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The Impact of Perceived Inflation on Cognitive Bias and Irrational Reasoning

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Master Thesis

presented as partial requirement for obtaining a Master's Degree in Data-Driven Marketing

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação

Universidade Nova de Lisboa

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Irrational Reasoning**

by

Laura Medalho Crisóstomo

Master Thesis presented as partial requirement for obtaining the Master's degree in Data-Driven Marketing, with a specialization in Marketing Research & CRM.

Supervised by

Professor Diana Orghian, PhD

July, 2024

STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism, any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

Lisbon, 15th July 2024

DEDICATION

This work is dedicated to my father, who with all his support, accompanied me through this process. For being a daily example of an exceptional, respectful, persistent worker and the most concerned and caring father. And especially for never allowing me to consider giving up, his belief in me provided the motivation and energy I needed to reconcile my personal, professional and academic life during these two years.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to Professor Diana Orghian for the invaluable opportunity to work and learn under her guidance. I deeply appreciated her constant support throughout this project, as she was always ready to assist me and address all my questions. She was constantly reassuring me and my colleagues and helping us to have a simpler and calmer perception of each phase of this journey.

Furthermore, I would like to extend my thanks to my friends and my boyfriend for their friendship, affection and encouragement, as well as for their patience and understanding when I was unable to be as present as I would have liked.

Lastly, I must also express my deepest gratitude to my family, especially my mum, dad, sister and grandparents for being a constant support, encouraging me to always be a better version of myself but loving all my versions unconditionally. Without their support, no achievement would be as gratifying.

ABSTRACT

As humans, we are prone to making irrational decisions, influenced by cognitive biases that affect our everyday decisions, shaping our judgments and actions in ways that are often difficult to recognize. Nevertheless, the field of behavioral economics enables us to identify these biases and to develop strategies for making more rational decisions. In periods of economic crises, conscious decision-making is even more important. Therefore, the objective of this research is to provide an answer to the following question: Does the perceived effect of Inflation influence consumers' reasoning? To achieve this purpose, a survey was conducted on a sample of 317 respondents. Each individual was questioned on the impact of inflation on their lives, after which they were presented with multiple problems used in the literature to uncover cognitive bias. The following cognitive biases were considered: mental accounting, endowment effect and anchoring. The objective was to test whether individuals who perceived that their lives had been affected by inflation exhibited distinct responses to the problems presented, compared to those who had not.

KEYWORDS

Cognitive Bias; Behavioral Economics; Inflation; Irrationality; Consumer Behavior.

Sustainable Development Goals (SDG):

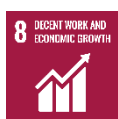


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LIST OF ABBREVIATIONS AND ACRONYMS

WTP	Willingness to pay
WTA	Willingness to accept
UN	United Nations
INF	Inflation
EE	Endowment Effect
MA	Mental Accounting
A	Anchoring
AVE	Average Variance Extracted

1. INTRODUCTION

What motivates people to buy the things they buy? According to traditional economics theory, all consumers rationally choose the optimal combination of products and services that maximize their satisfaction (Reisch & Zhao, 2017). An individual should only buy a 2-euro gelato in case that is the best option to use that money (Thaler, 2015). However, consumer decision-making is much more complex, individuals are in fact irrational, impulsive and their judgments and decisions are often subject to systematic biases. Cognitive biases are systematic errors in human thinking that can lead to irrational decisions (Kahneman & Tversky, 1973).

It has been demonstrated that individuals exhibit even less rationality when financial considerations are involved in decisions (Ariely & Kreisler, 2018). There are notable discrepancies between how individuals believe they utilize money, how they actually utilize it, and how they should utilize it rationally (Ariely & Kreisler, 2018). Furthermore, environmental factors, such as inflation, also significantly affect consumers' perception of pricing (Estelami, Lehmann & Holden, 2001). Given these insights, it is crucial to comprehend the manner in which the current economic conditions in Portugal, the increase of inflation rate, influence consumer reasoning. The research questions guiding this study is: Does the perceive effect of Inflation influence consumers' reasoning?

This study investigates the relation between inflation and the predisposition to be influenced by cognitive bias. Since behavioral economics has demonstrated that there are predictable ways in which humans are irrational (Ariely, 2008), it is crucial to recognize and understand these patterns of irrationality, in order to make more rational, well-informed and long-term decisions. The manifestation of irrational thinking and the influence of cognitive bias can result in actions and real decision-making. In a socio-economic context characterized by a high rate of inflation and financial difficulties, it is of extreme importance to educate individuals on making more sustainable, conscious and informed purchasing decisions. With this information, individuals can make more prudent financial decisions (Ariely & Kreisler, 2018).

This paper begins with a literature review that examines existing research and theoretical frameworks related to behavioral economics, the cognitive bias that will be explored in the research model and the potential connection of this field with economic Inflation. The Methodology section details the research model and the data collection method used. Subsequently, the empirical study chapter describes the data treatment applied and the sampling profile acquired. In the Results and Discussion section, a detailed description of the data analysis process is presented, and the findings of the study are interpreted. The paper concludes with a conclusion that summarizes the key findings, acknowledges the study's limitations, and suggests directions for future research.

2. LITERATURE REVIEW

2.1. NEOCLASSICAL ECONOMICS VS BEHAVIORAL ECONOMICS

Economics has traditionally focused on neoclassical theories. However, with the integration of insights from psychology, behavioral economics has emerged by showing that people often act irrationally due to biases, emotions, and social influences, deviating from the rational model.

The school of neoclassical economics believes that Homo economicus are rational individuals who always seek to maximize their utility, given their budget constraints. These individuals are constantly pursuing information to determine their best option, by considering all cost and benefits (Reisch & Zhao, 2017).

The traditional theory assumes that consumers carefully select the best combination of goods and services that provides them with the highest satisfaction, within their limited resources. To determine which combination is best, a utility function is applied to compare the different goods in terms of the satisfaction they provide to the consumer. The best option produces more utility than any feasible alternatives (Becker, 1976). By evaluating the utility obtained from each possible combination of goods, consumers can make informed decisions about how to allocate their resources more effectively and maximize their utility.

In the second half of the 20th century, the emergence of behavioral economics was stimulated by several factors. Firstly, the acceptance, by economists, of expected utility and discounted utility models as standard approaches for decision-making (Camerer, Loewenstein & Rabin, 2004). Expected utility model analyses decision-making in scenarios of risk and uncertainty. Economists debated whether the utility scale in the expected utility model would remain consistent in non-risky scenarios (Mongin, 1998). On the other hand, the discounted utility models demonstrates that future satisfaction or benefits are less significant relative to immediate satisfaction or benefits. The attitude of individuals in intertemporal choices contradicts the properties of this model (Lazaro, Barberan & Rubio, 2002).

Furthermore, psychologists also made a big contribution by demonstrating discrepancies between human behaviors and the predictions of utility models. Below, some refutations are briefly described.

Traditional economic theories assume that preferences are complete and transitive, which means that when making a choice, all alternatives can be ranked, and the preferences are consistent. However, psychologists, like Kahneman and Tversky (2013), refuted those assumptions by suggesting that cognitive processes can lead to violations of completeness (Camerer, n.d.). They argued that a choice can be influenced by the way options are described or framed (Kahneman & Tversky, 2013), preferences can reverse depending on how they are

expressed (Slovic & Lichtenstein, 1968) and the appeal of a choice depends on the set of alternatives they are part of (Simonson & Tversky, 1992).

Moreover, it was also revealed that people often deviate from expected utility theory when making decisions involving risk. Prospect theory, proposed as an alternative, assumes that individuals evaluate potential outcomes based on perceived gains and losses relative to a reference point, rather than absolute final outcomes. This reference point is defined based on their expectations, causing gains and losses to be perceived differently depending on it. Another significant feature of the prospect theory is the phenomenon of loss aversion, where individuals experience stronger negative emotions from losses than positive emotions from equivalent gains. Consequently, leading to individuals to be more risk-averse when faced with potential losses compared to potential gains (Kahneman & Tversky, 2013).

To conclude, Bayesian statistical judgment was another model explored by psychologists, suggesting that individuals misapplied rational decision-making principles, leading to phenomena like confirmation bias. This phenomenon refers to circumstances where people are likely to interpret new data in a way that confirms their presumptions, often ignoring or devaluing evidence that contradicts their existing views (Rabin & Schrag, 1999).

As referred previously, all these insights challenge the assumption of rationality in traditional economic models and were crucial in understanding the cognitive processes behind decision-making and human behavior, leading to the development of behavioral economics.

2.2. BEHAVIORAL ECONOMICS

Behavioral economics is a field that combines psychology and economics. It investigates how individuals behave rather than how the traditional utility theory defends they behave (Thorgeirsson & Kawachi, 2013). This field defends that human behavior varies depending on the context, circumstances, location, time, social influences and emotional judgments, which all impact decision-making. Behavioral economists argue that economics can benefit from a psychological foundation, as human decisions are often subject to systematic biases and emotions, leading to predictable irrational behavior (Hurley, 2012). The consequences of these biases result in the formation of a single choice rather than the adherence to the fundamental model proposed by neoclassical economics (Rehman, 2016).

In order to gain a deeper understanding of the systematic biases in human thinking, numerous psychologists and neuroscientists were studying the cognitive system and the way in which the brain processes information to make decisions. The approach they concluded consisted on two-process theories of reasoning (Stanovich & West, 2000), two kinds of human thinking: one intuitive and another reflective and rational. System 1 is called Automatic System and System 2 the Reflective System (Thaler & Sunstein, 2008).

System 1 is responsible for the automatic and heuristic processing of the brain. It is characterized by its largely unconscious and relatively undemanding nature, requiring minimal

or no effort. The capabilities of the brain when utilizing System 1 are derived from associations between ideas, basic skills that have already been acquired, associated knowledge retrieved from long term memory, accessed without any effort or voluntary control (Evans, 1984). Some abilities are innate and obvious for humans, such as the ability to recognize objects and observe the world around us. Others become automatic through time and practice. Some automatic activities attributed to System 1 are: perform a simple mathematical operation $2+2$, understand simple sentences, identify an object, speak the native language.

Conversely, System 2 is distinguished by its analytics and effortful processing. System 2 encompasses the processes of analytic intelligence that have traditionally been the subject of study (Stanovich & West, 2000). It directs attention to demanding cognitive tasks, including complex computations and logical reasoning. The operations of System 2 are frequently associated with the subjective experience of choice and concentration, reflecting a conscious effort to process information. Despite the diversity of tasks managed by System 2, it is always required to maintain sustained attention, which can be easily disturbed when it is diverted. This investment of attention has the effect of improving multiple activities and preventing the expression of many foolish thoughts and inappropriate impulses. This system is essential for tasks that involve deep thinking, problem-solving, and planning, and is therefore associated with a slower and more deductive process (Thaler & Sunstein, 2008). Some examples of activities that require the Reflective System are converting a temperature from Celsius to Fahrenheit, speaking a foreign language, solve a difficult equation and complete a tax form.

The major difference between the two systems is that they result in distinct types of task construal. System 1 is associated with emotional responses, whereas System 2 is associated with analytic responses.

System 1 functions automatically, without interruption, and continuously generating suggestions for System 2, including impressions, intuitions, intentions, and feelings. Once endorsed by System 2, impressions and intuitions become beliefs, and impulses turn into voluntary actions. Typically, System 2 accepts the suggestions of System 1 without significant modification. Individuals typically do trust their impressions and act on their desires. However, when System 1 identifies difficulties, it requests that System 2 engage in more detailed and specific processing in order to solve the problem. This occurs when System 2 is mobilized to address questions for which System 1 has no immediate answer. Although the majority of the thoughts and actions of System 2 are derived from those of System 1, System 2 intervenes when challenges arise, ensuring an efficient division of labor that minimizes effort and optimizes performance (Kahneman, 2012).

In conclusion, it is evident that there are inherent limitations associated with the fast and intuitive cognitive processes of System 1. The speed and efficiency associated with System 1 thinking often requires generalization and neglect of important information. Cognitive biases arise from the fact that System 1 is constantly evaluating situations and connecting it to

previous experiences. While can be very efficient, most of the times fails to fulfil the requirements of utility theory in predictable ways (Ehrlinger, Readinger & Kim, 2016).

2.3. COGNITIVE BIAS

Cognitive biases are systematic errors made by humans when making decisions, leading to irrational choices. Rational decision-making methods, such as mathematics, utility theory, are incapable of solving natural adaptive problems due to these biases, which highlight the irrationality of human behavior (Cosmides & Tooby, 1994). However, humans are not only irrational but predictably irrational. Irrationality occurs in consistent patterns, neither random nor senseless. It is systematic and predictable because people repeat those decisions consistently (Haselton, Nettle & Andrews, 2015). When making predictions and judgments under uncertainty, we rely on a limited set of heuristics and cognitive biases that sometimes produce reasonable judgments but often lead to serious and systematic errors (Kahneman & Tversky, 1973).

Understanding how we are predictably irrational provides a starting point for improving our decision-making and changing the way we live for the better (Ariely, 2008). Of the countless biases of which a human being is subject, three will be described in detail above due to their impact on the study presented.

2.3.1. MENTAL ACCOUNTING

Mental Accounting proposes that individuals use cognitive categories or “mental accounts” to divide their money, track their spendings and manage their consumption (Cheema & Soman, 2006). Researchers by investigating mental accounting were able to explain the process of multiple consumer spending behaviors (Levav & McGraw, 2009), such as savings, (Shefrin & Thaler, 2011), borrowing and debt (Hirst, Joyce & Schaedewald, 1994), the effects of payment on consumption over time (Gourville & Soman, 1998) and many others. Those studies prove that these cognitive process allows people to manipulate budgetary mental accounts and justify desirable expenses (Cheema & Soman, 2006).

Mental Accounting violates the economic principle that money is fungible, whereby any piece of money can be replaced by another piece of the same amount. A 10 euro bill is as valuable as any other 10 euro bill (Ariely & Kreisler, 2018). Nevertheless, the value assigned to money is not always consistent, it depends on the category to which the bill is assigned.

In theory, all economic decisions are made on the basis of opportunity costs, even relatively small transactions (Thaler, 2015). Consequently, when making a decision, it is of crucial importance to consider all the other options on which the same amount could be spent. To illustrate, in the case of a game ticket costing 100€, the cost of that ticket represents the value of the alternative uses to which that money could be used on. In the neoclassical economic theory, individuals should only go to the game if it represents the optimal use of that money

(Thaler, 2015). However, it is evident that individuals do not systematically consider all possible options or the value they ascribe to them. Rather, individuals categorize money into mental categories as a quick and easy way to classify it and the amount they are willing to spend (Ariely & Kreisler, 2018).

Mental accounting is frequently linked to budget categorizations and savings. It is common scenario for individuals who divide money by spending categories, like groceries, entertainment, travels, treating it as interchangeable (Ariely & Kreisler, 2018). However, the mental accounts created by individuals can be attributed to several factors, including the source of the money, the feelings it evokes or the subjective value of products. These factors will consequently influence the way in which the money is spent.

Consumers typically categorize their mental accounts according to the context in which the money was obtained. However, the concept of emotional accounting was introduced to explain situations in which money is labelled by the feeling it transmits (Levav & McGraw, 2009). The intensity of those feelings will markedly influence the way that money is spent.

Considering the example of funds received from a life insurance policy, it is evident that the emotional association of that money will be closely linked to feelings of sadness and grief at the loss of a loved one. The money itself would be negatively tagged and these feelings would influence the way in which the money is used. Consumers tend to experience more intense negative emotions than positive. Consequently, in the event of a negatively tagged money supply, consumers normally avoid expending it on hedonic products (Levav & McGraw, 2009). Their coping mechanism is to spend on virtuous products, such as altruistic helping or utilitarian products that provide functional benefits. These products represent a long-lasting benefit, a virtuous investment (Wertenbroch, 1998).

Another instance in which mental accounting is likely to occur is when a product is purchased and consumed at different moments. In such situations, the value of the product may change between the time of acquisition and consumption, dependent upon a multitude of factors, including market value, the cost of money, the consumer's opinion and appreciation.

To illustrate, consider the case of a bottle of wine purchased years ago for 20 euros. The price associated with consuming the bottle in the present for the majority of individuals is negligible, as the cost was incurred years ago. Alternatively, if the bottle has appreciated in value, many consider it a money-saving event. It is considered as the closure of the wine account (Shafir & Thaler, 2006).

However, the valuation of the products also depends on the items' history, their purpose and the intention of the owner. Considering the scenario in which, rather than consuming the bottle, it is accidentally dropped and broken. In this instance, the intended purpose of the bottle was not fulfilled, as it was broken and not consumed (Shafir & Thaler, 2006). In this case, most individuals would consider the cost of the bottle to be the cost of replacing the

bottle at the present time. This example demonstrates that mental accounting can be flexible, and the value of a specific item is very subjective, contrary to the traditional theory of opportunity cost.

It is of major importance to highlight the potential benefits of mental accounting for consumers, particularly in the context of savings. By allowing individuals to compartmentalize their money, mental accounting can help to reduce the cognitive costs associated with decision-making, as well as the time spent on such decisions. Furthermore, it supports the management of self-control problems (Thaler, 1999) . Nevertheless, it can also result in suboptimal decision-making.

2.3.2. ENDOWMENT EFFECT

Kahneman and Tversky's (2013) work on prospect theory which refuted the foundations of rational economic theory, Bernoulli's model. As previously stated in sub-chapter 2.1, prospect theory demonstrates that when directly compared, losses are perceived as more significant than gains. In the real world, many situations are essentially mixed, presenting both potential for loss and the possibility of gain (Kahneman, 2012).

When presented with a choice between a gamble where there is a 50% chance of losing \$100 and a 50% chance of winning \$150, people tend to reject the gamble. The fear of losing \$100 is more intense than the hope of gaining \$150 (Kahneman, 2012). The rejection of this gamble can be attributed to System 2, although the critical inputs are generated by System 1. From numerous observations, it was concluded that losses are perceived as more significant than gains, and that individuals exhibit a loss aversion tendency.

In the face of situations characterized by risk and uncertainty, individuals typically opt for the status quo, their current conditions (Samuelson & Zeckhauser, 1988), even in case better conditions are available. The concept of status quo bias is a normal consequence of loss aversion. This is because the fear of losing one's current conditions appears to be a more significant factor than the potential benefits (Kahneman, Knetsch & Thaler, 1991).

The cognitive processes mentioned above are consequences of the endowment effect bias. To demonstrate this point, consider the following example. An individual was not willing to pay, WTP, more than €35 for a specific bottle of wine. He would neither purchase nor sell the item at prices between €35 and €100, respectively (Kahneman, 2012). According to the economic theory, the WTP amount, and the willing to accept, WTA, amount should be identical. If the value of the bottle were perceived to be 50 euros, the individual would be willing to sell it for any amount greater than 50 euros and would be willing to pay 50 euros. However, WTA amount (100 euros) is considerably higher than the WTP (35 euros). This phenomenon can be explained by the endowment effect, which posits that individuals tend to overvalue items they possess (Thaler, 2015). The concept of prospect theory posits that when an individual owns an item, the pain of giving it up is perceived to be related to an emotional attachment. If he does not possess it, he considers the pleasure of acquiring it

(Thaler, 2015). This example demonstrates the tendency of individuals to remain in their status quo with aversion of losing their conditions and advantages.

2.3.3. ANCHORING

Anchoring bias is a cognitive process in which individuals become influenced by factors that should not be relevant for the decision (Ariely & Kreisler, 2018). This initial piece of information is a starting point that has been anchored. For example, when purchasing a soda, the WTP amount is approximately 1 euro. The consumer is not considering the value proposition of the product or its opportunity cost, instead, they are linking it with the price typically associated with soda. This irrational attitude contradicts the principles of the law of supply and demand, which stipulate that individuals should consider the value of a product and the opportunity cost of that money, rather than the selling price (Ariely & Kreisler, 2018).

An anchor affects the most diverse financial decisions and is typically influenced by a starting point. This influence can be derived from external sources, as in the case of herding, or from personal experiences, which is considered self-herding. Herding is a phenomenon in which individuals make assumptions based on the opinions and reviews of others. This can result in the assuming that a particular product is of high quality, based on the opinions of others who have purchased and used it.

Furthermore, self-herding can be a more dangerous phenomenon. This phenomenon occurs when individuals base their current decisions on their own past behaviors, assuming that a product has high value because they valued it highly in the past. Individuals tend to trust blindly their own decisions and attitudes. In the event that an individual purchases an item at a specific price, that price becomes associated with a positive decision and serves as a starting point anchor for future decisions on similar products. To illustrate, an individual who has previously spent four euros on a coffee is more likely to repeat this action in the future. Such individuals have previously made a similar decision. Consequently, they are likely to repeat it as they have a memory of the experience and trust their own decisions. Nevertheless, this hasty decision to rely on previous experience prevented them from analyzing the other options available to them. A single, one-time decision that leads to a process of self-herding and the formation of a cycle of incorrect valuation. This phenomenon is also associated with confirmation bias. When individuals make new decisions, they tend to reinforce previous ones (Ariely & Kreisler, 2018).

These effects are particularly pronounced when there is lack of knowledge about a product. The less knowledge a consumer has, the more depend consumers are on anchors (Ariely & Kreisler, 2018). When a new product or service is introduced to the market with no established market value, anchoring effects are especially strong. On the other hand, when there is knowledge and information about the product, it is harder for anchors to influence decisions or price perception.

An anchor can be defined as an influence derived from a variety of sources, including a perceived price or an external source. The anchor can be anything no matter how random. As a case study, consider the experiment in which a group of students was asked to write down the last two digits of their social security number and then compare this value with the price of certain products (Ariely, 2008). The extracted number was completely arbitrary and had no unrelated to the product in question. Nevertheless, it was demonstrated that this value did influence the estimate. As an anchor, this value influenced this estimate and future consumer decisions, despite being a random number. This long-term impact is referred to as arbitrary coherence (Ariely & Kreisler, 2018). It demonstrates how initial prices, even if randomly set, become powerful reference points that influence future financial decisions (Ariely, Loewenstein & Prelec, 2003).

In these cognitive processes, individuals frequently estimate by initially setting an initial value and then adjusting it mentally until they reach a final estimation (Tversky & Kahneman, 1974). This implies that different starting points result in disparate estimations. Several studies have been conducted to investigate the impact of plausible and implausible anchors on estimation. The results of these studies have demonstrated that implausible anchors can have a significant effect on estimation (Mussweiler & Strack, 2001).

Considering the estimation of annual temperature in Germany. In order to make a comparison between this target and 65°F, it is necessary to have specific knowledge of the temperature of Germany. This anchor can be considered within a plausible range of probabilities for Germany's annual temperatures. Consequently, further detailed knowledge is required to enable a comparison to be made with the real value. Conversely, when the target is compared to 300°F, it becomes evident that these anchors lie outside the normal probability distributions of the annual temperature of Germany. In the presence of an implausible anchor individuals will typically make a judgment based on a broader category. In this instance, it would be relatively straightforward to define that the temperature is below 300°F, given that such a value is not considered acceptable for temperatures on Earth. Furthermore, it has been demonstrated that the use of plausible anchors facilitates the accessibility, speed and accuracy of predictions (Mussweiler & Strack, 2000).

2.4. INFLATION AND PRICE PERCEPTION

The cognitive biases described in sub-chapter 2.3 have been demonstrated to significantly impact the consumer reasoning.

Money possesses properties that make it unique and essential for any individual. Its value is universal and it can be used in the present or the future without ever losing its value, in contrast to any material good (Ariely & Kreisler, 2018). This characteristic makes it particularly valuable for the most diverse fields. Pricing significantly impacts consumer buying behavior and it is the primary objective of marketing to understand the processes by which consumers form their price perceptions (Zhao, Yao, Liu & Yang, 2021).

It is proven that people are less effective at all kinds of problem-solving when there is money issues on their minds (Ariely & Kreisler, 2018). Financial difficulties can influence critical thinking processes through various pathways, resulting in significant implications for decision-making and overall life outcomes (Bertrand, Mullainathan & Shafir, 2006). It is therefore of major importance to discuss savings, financial habits, the comprehension of money behaviors and how irrational individuals behave when making decisions. The acquisition of knowledge on these topics can facilitate the formulation of more prudent financial decisions.

As previously stated in sub-chapter 2.3.3, when there is a lack of knowledge regarding a product, market price or economic factors, we are consequently more subject to the influence of cognitive bias. Consequently, those cognitive biases can lead to poor decision-making.

During periods of economic difficulty, individuals are no less susceptible to irrationality and the influence of cognitive biases than the general population. In fact, they are more likely to be affected by these factors, and therefore, less able to cope with the consequences of their actions. In such circumstances (Bertrand et al., 2006), the mentioned cognitive processes and poor decisions have a greater impact on individuals' lives.

Inflation has a substantial impact on consumer price knowledge. As inflation rate increases, the variability of prices rises, making it challenging for consumers to obtain and retain accurate price information. This instability serves to further diminish consumers' desire to engage with and learn about prices, thereby establishing a negative correlation between inflation rates and consumer price knowledge (Estelami et al., 2001). Consequently, pricing strategies that explore this lack of consumer awareness and knowledge become more effective in high-inflation conditions. Overall, inflation and economic instability present significant challenges to consumers' ability to maintain accurate price knowledge, impacting their reasoning.

In March 2024, the monthly inflation rate in Portugal was 2.6%¹, while in the Eurozone it stood at 0.8%². This indicates that inflation in Portugal increased by approximately three times more than the Eurozone average, thus highlighting Portugal as the country with the highest price increase. The unfavorable economic context has had a considerable impact on Portuguese families. The 2023 annual barometer revealed that 75% of families reported experiencing difficulties in meeting their financial obligations, with 7% indicating that they were in a critical situation³.

It is crucial to acknowledge that previous research has demonstrated a correlation between inflation and lack of price knowledge (Estelami et al., 2001). In the absence of price knowledge, individuals are more susceptible to biases such as mental accounting, the endowment effect

¹ <https://bpstat.bportugal.pt/conteudos/noticias/1299>

² <https://ec.europa.eu/eurostat/web/products-euro-indicators/w/2-03042024-ap>

³ <https://sicnoticias.pt/economia/2024-03-20-Tres-em-cada-quatro-familias-portuguesas-enfrentaram-dificuldades-financeiras-em-2023-4ba8dd29>

and anchoring (Ariely & Kreisler, 2018). The objective of this study is to investigate whether the current financial situation in Portugal, derived from the increase in the inflation rate, has influence on the cognitive processes and underlying reasoning.

For the purposes of this investigation, the following hypotheses are presented:

Hypothesis 1: The perceived negative effect of Inflation has a positive impact on Mental Accounting bias.

Hypothesis 2: The perceived negative effect of Inflation has a positive impact on Endowment effect bias.

Hypothesis 3: The perceived negative effect of Inflation has a positive impact on Anchoring bias.

3. METHODOLOGY

3.1. RESEARCH MODEL

The present study aims to understand how the perceived impact of inflation has impacted people's reasoning and made them more susceptible to the influence of cognitive biases such as mental accounting, endowment effect and anchoring.

In order to evaluate the perceived impact of inflation on each individual's life, the participants were presented with seven questions. The questions inquired about the influence of inflation on the cost of living, personal budgets, and whether spending habits and the quality of life had suffered alterations. Additionally, the participants were also questioned whether they started to have a tendency towards seeking the cheapest products and services, and whether they had to give up on certain leisure activities. Finally, it was also asked whether the persisting influence of inflation on their lives constituted a source of concern. The questions presented a series of scenarios that facilitated an analysis of the impact of inflation on the lives of the participants.

For each bias, three problems of the specific cognitive bias in question were presented, corresponding to three items in the analysis. The problems used in the study are presented in table 3.1.

Table 3.1 – Dependent variables

Dependent Variables	Items	Description	Authors
Mental Accounting	MA1	Theater ticket	(Ariely & Kreisler, 2018)
	MA2	Bordeaux wine	(Shafir & Thaler, 2006)
	MA3	Basketball game	(Kahneman, 2012)
Endowment Effect	EE1	Wage adjustments	(Kahneman et al., 1991)
	EE2	Sold-out concert	(Kahneman, 2012)
	EE3	Shortage of automobile	(Kahneman et al., 1991)
Anchoring	A1	Mississippi River	(Mussweiler & Strack, 2000)
	A2	African Nations in UN	(Tversky & Kahneman, 1974)
	A3	Mahatma Gandhi age	(Mussweiler & Strack, 2001)

Hypothesis 1: The perceived negative effect of Inflation has a positive impact on Mental Accounting bias.

The initial problem is a hypothetical scenario in which an individual attends a theatrical performance to the hottest new Broadway show, for which he has spent 100€. On the opening

day, upon arriving at the theater, the ticket was lost. Luckily, there is another 100€ bill available in the wallet. The decision is made to buy a replacement ticket.

It is now necessary to consider a different scenario on the day of the show. The individual had not purchased a ticket previously. When arriving at the theater, it is discovered that one of the two 100 euro bills in the wallet is missing. Despite the loss of 100 euros, another 100-euro bill remains. In both cases, the total cost for that night would also be considered.

Facing the second scenario, most individuals would consider the loss of a 100-euro bill to be a separate issue from the decision to attend the theatre. When money is lost from one's wallet and it is not classified in a specific budget category, people do not tend to perceive a need to punish any particular budget category, it belongs to different mental accounts. This implies that, in this instance, there was still money in the theatre budget account, and thus most people would not refrain from attending the show. Although individuals may exhibit disparate responses to these two scenarios, from an economic perspective, they are equivalent. In both scenarios, there is a plan to attend a performance, and a loss of a value of 100 euros (Ariely & Kreisler, 2018). According to the economics' theory, individuals who considered the cost of the night in both scenarios to be 200 euros are behaving rationally.

The second problem is the case of an individual who purchased a case of fine Bordeaux wine for 20 euros per bottle. In the present, the wine is auctioned at approximately 75 per bottle. Faced with the decision to drink a bottle, different perspectives on the cost emerge. For some, (i) the cost might be perceived as 0 euros, considering the purchase was made in the past and the expense has already been incurred. (ii) Others might consider the cost to be the original purchase price of 20 euros. (iii) An alternative perspective would be to consider the cost as 20 euros plus interest. Meanwhile, (iv) other respondents would equate the cost to the current market value of 75 euros, reflecting the potential revenue if the bottle were sold instead. Lastly, (v) the cost as -55 euros, reasoning that drinking a bottle worth 75 euros, which was purchased for only 20 euros, represents a saving of 55 euros (Shafir & Thaler, 2006). From an economic theory perspective, individuals who consider option (iv) are correct as the opportunity cost of drinking the wine is the possibility of selling it at that price (Thaler, 2015). Mental accounting is the tendency of individuals to mentally compartmentalize money based on diverse factors, such as the source, use or experiences. Individuals who would select other option besides (iv) are demonstrating mental accounting biases. In option (i), the cost of the wine bottle is set as already paid, therefore drinking it is free. Option (ii) and (iii) focus on the initial purchase without considering the current market value and the potential opportunity cost, solely considering the sunk cost of the wine. Finally, option (v) is where the individual identifies the consumption of the expensive bottle of wine as a cost-saving, as it was obtained for a lower price than its current market value. This option does not consider the opportunity cost of selling the wine at its market value.

The final problem of a mental accounting bias is the case of two avid sports fans who have made plans to travel 40 miles to attend a basketball game. One of these fans purchased his ticket in advance, while the other fan received a free ticket from a friend just the moment, he

was about to buy one. However, on the night of the game, a blizzard is forecasted. The question arises as to which of the two ticket holders is more likely to brave the harsh weather conditions and travel to see the game. According to behavioral economics principles, the likely answer is the fan who paid for his ticket. This prediction is based on the concept of sunk costs, whereby individuals are more inclined to go through with an activity if they have already invested money into it, even in adverse conditions. In opposition, the individual who received the ticket free of charge has not made a financial investment. A Neoclassical Economist would realize that the cost of the ticket is sunk and the fact that the ticket was bought would be irrelevant (Kahneman, 2012).

Hypothesis 2: The perceived negative effect of Inflation has a positive impact on Endowment effect bias.

The first problem that illustrates the cognitive bias known as the endowment effect considers two scenarios in which economic conditions influence perceptions of corporate decisions on wage adjustments. In the initial scenario, a company with a small profit in a community experiencing high rates of unemployment, but no inflation, decides to reduce wages and salaries by 7 percent. Other studies have demonstrated that this action is perceived as unfair by the majority of individuals (Kahneman et al., 1991). In the second scenario, the same company, now situated in a community with a high unemployment rate and 12 percent inflation, decides to increase wages by only 5 percent. In this instance, despite the wage increase being below the inflation rate, it is perceived by the majority as acceptable (Kahneman et al., 1991). From an economic standpoint, the two examples are extremely similar. In both cases, there was a reduction in wages of 7% decrease. However, the irrationality of individuals led them to consider the two cases to be different. In the first case, the wage cut is presented as a nominal loss, whereas in the second case, it is presented as a wage increase. The phenomenon of loss aversion provides an explanation for the divergence in opinions observed in the two scenarios.

In the second case, an individual holds a ticket to a sold-out concert by a popular band, originally purchased at the regular price of 200 euros. As an enthusiastic fan, he values the ticket highly and would have been willing to pay up to 500 euros for it. Upon obtaining the ticket, it is discovered through online sources that wealthier or more desperate fans are offering 3000 euros for the same ticket. He must decide whether to sell the ticket for a significant profit or to attend the concert (Kahneman, 2012). Economists posit that the opportunity cost of attending the concert is 3000 euros. It is therefore recommended that individuals attend the theatre only if it represents the best possible use of that amount. However, it is unlikely that many people would be willing to sell their tickets. In this case, the individual is only WTP 500 euros for the tickets yet is struggling to determine whether he is WTA 3000 euros. This demonstrates an endowment effect bias.

Lastly, a problem is provided to illustrate a shortage of a popular automobile model. In the first scenario, customers must wait for two months for delivery, and a dealer who previously sold the cars at the list price increases the price by 200 euros above the list price. A previous study has concluded that the majority of respondents consider this case to be unfair (Kahneman et al., 1991). In the second scenario, with the same waiting period, a dealer who had previously been selling the cars at a 200 euros discount below list price now adjusts the price to list price. In response to this scenario, a greater proportion of respondents found it acceptable (Kahneman et al., 1991). This example is similar to the first, that concerns salary adjustments. This allows us to conclude once again that the imposition of a surcharge, which is perceived as a loss, is considered more unfair than the elimination of a discount, which is seen as a reduction of a gain (Thaler, 1980)

Hypothesis 3: The perceived negative effect of Inflation has a positive impact on Anchoring bias.

The initial problem of the cognitive process of anchoring was based on the estimation of the length of the Mississippi River. The participants were requested to compare the length of the Mississippi River with a plausible anchor value of 2000 km and an implausible anchor value of 30000 km. The participants were then asked to indicate whether the Mississippi River is longer or shorter than the respective anchor value. Subsequently, participants were asked to provide an estimation of the length of the Mississippi River. The plausible anchor value is related to the length of the Mississippi River, requiring a more precise estimation from participants. In contrast, the value of the implausible anchor was related to the maximum length rivers can reach, requiring a broad judgement. A study revealed that individuals with an anchor point of 2,000 km were more likely to estimate a shorter river than those with other anchor points (Mussweiler & Strack, 2000).

The second study presents a methodology wherein the values 10 or 65 are randomly drawn for each participant, who is then asked to write down that value (Kahneman, 2012). Subsequently, the participants are required to compare the anchored value with the percentage of African nations among UN members, with the objective of determining whether the amount is larger or smaller than the number. Finally, the percentage of African nations in the UN was estimated (Tversky & Kahneman, 1974).

Finally, in the final problem presented, participants were asked to estimate whether Mahatma Gandhi was older or younger than either 140 years or 9 years at the time of his death. These questions presented two implausible values for Gandhi's age. Previous research had estimated that participants exposed to the high implausible anchor, on average, estimated Gandhi's age at death to be 67 years, whereas other estimates had him at merely 50 years (Mussweiler & Strack, 2001).

A proposed model was developed, based on an analysis of the literature presented above:

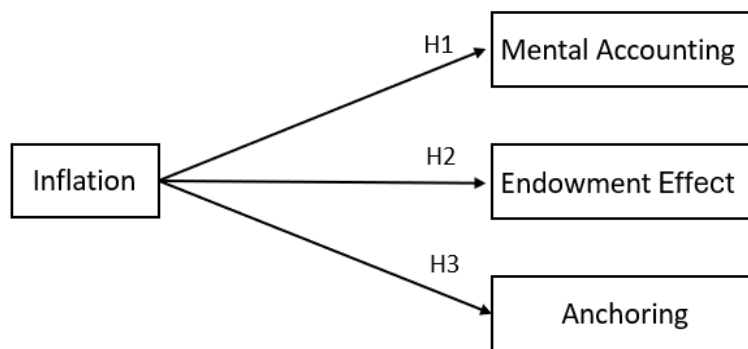


Figure 3.1 – Proposed Conceptual Model

3.2. SURVEY

In order to identify the possible correlation between inflation in Portugal and consumer irrationality, a questionnaire was carried out using examples of pricing cognitive biases.

The target population under study was all Portuguese residents over the age of 18. The main concern in selecting the sample was to ensure its diversity in terms of the variables chosen, both in terms of social factors (age; education) and the impact of inflation on their lives, so the data collection was carried out through “Qualtrics XM”. This method of data collection was chosen over others because it is logistically easier to conduct the survey online to reach the greatest number of Portuguese throughout the country. It also reduces or eliminates the potential bias introduced by the researcher. Given the target population under study, the survey could only be conducted in Portuguese.

The questionnaire had a total of 30 questions, and it was divided in 5 different segments, the first 4 corresponding to a variable under study: Inflation (7 questions), Mental Accounting (4 questions), Endowment Effect (5 questions) and Anchoring (6 questions) and the last segment the demographics questions (4 questions).

It began with a clarification that any response was voluntary, anonymous and that it was possible to withdraw from the survey at any time, accompanied by a consent question. In other words, the questionnaire did not start until each participant over the age of 18 agreed to take part. In the first segment, related to the variable Inflation, a Likert-type scale was employed with the following options: *Discordo Totalmente*, *Discordo*, *Não concordo nem discordo*, *Concordo* and *Concordo Totalmente*. As previously stated, in each of the subsequent sections, 3 examples have been presented for each cognitive bias. The problems were presented to the participants in a randomized order, meaning problems from different cognitive bias were presented in a mixed order. This way the order was not pre-defined, rather, all questions were randomized throughout the questionnaire. This method was employed to prevent the participants from associating the problems with one another and thereby minimize the influence of bias on their responses (Budd, 1987). These questions

included open questions and multiple choices. After the questions related to the topic under study, segmentation questions were asked, more precisely the age, the gender, education and country of residence. Participants whose country of residence was other than Portugal were excluded from the analysis. However, only 4 cases were excluded as this information was clarified in the introduction. All questions were mandatory, and it was not possible to rephrase answers once submitted, as the aim of the study was to test human irrationality.

4. EMPIRICAL STUDY

4.1. DATA COLLECTION

Once the survey had been completed, a pilot test was conducted with the intention of obtaining feedback on the structure and content. Feedback from the pilot test revealed several typographical errors, which were subsequently rectified, leading to the launch of the questionnaire.

To ensure the reliability of sample size, a minimum of 200 responses was targeted. The questionnaire was available online from 21 May to 28 May and published on multiple social networks including Instagram, Facebook, LinkedIn and WhatsApp. When analyzing the data, a total of 431 responses were collected, but only 323 were completed, giving a final completion rate of 75%. Of the 323 responses, 4 were not resident in Portugal, leaving 319 responses for final analysis.

4.2. DATA TREATMENT

Excel was used to transform the data extracted from the questionnaires before applying the hypothesis tests. Firstly, it was necessary to eliminate the observations corresponding to respondents who did not complete the survey. Additionally, four further observations were erased because the participants were not resident in Portugal.

In the case of the independent variable, the perceived effect of inflation, no transformation was required. However, in the case of the mental accounting and endowment effect, it was created for each item a dummy variable for each observation. A value of 0 was assigned to rational answers, while a value of 1 was assigned to intuitive answers. The classification was attributed in accordance with the rules described in Sub-chapter 3.1 for each item.

For the anchoring variable, given that the responses were open-ended, a different treatment was required. Firstly, it was necessary to remove special characters entered by the participants (% , km, etc.), despite the fact that the question expressly asked for the introduction of only a numerical value. Furthermore, in item A1, when participants were asked to estimate the length of the Mississippi River, two individuals replied, *Não sei* and these responses were excluded from the subsequent analysis having a final dataset of 317 answers. Additionally, the absolute value of the difference between the estimate provided by the participant and the anchoring value was calculated for each item, per observation.

4.3. SAMPLE PROFILE

The age distribution showed that most respondents were between 18 and 24 years of age, representing 42% of the sample. The next largest age groups were 55 to 64 years, with 17%, 45 to 54 years, with 15% and 25-34 (15%). Smaller proportions of respondents were aged 35-44 (9%) and 65 and over (3%).

Table 4.1 – Sample Profile | Age

Age	#	%
18 - 24	132	42%
25 - 34	46	15%
35 - 44	27	9%
45 - 54	49	15%
55 - 64	53	17%
65+	10	3%
Total	317	100%

The vast majority of people who responded were predominantly female, with 67% of respondents being female and 32% male. In addition, a small proportion of respondents identified as 'other' (1%) and 1 person preferred not to disclose their gender.

Table 4.2 – Sample Profile | Gender

Gender	#	%
Female	212	67%
Male	102	32%
Other	2	1%
Prefer not to answer	1	0%
Total	317	100%

Concerning Education level, more than half of the respondents had a bachelor's degree (51%), followed by those with high school degree (24%). Postgraduate and master's degree holders made up 9% and 16% of the sample respectively, with no respondents holding a PhD.

Table 4.3 – Sample Profile | Education

Education	#	%
High School	77	24%
Bachelor Degree	163	51%
Postgraduation	27	9%
Master Degree	50	16%
PhD	0	0%
Total	317	100%

This demographic overview reveals a young and predominantly female sample. A significant proportion of respondents have a bachelor's degree.

5. RESULTS AND DISCUSSION

5.1. DATA ANALYSIS

5.1.1. OUTLIERS

The subsequent step was to analyze the outliers of the numerical variables in order to ensure that any extraneous noise was eliminated from the data set. In other words, observations that differed significantly from the majority of the data will be identified and treated differently. To this end, the following box plots produced by the JASP software were analyzed.

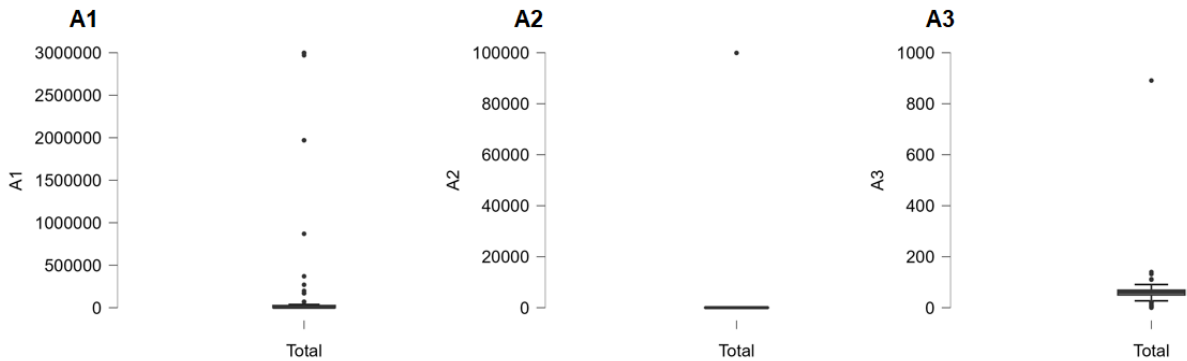


Figure 5.1 – Box Plots

By analyzing the box plots and calculating the interquartile range, it was possible to conclude that all the variables had values higher than the upper limit calculated. The upper limit values calculated were 104 903, 401, and 89 for items A1, A2, and A3, respectively.

Subsequently, nine observations were excluded, representing 2.8% of the total number of observations in the data set.

No special treatment was required for missing values, as all responses were mandatory in the survey. Any responses that were not completed were eliminated from the analysis, as referred to in the sub chapter 4.2.

5.1.2. MEASUREMENT RESULTS

In order to test the hypotheses presented in the study, ANOVA tests will be carried out, for each dependent variable. However, prior to the statistical tests, it is necessary to transform the study variables.

Inflation

The variable inflation is composed of seven ordinal scales. Some reliability and validity indicators were analyzed in order to assess the relationships between the items and the variable.

Firstly, the items’ outer loadings were subjected to analysis. This indicator reflects the strength of association between the item and the corresponding variable. It is recommended that the loadings should exceed 0.7 (Henseler, Ringle & Sinkovics, 2009) in order to ensure that the item in question represents the loading accurately. As illustrated in the figure 5.2, all items met the specified threshold of 0.7, with the exception of the variables INF 5 and INF 7.

Secondly, the Average Variance Extracted (AVE) indicator was subjected to analysis. This indicator serves to ascertain whether the questions and items in question converge, thereby ensuring that the same concept is being measured. The indicator must be greater than 0.5. In the event that the AVE is below 0.5, it can be inferred that the variable is not optimally represented by the items included in the analysis (dos Santos & Cirillo, 2023). The AVE indicator for inflation was found to be 0.543, indicating that the items in question represent more than half of the variance of their respective indicators. Finally, the composite reliability and Cronbach's alpha indicators were also analyzed, which are also measures that compare the variance of the items with the variable under study. The values of these indicators should be higher than 0.7 and as can be observed, this requirement is met (Warrens, 2015).

	Outer loadings	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
INF1 <- INF	0.753	0.859	0.891	0.543
INF2 <- INF	0.773			
INF3 <- INF	0.772			
INF4 <- INF	0.855			
INF5 <- INF	0.647			
INF6 <- INF	0.761			
INF7 <- INF	0.561			

Figure 5.2 – Inflation variable reliability and validity

In conclusion to the above detailed analysis, items INF5 and INF7 were removed. In order to perform the ANOVA analysis, a new variable was created, representing the average of items INF1, INF2, INF3, INF4 and INF6. This variable represents the average perceived impact of the increase of inflation on each participant's lives. As illustrated in the figure 5.3, a considerable proportion of respondents indicated that inflation had a notable impact on their lives, with an average rating of 3.7.

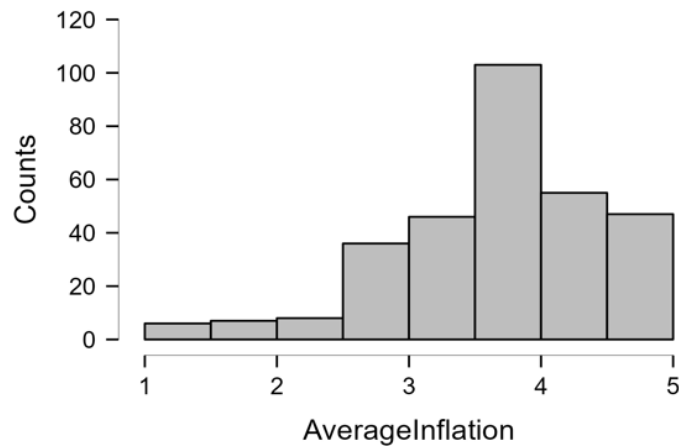


Figure 5.3 – Impact of Inflation on participants’ lives

The variable in question was used to divide all participants into two groups, with those whose average item score was above or below 3.8, which represents the median of the variable mentioned above: the average of items INF1, INF2, INF3, INF4 and INF6. A dummy variable was then created, with participants whose average was below 3.8 classified as non-affected by inflation and the rest as affected by inflation. The group classified as "Not Affected by Inflation" contained 135 participants, while the group designated as "Affected by Inflation" numbered 173.

Mental accounting and Endowment Effect

In contrast to the items presented for the Inflation variable, in the case of cognitive bias, independent problems were presented. The problems allocated to each variable (Mental Accounting, Endowment Effect and Anchoring) were independent and derived from distinct sources. Consequently, it was necessary to analyze them differently.

A variable was created to represent the problems of Mental Accounting and Endowment Effect. This variable represents the proportion of instances in which each participant exhibited an irrational response to the three problems presented to them.

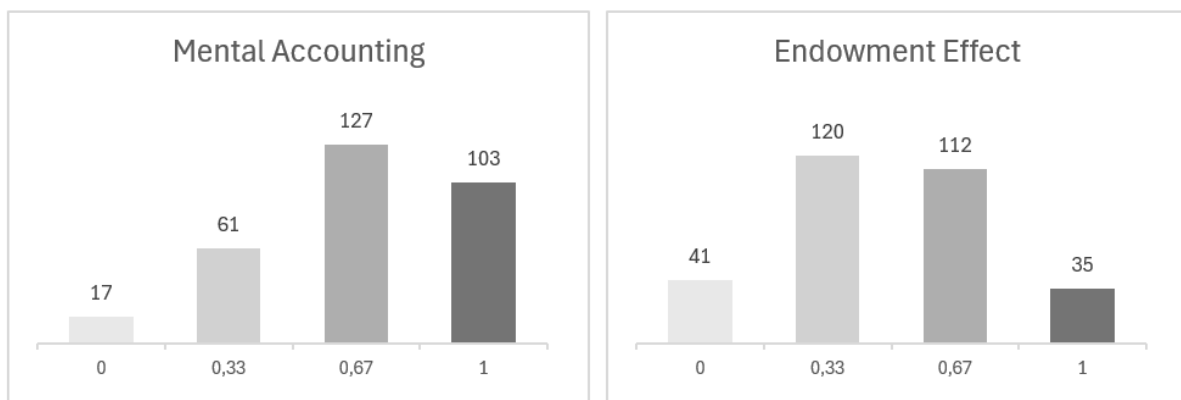


Figure 5.4 – Irrationality on the MA and EE problems

It is noteworthy that the participants exhibited more irrational behavior when confronted with mental accounting problems than in the endowment effect examples. In the case of mental accounting bias, 127 participants, 41% of the total, demonstrated irrational responses to two of the presented examples, while exhibiting rational responses to only one. A total of 103 participants, representing 33% of the sample, demonstrated a consistent pattern of irrational behavior when presented with the examples. In the case of the endowment effect, 75% of participants, 120 plus 112, demonstrated between one to two additional intuitive responses to the three problems associated with this cognitive bias.

Anchoring

In the case of anchoring, no additional transformation was necessary. As previously stated in chapter 4.2, the absolute value of the difference between the estimate provided by the participant and the anchoring value was calculated for each item, per observation.

Nevertheless, it is also possible to draw conclusions by analyzing the participants' responses to problems with this cognitive bias. Figure 5.5 indicates that in the instance where individuals were requested to estimate the length of the Mississippi River, those whose anchor value was 2000 responded with an average length of 5001 kilometers. However, the participants whose anchor value was 30000 km estimated a length of 19592km. In the case of item A2, the presence of the anchor does not appear to have exerted a particularly noticeable influence. For the example in which participants were asked to estimate Gandhi's age, as had been confirmed in previous studies, those exposed to a high implausible anchor estimated a higher value on average than those exposed to a low implausible anchor (Mussweiler & Strack, 2001).

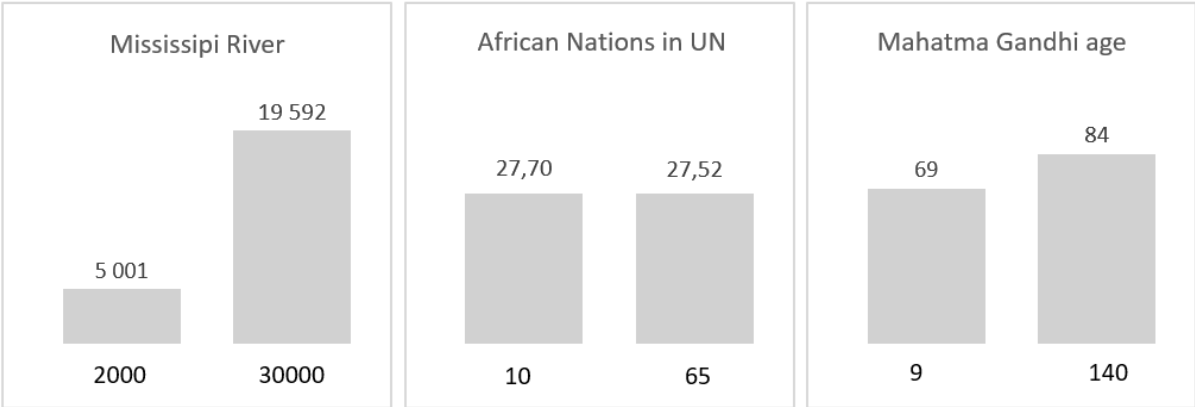


Figure 5.5 – Average estimations on the Anchoring problems

5.2. HYPOTHESIS TESTING

A one-way analysis of variance, ANOVA, is a statistical test employed to assess the statistical significance of differences in a dependent variable across different groups (Kim, 2017).

Hypothesis 1: The perceived negative effect of Inflation has a positive impact on Mental Accounting bias.

The initial test was conducted with dummy variable inflation and dependent variable mental accounting. As previously stated, the variable inflation divides the respondents into two groups based on the impact of inflation on their lives, representing one factor in the ANOVA analysis. The objective of this test is to evaluate the existence of significant differences between the dependent variable mental accounting in the two different groups: those who were affected by inflation and those who were not.

Prior to the application of the ANOVA test, it was necessary to ensure that the requisite assumptions were satisfied within the data. The first assumption was that the data was normally distributed. This meant that the data for each group was derived from a normal distributed population (Emerson, 2022). In accordance with Central Limit Theorem, the sampling distribution of the sample mean will approach a normal distribution as the sample size increases. The theorem suggests that for a random sample of $n > 30$, the standardized sample mean will converge to a standard normal distribution, with a mean equal to the population mean and a standard deviation equal to the population standard deviation divided by the square root of the sample size n (Islaqm, 2018). In this instance, both groups fulfil the requisite sample size of greater than 30, with the group labelled "0 - Non-affected by inflation" having 135 observations and the group labelled "1 - Affected by inflation" presenting 173 observations.

The second assumption for the application of an ANOVA test is the condition of homoscedasticity. This implies that the variance among the groups of data should be equal. In other words, the dispersion of the dependent variable, Mental Accounting, should be consistent across the two groups (Emerson, 2022). To test this requirement the Levene's test was applied, which is a powerful tool for checking the homogeneity of variances and robust to nonnormality (Gastwirth, Gel & Miao, 2009). The test showed that there is no statistically significant evidence that the variance across the groups is different as the p-value is greater than the significance level chosen, 0.05, $F(1, 306) = 3.292$, $p = 0.071$. Consequently, it was concluded that the assumption of homoscedasticity is fulfilled.

Once it had been established that all the requisite conditions had been fulfilled, a One-Way ANOVA was conducted. In the context of mental accounting problems, participants who had experienced inflation-related challenges ($M=0.68$, $SE=0.31$) exhibited a similar average reaction to those who had not been as significantly affected ($M=0.67$, $SE=0.27$), $F(1, 306) = 0.040$, $p = 0.843$, this indicates that the hypothesis is not supported.

Table 5.1 – Impact of Inflation on Mental Accounting

Dependent variable	Non-affected by inflation		Affected by inflation		F	p
	Mean	SE	Mean	SE		
Mental Accounting	0.672	0.270	0.678	0.305	0.040	0.843

Hypothesis 2: The perceived negative effect of Inflation has a positive impact on Endowment effect bias.

The second hypothesis aims to assess the influence of inflation on the variable Endowment effect, which reflects the irrationality of the participants when faced with the three examples of endowment effect bias. In this case, as in the previous test, it was necessary to confirm that the conditions required for an ANOVA were met. Given that the Inflation variable was the same as that used in the previous test, it was possible to guarantee the normality of the distribution, using the central limit theorem. Regarding the second assumption, the Levene test was once again carried out, which demonstrated that the condition of homoscedasticity was satisfied, $F(1, 306) = 0.019$, $p = 0.890$.

Upon the application of the aforementioned test, the result demonstrated that there is no statistical evidence to support this hypothesis, $F(1, 306) = 3.108$, $p = 0.079$. Since there is no significant difference between the two groups' responses to the endowment effect examples, ($M=0.46$, $SE=0.29$) and ($M=0.52$, $SE=0.28$). These results indicate that hypothesis 2 is not supported.

Table 5.2 – Impact of Inflation on Endowment effect

Dependent variable	Non-affected by inflation		Affected by inflation		F	p
	Mean	SE	Mean	SE		
Endowment effect	0.519	0.284	0.461	0.022	3.108	0.079

Hypothesis 3: The perceived negative effect of Inflation has a positive impact on Anchoring bias.

Lastly, this hypothesis aims to relate the inflation variable to the three variables associated with cognitive bias Anchoring. To this end, three ANOVA tests were conducted, one for each anchoring example presented, A1, A2 and A3. The dependent variables used for these tests represent the absolute value of the differences between the anchoring value and respondent's estimates.

In all the three tests, the normality assumption is met as the groups used in the analysis were the same as those used in the previous tests, including participants who have been affected by inflation and those who have not. In order to test the second assumption, the homoscedasticity, the Levene's test was once again applied to the three variables, divided between the two groups. In the case of variables A2 and A3, the test demonstrated that there was no statistically significant evidence to suggest that the variance across the groups differed, with $F(1, 306) = 3.473, p = 0.063$ and $F(1, 306) = 0.088, p = 0.768$, respectively. This indicates that the requirement of homoscedasticity was met.

With regard to variable A1, the results of the Levene test indicated that there is statistically significant evidence that the variances across the groups are different, $F(1, 306) = 4.754, p = 0.030$. Therefore, the assumption of homoscedasticity is violated. In this instance, the application of an ANOVA test was not feasible, and thus a Welch ANOVA was employed. This test enables the comparison of the means of different groups in the presence of heteroskedasticity (Celik, 2022). This method is a popular choice and performs well in cases where the data is heterogeneous and normally distributed (Hangcheng, 2015). The results of this test, which compared the answers on respondents who felt no impact from inflation ($M=11414.9, SE=12404.6$) with those who did ($M=15831.0, SE=31813.1$), indicated that there was no statistically significant difference in the responses between the two groups, $F(1, 306) = 2.790, p = 0.096$.

In the case of variables A2 and A3, as all the requisite conditions were met, two separate ANOVA tests were conducted. In both cases, no statistically significant evidence was found to suggest a difference between the two groups, $F(1, 306) = 1.052, p = 0.306$ and $F(1, 306) = 2.655, p = 0.104$, respectively.

Table 5.3 – Impact of Inflation on Anchoring

Dependent variable	Non-affected by inflation		Affected by inflation		F	p
	Mean	SE	Mean	SE		
Anchoring 1	11414.904	12404.643	15831.012	31813.074	2.790	0.096
Anchoring 2	30.956	23.583	28.358	20.768	1.052	0.306
Anchoring 3	56.015	18.724	59.543	18.957	2.655	0.104

Due to the fact that none of the three tests conducted yielded statistical evidence indicating a difference between the two groups, hypothesis 3 is not supported.

The findings of this study indicate that, in accordance with previous research, cognitive biases exert a significant influence on people’s cognition (Tversky & Kahneman, 1974). As demonstrated in the analyses in sub-chapter 5.1.2, participants exhibited irrational responses when presented with examples of cognitive biases, including Mental Accounting, the

Endowment Effect, and Anchoring. In the case of Mental Accounting, the majority of participants provided responses that were irrational in two or three problems. Regarding the Endowment Effect, most participants demonstrated a tendency to be influenced by this bias in one or two instances. Additionally, Figure 5.5 illustrates that in two of the presented problems, anchoring values significantly impacted participants' responses.

Contrary to expectations, no correlation was identified between consumers perceived negative effect of inflation and their susceptibility to be influenced by cognitive bias. In previous studies, a positive correlation was identified between inflation and errors in price recall (Estelami et al., 2001). This indicates that as inflation increases, consumers are less prone to remember and recognize prices accurately, rather than improving it, and consequently it decreases their price knowledge. Additionally, behavioral economics posits that without accurate price knowledge, individuals are more prone to biases such as mental accounting, the endowment effect, and anchoring (Ariely & Kreisler, 2018). In sub-chapter 6.2, the factors that may have influenced the inability to achieve the same results in this study will be discussed.

6. CONCLUSIONS AND FUTURE RESEARCH

6.1. CONCLUSIONS

This research addressed the primary question of whether the impact of inflation on individual Portuguese people could influence their reasoning. Although the impact of cognitive bias on respondents' answers was verified, as previously stated, it was not possible to establish a link between inflation and irrational response.

This analysis was conducted using a questionnaire, with 317 responses collected. Following the application of various data treatment and data transformation processes, five One-Way ANOVA tests were conducted, using the variable Inflation as a factor. It was thus demonstrated that no statistically significant differences were observed in the responses between the group of individuals who perceived that their lives had been affected by inflation and those who were not. Contrary to expectations, the results of the study demonstrated that none of the proposed hypotheses were supported.

6.2. LIMITATIONS AND FUTURE WORK

While this study provides valuable insights into the consumer's cognition, several limitations must be acknowledged.

The principal theoretical limitation of this research is that there is no previously developed study that directly links inflation with the fact that individuals are more susceptible to being influenced by cognitive biases.

The second limitation identified relates to the anchoring problems selected. These examples were the ones that, from all the literature read, best suited the data collection method used, the questionnaire. However, these examples, unlike the ones used for the other biases, had exact answers. For example, when questioned whether the Mississippi River is longer or shorter than an anchor value, the response can be easily obtained via an internet search, as it is not a subjective or opinionated answer, but rather a fact. While the influence of anchors is evident on average for problems A1 and A3, it is not possible to confirm with certainty that none of the participants used an external source to answer these questions. This may be one of the factors that influenced the absence of an anchor effect in problem A2.

Besides the theoretical limitations mentioned, it is crucial to mention practical limitations that arose during the study. This limitation is related to the fact that most participants considered that inflation has had a significant impact on their lives. The dummy variable Inflation was divided using the median of 3.8. Consequently, this implies that participants in the Non-Affected by Inflation group may have experienced some impact from inflation, although to a lesser extent than those in the other group. If the division was made using the scale used, i.e. if the impact of inflation was less than 2.5, then the participants would be considered non-affected by inflation and the rest affected by inflation. This would result in the creation of very

heterogeneous groups of 21 and 287 participants, respectively, which would also greatly bias the results.

The final limitation to be discussed is that the data collection for the study was primarily conducted via social networks, mainly Instagram and WhatsApp groups. Consequently, 42% of the study's participants are aged between 18 and 24. It is possible that this sample may have introduced a degree of bias into the results of the study. Given that a significant proportion of young people in this age group are still financially supported by their families, it is possible that they may not do shopping on their own. Even if they did, it is possible that many may still have been under 18 when the inflation rate first increased in recent years. Consequently, they are unable to fully comprehend the precise impact inflation has had on their lives.

For future research, and in order to combat the first limitation mentioned, it would be advisable to conduct individual studies on consumer price knowledge. It would be interesting to analyze this variable and identify its impact on the relation between inflation and consumer bias. A further suggestion would be to collect participants with more diverse socio-demographic characteristics and to gather additional data to characterize the respondents and the impact of inflation on their lives. This could include information on income level, current occupation (including whether the individual is studying, working, unemployed, retired, working and studying), marital status, and other relevant factors. Finally, a valuable extension of this research would be to replicate the study to examine actual consumer behavior. This study focused on the influence of cognitive biases on consumer reasoning. Incorporating real cases of purchase intention into the study would allow a comprehensive understanding of whether inflation impacts consumer decision-making.

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APPENDIX

APPENDIX A | ETHICAL COMMITTEE APPROVAL

The Ethical Committee pronounced favorably on 5 of May 2024 as the conducted study is compliant has no significant ethical implications, according to the NOVA IMS Ethics principles.



Figure 1 - Ethical Committee Approval

APPENDIX B | SURVEY

The impact of Inflation on Pricing Cognitive Bias

Q1 Caro Participante,

Obrigado por dedicar o seu tempo a participar neste inquérito. Sou estudante do mestrado de Data Driven Marketing na Nova IMS e a sua resposta será uma enorme contribuição para a conclusão da minha dissertação de mestrado. Este inquérito demorará menos de 5 minutos a ser concluído e agradeço as suas respostas

honestas. A participação é anónima e voluntária, e tem a opção de sair do inquérito a qualquer momento, sem qualquer consequência. Este estudo dedica-se exclusivamente a pessoas residentes em Portugal. Se não for o seu caso, por favor não complete o questionário. Se tiver alguma questão, não hesite em contactar-me através do email r20191255@novaims.unl.pt.

Obrigada,
Laura Crisóstomo

Q2 Declaro que tenho 18 anos de idade ou mais e concordo em participar nesta pesquisa. Declaro que fui informado que a minha participação neste estudo é voluntária e que posso abandonar este inquérito a qualquer momento sem qualquer penalização, sendo todos os dados confidenciais.

- Concordo em participar (1)
- Não concordo em participar (2)

Q3 Em baixo vamos apresentar um conjunto de afirmações. Por favor, indique o quanto concorda com cada uma das mesmas.

A março de 2024 foi registado, pelo BdP, uma **taxa de inflação** de 2,6% face ao período homólogo.

Q4 A inflação teve um impacto significativo no meu custo de vida.

- Discordo Totalmente (1)
- Discordo (2)
- Não concordo nem discordo (3)
- Concordo (4)
- Concordo Totalmente (5)

Q5 A inflação teve um impacto significativo no meu orçamento doméstico.

- Discordo Totalmente (1)
- Discordo (2)
- Não concordo nem discordo (3)
- Concordo (4)
- Concordo Totalmente (5)

Q6 A inflação provocou uma alteração nos meus hábitos de consumo.

- Discordo Totalmente (1)
- Discordo (2)
- Não concordo nem discordo (3)
- Concordo (4)
- Concordo Totalmente (5)

Q7 A inflação afetou a minha qualidade de vida.

- Discordo Totalmente (1)
- Discordo (2)
- Não concordo nem discordo (3)
- Concordo (4)
- Concordo Totalmente (5)

Q8 Tive tendência a procurar por produtos mais baratos devido ao aumento de preços, causado pela inflação.

- Discordo Totalmente (1)
- Discordo (2)
- Não concordo nem discordo (3)
- Concordo (4)
- Concordo Totalmente (5)

Q9 Tive de abdicar de algumas atividades de lazer devido ao aumento dos preços, provocados pela inflação.

- Discordo Totalmente (1)
- Discordo (2)
- Não concordo nem discordo (3)
- Concordo (4)
- Concordo Totalmente (5)

Q10 Estou preocupado com o impacto contínuo que a inflação possa ter na minha vida pessoal.

- Discordo Totalmente (1)
- Discordo (2)
- Não concordo nem discordo (3)
- Concordo (4)
- Concordo Totalmente (5)

Q11 As próximas questões têm como objetivo obter informações sobre o seu comportamento enquanto consumidor.

Q12 Imagine que acabou de gastar 100€ num bilhete para o novo e popular espetáculo da Broadway. Quando chegou ao teatro no dia da estreia, olhou para a carteira e descobriu, com tristeza que perdeu o bilhete. Felizmente, tem outra nota de 100€ na carteira. Avançou e comprou outro bilhete de substituição.

Quanto diria que lhe custou a ida de teatro?

Por favor insira um número inteiro, **sem** o uso de caracteres especiais (€, %, &, km, etc...).

Q13 Agora, imagine que as coisas correram de forma diferente no dia do espetáculo. Não comprou bilhete com antecedência. Quando chegou ao teatro, abriu a carteira e percebeu que perdeu uma das duas notas de 100€ que tinha. “Oh, não! Agora estou 100€ mais pobre. Felizmente, ainda tenho outra nota de 100€.” Comprou o bilhete.

Quanto diria que lhe custou a ida de teatro?

Por favor insira um número inteiro, **sem** o uso de caracteres especiais (€, %, &, km, etc...).

Q14 Suponha que comprou uma caixa de um bom vinho tinto, sendo que custou 20€ cada garrafa. O vinho valorizou e agora é vendido por cerca de 75€ cada garrafa. Um dia decidi beber uma dessas garrafas.

Qual das alternativas a seguir melhor reflete o que sente sobre o custo de beber a garrafa?

- 0€, já tinha pago a garrafa. (1)
- 20€, o valor que paguei pela garrafa. (2)
- 20€ + juros. (3)
- 75€, o valor que poderia receber se vendesse a garrafa. (4)
- 55€, tenho a possibilidade de beber uma garrafa que vale 75€ e apenas gastei 20€, por isso poupei dinheiro ao beber a garrafa. (5)

Q15 Duas ávidas adeptas de desporto planeiam viajar 65 km para assistir a um jogo de basquetebol. Uma delas pagou pelo seu bilhete; a outra estava a caminho de comprar um bilhete quando recebeu um grátis de um amigo.

Uma tempestade de neve está anunciada para a noite do jogo.

Qual das duas adeptas é mais provável que vá enfrentar a tempestade de neve para assistir ao jogo?

- A adepta que pagou pelo seu bilhete (1)
- A adepta que recebeu o bilhete gratuitamente (2)
- Igualmente prováveis (3)

Q16 Uma empresa está a obter pouco lucro. Está localizada numa comunidade que enfrenta um problema substancial de desemprego, mas sem inflação. A empresa decide **diminuir** os salários em 7% este ano.

O que acha desta medida?

- Aceitável (1)
- Injusto (2)

Q17 Uma outra empresa que também está a obter pouco lucro, está localizada numa comunidade que enfrenta um problema substancial de desemprego e também inflação de 12%.

A empresa decide **umentar** os salários apenas em 5% este ano.

O que acha desta medida?

- Aceitável (1)
- Injusto (2)

Q17 Suponha que tem um bilhete para um concerto esgotado da sua banda preferida, que comprou ao preço normal de 200€. É um fã entusiasta e estaria disposto a pagar até 500€ pelo

bilhete. Agora tem o seu bilhete e descobre que na Internet há fãs mais ricos ou mais desesperados que estão a oferecer 3.000€.

Venderia o bilhete?

Sim (1)

Não (2)

Q18 Desenvolveu-se uma escassez para um modelo popular de automóvel e, consequentemente, os clientes agora têm de esperar dois meses pela entrega. Um distribuidor estava a vender estes carros com um desconto de **200€ abaixo** do preço tabelado. Agora, o distribuidor decide vender este modelo apenas ao preço tabelado.

Aceitável (1)

Injusto (2)

Q19 Desenvolveu-se uma escassez para um modelo popular de automóvel e, consequentemente, os clientes agora têm de esperar dois meses pela entrega. Um distribuidor estava a vender esses carros ao preço tabelado.

Agora, o distribuidor decide fixar o preço deste modelo **200€ acima** do preço de tabela.

Aceitável (1)

Injusto (2)

Q20 O Rio Mississippi é mais longo ou mais curto do que 2000km?

Mais longo (1)

Mais curto (2)

Q21 O Rio Mississippi é mais longo ou mais curto do que 30.000km?

Mais longo (1)

Mais curto (2)

Q22 Qual é a sua estimativa para o comprimento do Rio Mississippi?

Por favor insira um número inteiro, **sem** o uso de caracteres especiais (€, %, &, km, etc....).

Q23 Ser-lhe-á atribuído um número aleatório de 0 a 100.

Por favor, avance para a próxima página para continuar o questionário.

Q24 O seu número é o **10**.

Por favor, escreva por extenso o número que lhe foi indicado acima.

Q25 O seu número é o **65**.

Por favor, escreva por extenso o número que lhe foi indicado acima.

Q26 Qual é a sua melhor estimativa para a percentagem (%) de nações africanas nas Nações

Unidas?

Por favor insira um número inteiro, **sem** o uso de caracteres especiais (€, %, &, ...).

Q27 Mahatma Gandhi era mais velho ou mais novo do que 140 anos quando faleceu?

Mais velho (1)

Mais novo (2)

Q28 Mahatma Gandhi era mais velho ou mais novo do que 9 anos quando faleceu?

Mais velho (1)

Mais novo (2)

Q29 Qual é a sua melhor estimativa para a idade que Mahatma Gandhi tinha quando faleceu?

Por favor insira um número inteiro, **sem** o uso de caracteres especiais (€, %, &, ...).

Q30 Qual é o seu país de residência?

Portugal (1)

Outro (2)

Q31 Quantos anos tem?

18 - 24 (1)

25 - 34 (2)

35 - 44 (3)

45 - 54 (4)

55 - 64 (5)

65+ (6)

Q32 Qual o seu género?

- Feminino (1)
- Masculino (2)
- Outro (3)
- Prefiro não responder (4)

Q33 Qual o nível mais alto de habilitações académicas que completou?

- Ensino secundário (1)
- Licenciatura (2)
- Pós-Graduação (3)
- Mestrado (4)
- Doutoramento (5)

APPENDIX C | SURVEY FLOW

Standard: Intro (1 Question)
Standard: Consent (1 Question)

Branch: New Branch

If

If Declaro que tenho 18 anos de idade ou mais e concordo em participar nesta pesquisa.
Declaro que f... Não concordo em participar Is Selected

EndSurvey:

Block: Inflação (8 Questions)
Standard: Mental Accounting (5 Questions)
Standard: Endowment effect (5 Questions)

BlockRandomizer: 1 - Evenly Present Elements

Block: Mississippi 2000 (1 Question)
Block: Mississippi 30000 (1 Question)

Standard: Mississippi km (1 Question)
Standard: Aleatório (1 Question)

BlockRandomizer: 1 - Evenly Present Elements

Block: número 10 (1 Question)
Block: número 65 (1 Question)

Standard: African Americans in UN (1 Question)

BlockRandomizer: 1 - Evenly Present Elements

Block: Gandhi 140 (1 Question)
Block: Gandhi 9 (1 Question)

Standard: Gandhi idade (1 Question)
Standard: Anchoring (6 Questions)
Standard: Framing (4 Questions)

APPENDIX D | DESCRIPTIVE STATISTICS

Descriptive Statistics

Descriptive Statistics						
	Valid	Missing	Mean	Std. Deviation	Minimum	Maximum
INF1	317	0	4.211	0.836	1.000	5.000
INF2	317	0	4.073	0.906	1.000	5.000
INF3	317	0	3.644	1.038	1.000	5.000
INF4	317	0	3.445	1.053	1.000	5.000
INF5	317	0	4.158	0.861	1.000	5.000
INF6	317	0	3.300	1.167	1.000	5.000
INF7	317	0	4.237	0.782	1.000	5.000
MA1	317	0	0.691	0.463	0.000	1.000
MA2	317	0	0.770	0.422	0.000	1.000
MA3	317	0	0.552	0.498	0.000	1.000
EE1	317	0	0.536	0.499	0.000	1.000
EE2	317	0	0.549	0.498	0.000	1.000
EE3	317	0	0.379	0.486	0.000	1.000
AF1	317	0	67665.650	369935.911	0.000	2.998×10 ⁺⁶
AF2	317	0	344.694	5611.293	0.000	99935.000
AF3	317	0	60.703	50.377	0.000	891.000

