a structured questionnaire via Google Forms, in the period from June 17 to September 15, 2021, sent to social media groups and directed to those who have already made some kind of investment in fixed and variable income assets.

In the first part of the survey, information was collected on types of investment, period, profitability or loss, and volume of investments. The answers were validated by question 1 (one), which integrates an identification filter on how the individual usually invests in financial assets. In the second part, there are the questions about heuristics, decision-making, and performance, from 7 to 32 (Table 1), whose answers were measured through a 7-point Likert scale, ranging from "1 - Totally disagree" to "7 - Totally agree". In the third part of the study, we sought to collect information from the individuals who make up the sample, based on their sociodemographic profile.

To verify the understanding of the instrument, we conducted a pre-test with 15 users. The pre-test showed that the instrument was understandable and adequate for the study. To calculate the sample size, we used G*Power 3.1.9. For the calculation, it should be noted that there are two parameters, the power of the test (Power = 1 - βerror prob. II) and the effect size (f2). Cohen (2013) and Hair (2016) report using power as 0.80, median f2 = 0.15, and 6

predictors were used. We obtained that the minimum calculated sample size should be 98. For a solid model, it would be interesting to use twice that value, with 196 respondents. After the application of the questionnaire, we collected a sample of 274 respondents, of which 220 made some kind of investment and only 54 did not (those 54 were removed from the sample).

Table 1 - Constructs, Authors, and Variables

Constructs	Variables
Representativeness Kahneman and Tversky (1979), Waweru *et al.* (2008)	7 - I resort to information regarding asset prices before making my decision to invest.
	8 - I buy stocks in the capital market that are "bullish".
	9 - I avoid investing in stocks that have had poor performances in the recent past.
Overconfidence Waweru *et al.* (2008), Babajide and Adetiloye (2012)	10 - I know what action to take to increase the value of my investment.
	11 - I consider myself an intelligent investor in the financial market.
	12 - I am always confident that I will win when I trade in the financial market.
	13 - I can choose assets to invest in with higher rates of return than the average market rates.
Anchoring Kahneman and Tversky (1979), Babajide and Adetiloye (2012)	14 - I trust the returns previously achieved in the market as a reference to estimate the future returns of my investments.
	15 - I trust my past experiences in the financial market to make my future investments.
	16 - I estimate future changes in stock prices based on recent capital market prices.
Availability Kahneman and Tversky (1979), Lobão (2012), Waweru *et al.* (2008)	17 - I prefer to invest in assets present in national markets rather than in the international market as national market information is more available.
	18 - I consider the information provided by my closest friends and relatives as a reliable reference for my investment decisions.
Loss Aversion Kahneman and Tversky (1979), Thaler and Johnson (1990)	19 - After obtaining a gain, I am more likely to look for investments with a higher risk than usual.
	20 - After making a loss, I am more likely to become more risk averse.
Herding Effect Düring *et al.* (2017), Waweru *et al.* (2008)	21 - The decision of choosing to buy and sell financial assets, by other investors, has an impact on my investment decisions.
	22 - The amount of money invested in financial assets by other investors has an impact on my investment decisions.
	23 - I usually react quickly to changes in decisions made by other investors.
	24 - I follow the reactions of other investors in the financial market.
Decision-making Oliveira and Krauter (2015), Parker *et al.* (2016)	25 - Generally, when buying a stock I am comfortable with choosing the stock purchased.
	26 - Generally, when buying a stock I feel good about choosing the stock purchased.
	27 - Generally, when buying a stock I am experiencing negative emotions about choosing the stock purchased.
	28 - Generally, when buying a stock, whether or not it is "the best choice," I feel good about choosing the stock purchased.
	29 - Generally, when buying a stock, although I don't know if the stock purchased is the best one, I feel perfectly comfortable with the choice I have made.
Performance Obtained Luong and Ha (2011)	30 - The rate of return on my investments meets my expectations.
	31 - I am satisfied with my investment decisions.
	32 - The rate of return obtained on my investments is equal to or higher than the market's average rate of return.

Missing values and univariate and multivariate outliers were analyzed, and the criteria used for Structural Equation Modeling (SEM), performed by Smart-PLS 3.0 (Sarstedt *et al.*, 2017), were presented. However, no respondents were removed based on these criteria. Regarding normality, the results pointed out that the data is not normal, thus we choose to

estimate the structural equation modeling by the PLS-SEM methodology that does not need normality of the data, through the use of Smart-PLS 3.0 software (Hair *et al.*, 2019).

Thus, we initially analyzed the convergent and discriminant validity of each construct based on the procedures proposed by Fornell and Larker (1981), observing the values of the factor loadings, which should exceed 0.5 (Hair *et al.*, 2019). For Fornell and Larker (1981), the composite reliability (CR) is satisfactory when greater than 0.7 and the average variance extracted (AVE) greater than 0.5, indices that make up the convergent validity. For discriminant validity, the same authors indicate that it is achieved when the variance extracted from each construct is greater than the shared variances (squared correlations) with other constructs.

Furthermore, to recognize the model fit we used the Standardized Root Mean Squared Residual (SRMR) - which should be less than 0.8 (Hair *et al.*, 2019). After validating the constructs, we analyzed the hypothesis tests and the model's predictive ability. For the hypothesis tests, we considered $p < 0.05$ (Hair *et al.*, 2019). For model prediction, we used f^2, which should have a value greater than 0.02, and Q^2, which should have a value greater than 0.025, and R^2, which should have a value above 0.10 (Hair *et al.*, 2019). For Cohen (2013), when applied to the social and behavioral sciences, the coefficients of determination are classified as small effect ($R^2 = 2\%$), medium effect ($R^2 = 13\%$), and large effect ($R^2 = 26\%$). Furthermore, the Variance Inflation Factor (VIF) must be less than 5.

4 RESULTS

We begin the analysis of the results with an explanation of the data collected about the respondent's sociodemographic profiles. Regarding gender, 41 (18.6%) identified themselves as female and 179 (81.4%) as male. The average age of the participants was 40 years old. As for the level of education, more than 92% said they had higher education. Regarding the regions of the respondents, most of them live in the Northeast (88 - 40%), followed by the Southeast (76 - 34.55%). Next, were questions about the type of investment: stocks, real estate funds, fixed income, savings, and TreasuryDirect; concerning the period that the person invests in this application (Table 2).

Table 2 - Type of Investment and Period

Variable		Period	Frequency	%
Investment Type	Stocks/Shares	I do not invest	24	10.91
		Less than 1 year	17	7.73
		From 1 to 3 years	97	44.09
		From 3 to 5 years	50	22.73
		From 5 to 10 years	15	6.82
		More than 10 years	17	7.73
	Real estate funds	I do not invest	77	35.00
		Less than 1 year	23	10.45
		From 1 to 3 years	84	38.18
		From 3 to 5 years	24	10.91
		From 5 to 10 years	7	3.18
		More than 10 years	5	2.27
	Fixed Income	I do not invest	58	26.36
		Less than 1 year	7	3.18
		From 1 to 3 years	38	17.27
		From 3 to 5 years	66	30.00

		From 5 to 10 years	18	8.18
		More than 10 years	33	15.00
	Savings	I do not invest	102	46.36
		Less than 1 year	6	2.73
		From 1 to 3 years	10	4.55
		From 3 to 5 years	38	17.27
		From 5 to 10 years	11	5.00
		More than 10 years	53	24.09
	TreasuryDirect	I do not invest	102	46.36
		Less than 1 year	13	5.91
		From 1 to 3 years	41	18.64
		From 3 to 5 years	41	18.64
		From 5 to 10 years	16	7.27
		More than 10 years	7	3.18

The type of asset in which the sample most concentrates its investments is stocks (89.09%), followed by Fixed Income (73.64%) and Real Estate Funds (65%). Savings and TreasuryDirect have the lowest percentage of investors among the available options (53.64% each), but Savings is the type of investment with the highest percentage of investors with a long-standing profile (24.09% report having investments in this class for more than 10 years, while the other types of assets, except Fixed Income, do not reach 10% of respondents in this time frame). The second stage of the results analyzed the average amount invested, profitability, and/or loss of the respondents' invested capital (Table 3).

Table 3 - Average Value, Return, and/or Loss of Invested Capital

Variable		Frequency	%
Average value of the invested amount	Up to 10 thousand	42	19.09
	10,000 to 50,000	33	15.00
	50,000 to 100,000	41	18.64
	100 thousand to 200 thousand	36	16.36
	200 thousand to 500 thousand	28	12.73
	Over 500 thousand	40	18.18
Average return on the investment portfolio	No profit	28	12.73
	Less than 1% profit	11	5.00
	From 1% to 5%	52	23.64
	From 5% to 10%	51	23.18
	More than 10%	78	35.45
Average loss of the investment portfolio	No loss	192	87.27
	Less than 1% profit	1	0.45
	From 1% to 5%	6	2.73
	From 5% to 10%	6	2.73
	More than 10%	15	6.82

As to the investment's average values, there is not a symmetrical distribution of respondents among the value ranges selected for the survey. Regarding the profitability of the capital invested, only 12% of the participants reported no profit. Also, a gradual positive

correlation is noticeable in the answers - less than 1% (5%); from 1% to 5% (23%); from 5% to 10% (23%); more than 10% (35%). Finally, about losses, most of the respondents (87.27%) reported never having had losses on the value of the capital invested. Only 6.82% reported already having had losses of more than 10% of the investment value.

4.1 Structural Equation Modeling

Initially, the factor loadings were analyzed and we removed the decision variable 3 (Q.27) since it had a factor loading below 0.5 (-0.312). Concerning convergent validity, the results are shown in Table 4. It is possible to see that the constructs Loss Aversion (LOSS), Availability (AVL), and Representativeness (REPRE) presented low values for Cronbach's Alpha, Composite Reliability, and Average Variance Extracted, so we chose to remove them. As for the Anchoring construct (ANC), although the construct showed a value below 0.7 for Cronbach's Alpha, it showed acceptable values for Composite Reliability and Average Extracted Variance, so we decided to keep it in the analysis.

Table 4 - Convergent Validity

Constructs	Cronbach's Alpha	Composite Reliability	Average Extracted Variance
Anchoring (ANC)	**0.673**	0.815	0.595
Loss Aversion (LOSS)	**0.373**	**0.409**	**0.456**
Decision-making (DM)	0.849	0.899	0.691
Availability (AVL)	**0.270**	**0.341**	**0.460**
Overconfidence (OC)	0.778	0.857	0.602
Herd Behavior (HERD)	0.881	0.917	0.733
Performance (PERF)	0.847	0.907	0.766
Representativeness (REPRE)	**0.254**	**0.336**	**0.361**

Next, in Table 5, we present the convergent and discriminant validity of the model. The model presents convergent validity for all constructs since the Cronbach's Alphas were above 0.7, the Composite Reliability was above 0.7 and the Average Variance Extracted was above 0.5. Furthermore, discriminant validity was also found, since the variance extracted from each construct is greater than the shared variances. The model presented the following fit value: SRMR (0.079). We inserted the variable LOSS2 (Q.20) into the model.

Table 5 - Convergent and Discriminant Validity

	Cronbach's Alpha	Composite Reliability	AVE	ANC	DM	OC	HERD	LOSS2	PERF
ANC	0.673	0.815	0.596	**0.772**					
DM	0.849	0.898	0.690	0.321	**0.830**				
OC	0.778	0.858	0.603	0.521	0.499	**0.776**			
HERD	0.881	0.918	0.737	0.159	-0.154	-0.083	**0.859**		
LOSS2	1.000	1.000	1.000	-0.028	-0.264	-0.168	0.349	**1.000**	
PERF	0.847	0.907	0.765	0.254	0.517	0.570	-0.207	-0.213	**0.875**

Next, in Table 6, after the analysis of the convergent and discriminant validity, we proceeded to the hypothesis test and the predictive analysis of the model. The results indicated that the heuristics: Overconfidence and Anchoring positively influence the decision-making process as well as its results; Loss Aversion negatively influences the decision-making process as well as its results; the Herding effect has no importance in investors' decisions, and the heuristics of Representativeness and Availability consist of an untested hypothesis because the constructs had no convergent validity. For all significant relationships there was

predictive validity since the f^2 was greater than 0.02, the R^2 greater than 0.02, and the Q^2 greater than 0.

Table 6 - Hypothesis Test

Hypothesis	f^2	VIF	OS	SD	TS	P	R^2	Q^2	Result
H2 - Overconfidence > Decision	0.173	1.427	0.397	0.066	5.999	0.000	0.294	0.197	Accepted
H3 - Anchoring > Decision	0.027	1.428	0.156	0.059	2.640	0.008			Accepted
H4 - LOSS2> Decision	0.031	1.152	-0.158	0.065	2.439	0.015			Accepted
H6 - Herd Behavior > Decision	0.012	1.192	-0.098	0.065	1.512	0.131			Rejected
H7 - Decision > Performance	0.361	1.000	0.515	0.058	8.870	0.000	0.262	0.191	Accepted

OS = Original Sample; SD = Standard Deviation; TS = T-statistics; P = P-value; R^2 = Adjusted R^2.

5 DISCUSSION

Disposition and Representativeness did not present adequate values for convergent validity. Thus, we decided to remove the constructs from the model. These changes in the model make it impossible to test hypotheses 1 and 5 of the study due to the non-convergence of the constructs' quality. The remaining hypotheses 2, 3, 4, 6, and 7 were tested and the discussion of their results is presented in sequence.

Hypothesis 2, which inferred a positive influence of the Overconfidence construct on decision-making, was accepted. Tversky and Kahneman (1981) show that the behavior related to overconfidence induces the investor to feel more secure with his actions and knowledge, transmitting this feeling to his decisions when choosing financial assets. Overconfidence is a heuristic that should be taken very carefully, because the investor may have both satisfactory or unsatisfactory results, however, what will differentiate satisfactory decision-making from an unsatisfactory one will be caution, the constant study of the Financial Market, self-control over decision-making, and of course, decision-making for medium and long term. Therefore, the Overconfidence bias has a positive result on decision-making.

Hypothesis 3, which exposes the influence of the Anchoring construct on decision-making, was accepted. The study's results showed that Anchoring has a positive influence on decision-making. Tversky and Kahneman (1975) point out that investors tend to have an initial idea before the fact occurs, in the Financial Market this appears when the investor determines a price based on past information or not, or in an analyses process to make decisions, however, these prices and processes will adjust over time. Therefore, the contradiction of this hypothesis shows that establishing the value of an asset based on past information positively impacts the decision-making process.

However, the investor must be very careful when making a decision based on the Anchoring bias, since these references do not always correspond to relevant or correct information to generate correct decisions; another issue is that investors should avoid getting "stuck" with initial information, and ideally should seek to constantly update themselves in the Financial Market. Therefore, the Anchoring bias had positive results in the decision-making of the surveyed investors.

Hypothesis 4, which exposes the influence of the Loss Aversion construct on decision-making, was accepted. Kahneman and Tversky (1979) present that the behavior related to Loss Aversion refers to the human being's tendency to give much greater weight to lose than to gain, interpreting gains and losses in different ways. In such a way, people would not be afraid of taking risks, but rather, of losing. However, there is an important peculiarity to be observed: if the investor suffers a loss, there will be a reversal of perspective, and he will tend to experience greater risk aversion. Therefore, investors need to analyze with caution the buying and selling of stocks in moments of euphoria or discouragement, as it will negatively influence the results achieved. Therefore, the loss aversion bias had negative results in the decision-making of the surveyed investors.

Hypothesis 6, which inferred the influence of Herd Behavior on decision-making, was rejected. Silva (2010) argues that Herd Behavior is involuntarily detected when an investor decides to follow the decision of a group of investors, which he believes to be better informed, instead of relying on his perceptions and information. In the case of the present study, the herding effect did not prove to be important in the decision-making of the investors in the sample. The analysis of the results showed that the decision of choosing to buy and sell financial assets, by other investors, impacts either positively or negatively on the decision of the respondents.

Other studies also did not find evidence supporting the existence of a significant influence of Herd Behavior on investor behavior (Kanojia *et al.*, 2018; Alquraan *et al.* 2016). We believe that one of the reasons for the impossibility of detecting a significant influence from the Herd Behavior may be related to the non-segmentation of the sample for the analysis of the constructs' effects on their decision-making processes. Studies with results that support the occurrence of Herd Behavior had their sample segmented to run the analysis (i.e. Bosch and Smimou 2022). Segmenting the sample is important since some investor profiles are more likely to be influenced by Herd Behavior than others - such as inexperienced traders or investors with a low level of instruction and financial education.

Inexperienced traders will be more likely to seek advice from other investors to develop their investment strategies (Sahi and Arora, 2012), so the less knowledge an investor has about the market, the more easily that person will be influenced by the Herd Behavior. Meanwhile, the level of education exerts an influence, since more educated investors may have easier access to good quality financial information, or because when they receive new information they will also have a greater ability to assess and judge its quality, which results in an improvement in the factors of their decision process (Metawa *et al.*, 2019).

In addition to these issues, in Metawa *et al.* (2019) it appears that age, gender, education level, and experience in the financial market also influence the investment decision. Our sample has a little diversified audience, with more mature, experienced investors with a higher level of formal education. A more diversified sample would help to understand whether Herd Behavior is not influential in the decision-making process of Brazilian investors.

In sum, it is necessary to be careful with excesses, and it is not recommended to make decisions based solely on the behavior of other investors, just as it is not recommended to make decisions based solely on one's information and knowledge, completely ignoring the behavior of other investors in the market. Also, it is important to remember that there are other factors besides the heuristics analyzed here that can interfere with the investors' behavior. Such as the exponential growth of the internet generating easy access to a large collection of information that can interfere with the investor's decision-making process, which can mitigate or strengthen the heuristics influence.

Furthermore, there are intrinsic characteristics of each person that will lead to different profiles of investors, who will buy different types of stocks, will use different sources of information, and will behave differently (Wood and Zaichkowsky, 2004), with no right or wrong style. For that reason, we suggest that investors learn how to reconcile the types of information available for their decision-making process, avoiding attachment to only one type.

Finally, hypothesis 7, which claims the influence of decision-making on performance, was accepted. Nofsinger (2006) states that the behavior related to decision-making can be influenced by psychological biases, and it is important to identify these biases so that one can reduce the risks in the decision-making process. Thus, the acceptance of this hypothesis shows that the investor is influenced by heuristics in financial decision-making.

Our results in hypothesis 7, the verified positive influence of decision-making affected by heuristics on investor performance, are in agreement with the study of Sahi and Arora (2012), where investors influenced by biases also showed financial satisfaction. In theory, letting heuristics affect the decision process should generate bad results, such as increased market volatility. Though, we need to study more about the biases that affect the investor's decision-making process to understand if there is any indication of when and why a bias will affect it in a harmful way, as there is evidence that the presence of bias can also return as a positive financial result for the shareholder.

6 CONCLUSIONS

Regarding the analysis of heuristics, the results of the study show that the constructs Overconfidence and Anchoring exert a positive influence on investor decision-making, the heuristic Loss Aversion exerts a negative influence on investor decision-making and the heuristic Herding Effect showed no importance in decision-making by the investors surveyed. Again, the hypotheses concerning the Representativeness and Availability heuristics could not be tested because the constructs did not have convergent validity. Regarding decision-making, the results indicate that investors feel secure in the attitudes taken related to financial decisions. In the analysis of the effect of decision-making on investors' performance, the results related to the decisions made about their financial investments were positive.

The decisions made about the financial market show that investors' decisions are not always rational, because they can be affected by biases that lead to irrational decisions, something verifiable through the results of this study. Thus, our study seeks to contribute to the investigation of how heuristics influence the decision-making process of investors and their financial results, generating information about the decision-making process of these economic agents. It is also believed that the data collected can contribute to subsidizing actions in decision-making in an extremely volatile and competitive market, in which financial decisions change quickly according to the "mood" of the market, enabling the development of more effective plans and strategies for the financial decision-making of investors.

So through our study results, Brazilian investors can identify these biases in their financial behavior, and understand more about how these factors can influence their investment decision-making. From the academic point of view, the article brings contributions to the financial behavior of investors in the decision-making process with information about how heuristics impact this process, as well as in helping to understand these "pocket rules". The questionnaire used is a working tool that can be optimized by other researchers based on the limitations present here and used in future studies.

Thus, it becomes fundamental to clarify some adversities that limited the development of the study. First, is the non-measurement of the Representativeness and Availability constructs, making it impossible to evaluate the influence of the probabilities of past events occurring in the future and of excessive information about the financial market affecting investment decisions. Also, the analysis was not segmented based on the investment style profile of the sample or sociodemographic information, which would make it possible to verify the validity of the argument that more inexperienced and less educated investors are more likely to be influenced by the Herd Behavior.

Furthermore, the results presented are based on a small sample of the universe of Brazilian investors, not allowing the generalization of the findings, being recommended in future studies the attempt to collect a more significant sample or apply an already delimited model seeking to observe a specific group. Related to this suggestion, it is also proposed for future investigations the sample discrimination based on information about the sociodemographic profile, with the possibility of identifying whether there are specific characteristics of gender, age, or region in Brazilian investors that affect their decision-

making process. In addition, another possible path for future studies is to evaluate the financial behavior of investors by analyzing the types of traders - for example, Day trading, Swing Trading, Position Trading, and Buy and Holder), which could allow a more accurate assessment of the heuristics influences on the decision-making and performance of each type of trader, also enabling comparisons to be made.

Future studies could try to collect data from the Brazilian stock market (B3) for more accurate performance data. As well as try to replicate the study instrument over some period to identify whether the influence of heuristics in decision-making changes. Lastly, as already mentioned, we could not analyze the influence of two heuristics of the six elected in this study. Thus, studies can expand the number of heuristics analyzed in their model (i.e., Conservatism; Regret Aversion; Mental Accounting; Cognitive Dissonance; Mood Bias; Cultural Bias) with a larger sample size for the different groups of investors present in the financial market.

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