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Free Products and Their Impact on Consumer Behavior

por

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Biographical Note

Francisco Saraiva, born in 1977, grew up in Oporto. He attended Oporto University, where he earned an undergraduate degree in Economics (2000) and an MBA/DFA in Logistics (2002). His love for language learning led him to earn another undergraduate degree in Business Communication from Oporto Polytechnic Institute (2009) selecting English, German and Spanish in his core curriculum.

After two years of experience in consulting, he joined the Port of Leixões where he has been for the past 8 years. He started as an analyst and participated in several projects in multiple areas including IT, accounting, project finance and concessions. He is now working in marketing and public relations.

Acknowledgments

Life is what happens when you are busy pursuing your goals. It does not stand still, nor wait until you are finished. My reflections on happiness in the last five years with the help of some authors in the positive psychology field led me to a major transformation in the way I think about goals, time usage and life in general. Even the topic of this dissertation would be different if I was not inspired to find what I really find pleasurable, engaging, and meaningful. Therefore, my first words of acknowledgment go to Selingman, Csikszentmihalyi, Gilbert, and everyone else working in this field for helping me put the over-generalized deferred gratification model into perspective.

The completion of my dissertation has been a long and pleasant journey. Much has happened in the time that I have been involved with this project. Some people have questioned whether I would finish my dissertation and doubted my commitment to it. I, on the other hand, barring a crashing hard disk, losing confidence so many times, getting writer's block just as many, knew I would complete my dissertation. However, I could not have succeeded without the invaluable help of several supporters. Without them, especially the selected few I am about to mention, I may not have gotten to where I am today.

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As a participant in the Master in Economics Program of the University of Oporto and an ex-student from the last century, I would like to thank the faculty and staff for all their support, not only in this one project but for all the years in my education on the

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I am also thankful to Akhil and Stephen for their careful proofreading of this document and to Pedro, Jorge, and all other colleagues at work who showed interest in the theme and offered help.

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Abstract

Keywords: free, zero, pricing, preference inconsistency, response latency

When faced with a choice between two products, one of which is free, people overreact to the free product with demand exceeding what standard cost-benefit analysis predicts. One possible explanation for this result is affect. Free goods elicit affect which can trigger an automatic cognitive process that favors their selection. Response latency was selected as an implicit measure of attitude to assess if information processing is facilitated by a free product. Faster response times would suggest information processing was facilitated. The evidence from the response latency analysis was mixed and did not lead to a clear conclusion.

[Portuguese]
Quando confrontados com uma escolha entre dois produtos, um dos quais grátis, os indivíduos reagem de forma exagerada ao grátis com uma procura superior à que seria de esperar de uma análise custo-benefício. Uma possível explicação para este resultado é o afeto. Bens grátis incitam afeto que pode desencadear um processo cognitivo automático que favorece a sua selecção. A latência de resposta foi escolhida como uma medida implícita de atitude para avaliar se o processamento de informação é facilitado por um produto gratuito. Tempos de resposta mais rápidos sugeririam que o processamento de informação é facilitado. A evidência da análise de latência de resposta foi mista e não conduziu a uma conclusão clara.

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1. Introduction

Intuition and anecdotal evidence suggest that in some sense, people value free products too much. Usually, the demand at a price of zero is many times higher than the demand at a very low price. Our goal is to examine the validity of this intuition and to establish the causes of the phenomenon.

At first glance, it might not be surprising that the demand for a good is very high when the price is zero, but the extent of the effect is too large to be explained by this simple economic argument.

In the paper that inspired this research, Shampanier et al (2007) examined the impact of "zero prices" on consumers' choice. In one of their experiments, participants were offered a choice between a cheaper lower quality chocolate (Hershey's) and a more expensive higher quality one (Ferrero Rocher). The prices of the chocolates were manipulated between subjects in the following manner: $0.02 and $0.27; $0.01 and $0.26; and zero and $0.25. Results showed that while there was roughly an even-split between the two chocolates in the first two conditions, 90% chose Hershey's when it was free, indicating a discontinuity in the cost-benefit evaluations. In other words, consumers over-reacted to the free chocolate.

Our experimental study had the purpose of bringing additional evidence about this subject by running a similar experiment. However, the conducted experiment had three additional features: response latency was measured between the exposure to the options and the moment one was selected; subjects chose chocolates sequentially under each condition and the study was complemented with a questionnaire.

Previous research points to affect as a key element in the explanation for the attractiveness of free. Response latency was selected as an implicit measure of attitude to assess whether information processing is facilitated (i.e., shorter latencies) or hindered (i.e., longer latencies) by the presentation of the attitude object, (i.e., the free product). If affect accounts for the over-reaction to free products, then we should have shorter latencies when subjects face free products.

Sequentially exposing subjects to both conditions in a random order allows, for instance, the assessment of the impact of the conditions' order on choice consistency or

response latency. This information complemented with the self-reported preferences expressed in the questionnaire could bring additional clues for further investigation.

2. Literature Review

2.1. Zero as a Special Price

The objective of this chapter is to analyze and offer a critical assessment of previous work that is relevant to a better understanding of the over-reaction to free products and of its possible causes.

We are going to start with the contributions from Prospect theory applied to choices from binary sets. Prospect theory is a general framework for understanding cognitive biases and is the foundation for the effects we are going to discuss within this chapter.

We will present some evidence from previous studies on the importance of context and the impact a reference point can have on a buying decision. After presenting the concept of Distinction Bias and the Principle of Diminishing Sensitivity, it will be shown that zero is a special case that prevents consumers from using relative comparisons when making decisions.

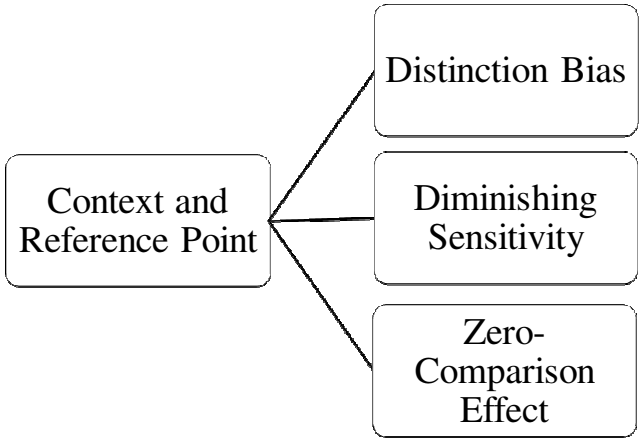

Figure 1 - Context and reference point effects in choices from binary sets

After that we will review the literature on the probable causes for the over-reaction to free products. We discuss the social norms and the mapping difficulty explanations. However, the previous evidence points to affect as a key element in the explanation. Subsequently, we are going to propose two potential mechanisms related to affect for

free products. One is related to the possibility that a free product may be able to reduce to zero the perceived risk of buyer's remorse (Zero-risk Bias). The other is associated with Mental Transaction Costs.

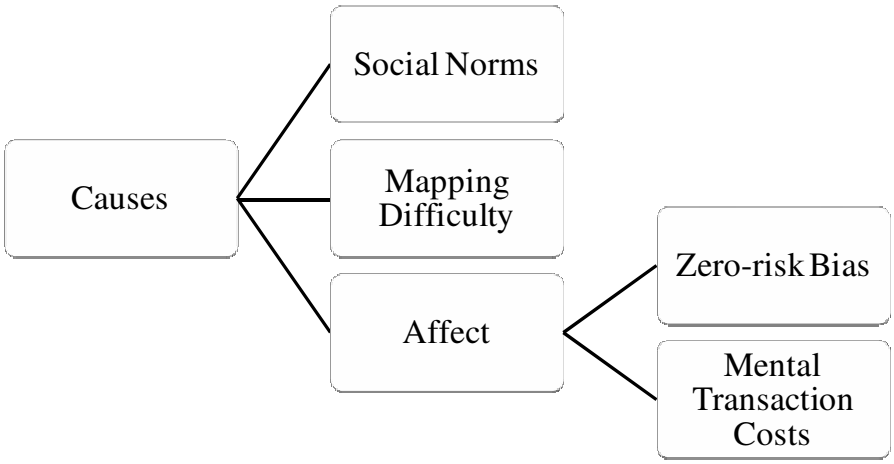

Figure 2 – Possible causes for the over-reaction to free products

Afterwards, we are going to explore contemporary theoretical developments related to attitudes, automatic cognitive processes and the specific consequences of affect on consumer behavior. Implicit and explicit measurements of attitudes will be discussed with an emphasis on the advantages of giving priority to an implicit measurement such as response latency. It will be shown that response latency analysis is a powerful tool for studying automatic processes in judgment and choice. Since an explicit measurement will complement our study, we will explain why Likert scales are the best approach.

Finally, we discuss the context where subjects choose chocolates sequentially under both conditions. We will review the literature on consumers' sequential decisions among binary sets and whether they stick with a favorite or switch to something different.

2.2. Prospect theory

One of the lasting contributions of behavioral economics is the availability of a rich set of competing models of behavior in many settings, with Expected Utility theory and Prospect theory as the two front runners for choices under uncertainty.

Prospect theory originated in the works of cognitive psychologists Kahneman and Tversky (1979) who argue that decisions always conform to the conventional economic concept of "rational" from expected utility theory. It is a general framework for understanding cognitive biases. The model tries to simulate real-life choices, rather than optimal decisions. It describes how people make choices in situations where they have to decide between alternatives that involve risk. According to Prospect theory, such decision processes consist of two stages: editing and evaluation. In the first stage, possible outcomes of the decision are ordered following some heuristic. In particular, people decide which outcomes they see as basically identical and they set a reference point and consider lower outcomes as losses and larger as gains. In the evaluation phase, people behave as if they would compute a value (utility), based on the potential outcomes and their respective probabilities, and then choose the alternative having a higher utility.

Daniel Kahneman and Amos Tversky found inconsistencies with the assumption of rationality that can be categorized into problems of:

(a) Framing – people sometimes make different choices when the same problem is presented in different ways. For example, if an unusual disease is expected to kill 600 people next year, research has shown investing in a program that "will save 200 people" has more appeal than one in which "400 people will die," in spite of both programs ultimately aiming at the same goal (Tversky & Kahneman 1981).

(b) Nonlinear preferences – people make choices inconsistent with the assumptions about preference functions. If A is preferred to B and B is preferred to C, then when people choose C over A, they are not behaving in agreement with economic rationality, particularly, preference transitivity.

(c) Risk aversion and risk seeking – some individuals will simultaneously and knowingly take unfair bets to avoid risk (e.g., by buying life insurance) and unfair bets that increase risk (e.g., playing slot machines).

(d) Source – the mechanism may matter even if the probable outcomes of activities are identical. People may pay more for a good because of the way it is packaged than they will for an identical item that is packaged differently, even if they intend to immediately discard the packaging.

(e) Loss aversion – potential losses loom greater than relatively equal potential gains. The observed asymmetry in these differences is far too large to be explained solely by income effects.

2.3. Context and reference point

Some research in behavioral economics has challenged the view that user preferences exist a priori and suggests that preferences are formed at the time of choice or evaluation and are influenced by the context (Bettman et al. 1998). An important context characteristic is whether a product is evaluated alone or in the presence of another alternative (Hsee & Leclerc 1998). The presence of another product provides a reference against which attributes of a focal product can be compared and can lead to what Hsee and Zhang (2004) called "distinction bias." It is an explanation for differences in evaluations of options between joint evaluation mode and separate evaluation mode. It suggests that viewing options simultaneously makes them seem more dissimilar and makes even small differences between options salient.

Let's consider the example described in Palmeira (2011). When televisions are displayed next to each other on the sales floor, the difference in quality between two similar high-quality televisions may appear substantial. A consumer may pay a much higher price for the higher-quality television, even though the difference in quality is imperceptible when the televisions are viewed in isolation. The consumer will be watching only one television at a time, so the lower-cost television could have provided a similar experience at a lower cost.

In some demonstrations of context effects, researchers contrast choices from binary sets with choices from extended sets, which include an additional option. It is shown that the

presence of this option increases the attractiveness of one of the original alternatives, as consumers use information from the entire set to make their decisions. The tendency to rely on contextual cues is so strong that effects have been shown even when the additional option is dominated (J. Huber & McCann 1982) or unavailable (Hedgcock et al. 2009; Simonson 1989). Research by Hsee and colleagues (Hsee 1996; Hsee & Leclerc 1998; Hsee & J. Zhang 2004) have shown that contextual influences can occur even in binary sets. Contrasting separate and joint evaluations, this line of research has shown that attribute values of an alternative are used as references in the judgment of the attractiveness of another alternative. For example, in one of his studies, Hsee (1996) showed that in separate evaluations, a dictionary with 10,000 entries in good condition is better evaluated than one with 20,000 entries, but with a torn cover. However, in a joint evaluation task, most people prefer the dictionary with 20,000 entries. Hsee reasoned that in separate evaluation it is hard to judge the number of entries in a dictionary. In this sense, participants are relatively insensitive to a difference between 10,000 and 20,000 when only one of the dictionaries is presented.

There is also evidence that consumers look to the price for cues to categorize contexts and use market norms when the price is non-zero, but revert to social norms when the price is zero (Heyman & Ariely 2004). This is an effect that is discussed later.

2.3.1. Diminishing sensitivity

The importance of reference points in judgment and decision making was also recognized in the extension of Prospect theory (Kahneman & Tversky 1979) to riskless choice. Reference-dependence is one of the fundamental principles of their proposed value function, which is also characterized by diminishing sensitivity. According to the principle of diminishing sensitivity (Kahneman & Tversky 1979; Tversky & Kahneman 1992), the perceived difference between two quantities decreases as both quantities increase by the same amount. In other words, the difference between 10 and 20 is perceived as larger than the difference between 110 and 120, even though in both cases the difference is ten units. Values are not evaluated in isolation or as absolute differences. Rather, individuals focus on relative differences. Twenty is the double of 10, or 100% more, whereas 120 is roughly 10% more than 110. This type of comparison

helps in providing meaning to absolute differences. For example, a shopping decision may be framed as a contrast between a 10% difference in price versus a 30% difference in quality, as opposed to an evaluation of the dollar difference in price compared to the absolute difference in quality.

An interesting consequence of this principle is that consumers' perceptions can be influenced by how one frames a difference between alternatives. For example, the sound quality of hi-fi systems can be expressed as audio signal delivery or as its complementary value, audio distortion. Wong and Kwong (2005) showed that in a choice task between two hi-fi systems, a difference in audio signal had a drastically stronger impact when it was described as audio distortion (0.003% vs. 0.01%) than when it was described as audio signal delivery (99.997% vs. 99.99%). Even though the absolute difference is the same in both cases (0.007%), consumers tend to be influenced by relative differences. In the former, consumers could interpret the difference not as 0.007% but instead by noting that one's quantity is roughly three times the other. On the other hand, in the latter, this type of interpretation leads consumers to conclude that the two quantities are roughly the same.

2.3.2. Zero-comparison effect

An important limitation of this type of comparison occurs when one of the attributes is zero. In relative terms, compared to zero, any number is infinitely larger; so this type of comparison becomes meaningless (Palmeira, 2010). Consumers lose the reference point that allows them to use relative comparisons between attributes and, as a result, they might focus on absolute differences instead. He termed this the "zero-comparison effect." In several experiments, Palmeira (2010) arrived at an interesting and somewhat surprising conclusion. He found evidence that worsening a product by increasing the level of an undesirable attribute from zero can increase its attractiveness. For instance, participants were offered two hi-fi alternatives that differed only in terms of audio-signal distortion. The sound quality of option A was the only factor manipulated between conditions, as 0.003% in the control condition and 0.000% in the zero-value condition. As A's signal distortion improved from 0.003% to 0% its choice share dropped from 83% to 56%.

Being an undesirable attribute, price seems to perform differently from other undesirable attributes (Palmeira, 2010). If one was to apply the rationale from the described zero-comparison effect to price, he or she should have predicted the opposite of what Shampanier et al (2007) found. Taking the perspective that a small number provides a reference, whereas zero takes the reference away, consumers should consider Ferrero Rocher as extremely expensive, since it is being sold for more than ten times the price of Hershey's and prefer the latter. Therefore, compared to the zero and 0.25 condition, Hershey's should get a greater choice share when it has a very small price than when it is free. This was clearly not the case.

One cannot conclude that the zero-comparison effect does not exist when it comes to price. It is possible that this effect is present but there are other stronger opposing effects that are key factors in understanding the attractiveness of free products.

Nevertheless, it must be acknowledged that although we referred to a switch from relative comparisons to absolute ones, no clear evidence was found in the literature for this shift. To better understand the zero-comparison effect, further investigation is necessary to support or challenge this claim.

2.4. Social Norms

As mentioned before, a possible mechanism that might explain the overemphasis on free options deals with the norms that might accompany free products. Free invokes norms of social exchange, whereas costly options invoke market exchange norms (McGraw & Tetlock 2005; Kim et al. 2009; Edelman 2009). In one study, Heyman and Ariely (2004) demonstrate that people are likely to exert more effort under a social exchange than when monetary amounts are mentioned. However, when the elements of both social exchanges and monetary exchanges are present, the results are very similar to those of a monetary exchange. It is highly unlikely that participants apply social exchange norms to one option in the choice set (free option) and monetary exchange norms to the other (cost option). Instead, participants most likely apply the same set of norms to all choices in the set, and thereby eliminate the effect of social exchange norms.

Shampanier et al (2007) further tested the social norms hypothesis by offering the low-value chocolate for a small negative price ($−0.01), which creates a transaction with no financial cost, but still mentions money, and thus presumably does not invoke social exchange norms. They conclude the effect is not due to social exchange norms, since demand in this condition is similar to that in the free condition.

2.5. Mapping Difficulty

Another possible mechanism underlining the zero-price effect comes from the fact that people have difficulty mapping the utility they expect to receive into monetary terms (Ariely et al. 2006; Hsee et al. 2003; Nunes & Park 2003). For instance, there is evidence that maximum willingness to pay is susceptible to anchoring with an obviously irrelevant number such as the last two digits of a social security number (Ariely et al. 2006). These results reinforce the importance of context and that people resort to the use of external cues to come up with their valuations. To the extent that evaluating the utility of a piece of chocolate in monetary terms is difficult, loss-averse consumers might resort to a strategy that assures them of some positive surplus. As mentioned before about prospect theory, loss aversion refers to people's tendency to strongly prefer avoiding losses to acquiring gains. According to Shampanier et al (2007), the allure of free might be tied to this fear of loss. There is no clear possibility of loss when you choose a free item but there is a risk of having made a poor decision when you pay for that item. The zero-price effect might be attributed, according to this perspective, to the uncertainty surrounding the overall benefit associated with costly options and the contrasting certainty about overall benefits of free options.

To test this hypothesis Shampanier et al (2007) ran an experiment where children were able to exchange chocolate for chocolate rather than for money. Presumably, chocolates can be mapped more naturally onto other chocolates. They concluded that the zero-price effect remains strong even when the trade-offs involve commensurate products, which reduces the strength of the mapping difficulty hypothesis.

These results generalize Shampanier's et al (2007) previous findings. Attractiveness of zero cost is not limited to monetary transactions; there seems to be a general increase in the attractiveness of those options that do not require giving up anything. The results

hold when the goods and exchange currency are commensurate. Another important result is that, although a 0.01 price is not common in the marketplace, trading candies is common between children and approximate a real-life situation, which adds ecological validity to the findings.

Although these results challenge the mapping difficulty hypothesis, it does not exclude other possible mechanisms associated with the fear of loss effect that was mentioned.

2.6. Affect

The role of affect in decision making is currently a major focus in decision research. A number of new lines of research have begun to draw attention to the important role of affect in judgment and choice (Knutson et al. 2007; Rick & Loewenstein 2007; Mellers et al. 1999; Shiv & Fedorikhin 1999; Loewenstein & Lerner 2003; Hermalin & Isen 2008). Traditionally decision theory tended to focus on more cognitive types of errors - like the aforementioned distinction bias or diminishing sensitivity - as the main sources of sub-optimal decision making. Recent research is providing evidence for the idea that affect can distort decision making. The new research is also pointing to the conclusion that many biases that had earlier been viewed in cognitive terms may in fact reflect the influence of affective factors (Loewenstein et al. 2008; Lee et al. 2009). Parallel developments have been occurring in neuroscience, with that field showing signs of splitting into two subfields, one focusing on 'cognitive neuroscience' and the other on 'affective neuroscience' (Damásio 2006; Panksepp 2004).

A mechanism that might account for the zero-price effect is affect, such that options with no cost invoke a more positive affective response. Consumers might use this reaction as a decision-making cue opting for the free option. Previous research considers two basic components (Finucane et al. 2000; Slovic et al. 2007; Gourville & Soman 2005). The first is that free offers evoke a higher positive affect, and the second is that people use this affect as an input for their decision-making process.

Shampanier et al (2007) finds evidence that the free good elicits a more positive affect than standard cost-benefit analysis predicts. One reason for this could be that the decision to take a free candy is a much simpler decision, and that simplicity could be the driver of higher affect (Schwarz 2002; Diederich 2003). This topic shall be brought into

notice later in order to discuss the simplicity of the decision in more detail while discussing mental transaction costs.

Alternatively, much like the disutility of paying while consuming (Prelec & Loewenstein 1998), it is possible that options that involve both benefits and costs create a negative impact on affect due to the simultaneity of these two components — whereas options that have only benefits do not include this penalty.

In another experiment, Shampanier et al (2007) forced participants to engage in a cognitive and deliberate evaluation of the alternatives before they choose, and thereby make non-affective, more cognitive evaluations available and accessible to participants.

They concluded that affect invoked by the free option drives the zero-price effect, but when people have access to available cognitive inputs, they base their decisions on those, and the benefit of zero largely dissipates.

This explanation is sound but does not address what might cause this affect for free products in the first place. We are going to propose two potential explanations. One is related to the possibility that a free product may be able to reduce to zero the perceived risk of buyer's remorse. The other is rooted in the fact that people are always looking for ways to economize on their mental effort. In other words, we may like free because it helps us think less.

2.6.1. Heuristics and Zero-risk Bias

Individuals operate within both mental and environmental constraints. These include their limited cognitive resources, the information they have, or the finite amount of time available to make decisions (Baayen & Milin 2010). Therefore, decisions are merely bounded rational. Instead of a rigid rule of optimization, people commonly use heuristics to make decisions which ease the effort associated with the decision-making process. In everyday conversations, people often refer to heuristics as an “educated guess,” a “mental shortcut,” or a “rule of thumb.”According to Simon (1990), as cited in Shah and Oppenheimer (2008), heuristics are “methods for arriving at satisfactory solutions with modest amounts of computation.”

While often useful and convenient in everyday life, the use of heuristics means decisions are likely to be grounded on an incomplete appreciation of information and to

be influenced by extraneous factors. This might lead to anomalous and contradictory behavior under the effect of cognitive biases (Baayen & Milin, 2010). On the other hand, some research (Todd & Gigerenzer 2003) suggests that, with experience, people become well equipped to identify redundant information and to make accurate judgments from only small amounts of information. These 'fast and frugal' heuristics may be just as effective as complex forms of thinking (Gigerenzer 2004). The discussion continues between those who emphasize the repeated success of heuristics in generating sensible decisions and those who stress cognitive errors occasionally produced by heuristics.

Experience and feedback will usually result in the abandonment of grossly inaccurate heuristics. However, it cannot be assumed that inaccurate judgments will be recognized or individuals will have sufficient insight into their own thinking to recognize the underlying cognitive mechanisms and how they need to be changed (Baayen & Milin, 2010).

The propensity to use heuristics depends on the type of attributes and the difficulty of measurement. For instance, decision making is more heuristic in situations that involve spending time rather than money because, compared to monetary expenditures, temporal expenditures are harder to account for (Saini & Monga 2008).

Some heuristics are based on attempts to recognize relationships between variables. In fact, they seem to work by an unconscious process called attribute substitution (Kahneman & Frederick 2002). Attribute Substitution theory suggests that when individuals have to make a judgment of a target attribute that is computationally complex or relatively inaccessible, they are likely to substitute it with a more easily calculated or accessible heuristic attribute. For instance, people may assume a relationship between price and quality, using one to predict the other (Völckner & Hofmann 2007). Even when the relevant uncertainty has been removed (i.e. post-tasting the products), studies have found that prices affect subjective quality evaluations of foods (Heffetz & Shaya 2009) and wines (Almenberg & Dreber 2010).

In the case of free products, it is possible that a heuristic might be linked with the zero-risk bias (Wakker et al. 1997; Kahneman & Tversky 1979). There is evidence that individuals prefer small benefits that are certain to large ones that are uncertain. This occurs when individuals value complete elimination of a risk, however small, to a

reduction in a greater risk. Individuals might assume that free products (zero-price) reduce to zero the probability of buyer's remorse (zero-risk). Zero-risk bias is one possible mechanism behind affect for zero-price. This zero-risk is a type of "nothing to lose" rationalization that may easily become a rule of thumb to apply when the individual is facing any zero-price offer. This is consistent with the view that zero prices create an environment of low risk experimentation and progress for consumers (Hippel 2001).

2.6.2. Mental Transaction Costs

Mental accounting is the set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities (Thaler 1995, 2004, 2008; Rajagopal & Rha 2009). Mental accounting procedures are those heuristics that have evolved to economize on time and thinking costs.

Mental transaction costs are the costs the buyer faces trying to estimate the desirability of the transaction (Szabo 1999; Kivetz 1999). This involves estimation such as the characteristics of the subject of the transaction, the uncertain future cash-flows and the actual inconvenience of having to make the decision. The effort required to process complex information may be regarded as a transaction cost and, like other costs, tends to keep people away from making purchase decisions. People tend to be cognitive misers (Garbarino & Edell 1997; Swait & Adamowicz 2001; Bettman et al. 1998). They will not waste effort thinking about something they consider not to warrant it and will be looking for ways to economize on their mental effort. It would be enormously taxing on individuals to attend to all information in the world with a high degree of analysis. As a result, people aim to expend the minimum amount of cognitive resources.

Szabo (1999) extended transaction costs to purchasing decisions. Mental transaction costs associated with the evaluation of a purchasing decision create a minimum level of inconvenience that cannot be removed simply by lowering the price of goods. Szabo (1999) looked at the idea of micropayments, a system that would allow you to pay fractions of a cent per Web page you read, for example. These business models are destined to fail, Szabo concluded, because although they minimize the economic costs of choices, they still have all the cognitive costs. As Odlyzko (2001) has pointed out,

consumers prefer flat-rate pricing from internet providers even though it costs them more because they eliminate this kind of cognitive costs. Furthermore, there is additional evidence of the impact of mental transaction costs from road pricing based on highway tolls (Levinson 2010).

Using the same reasoning, zero-price can have a significant impact on mental transaction costs (Anderson 2009; Anderson 2008; Pauwels & Weiss 2008). If we consider an individual offer of a free chocolate then we should expect a lower mental transaction cost compared with a non-zero priced offer. People, in this case, have one less computation because they do not have to answer the "Is it worth it?" question. People can use something like a "nothing to lose" heuristic and the decision to accept the offer gets easier.

We should note that there are other mental transaction costs to free products. People worry if it is really free or fear negative consequences for their social image by possibly being seen as a miser. They also weigh nonmonetary costs and externalities like, for instance, considering the environmental impact of a free newspaper (Anderson 2009).

The following diagram illustrates the two possible non-mutually exclusive causes for affect that were discussed.

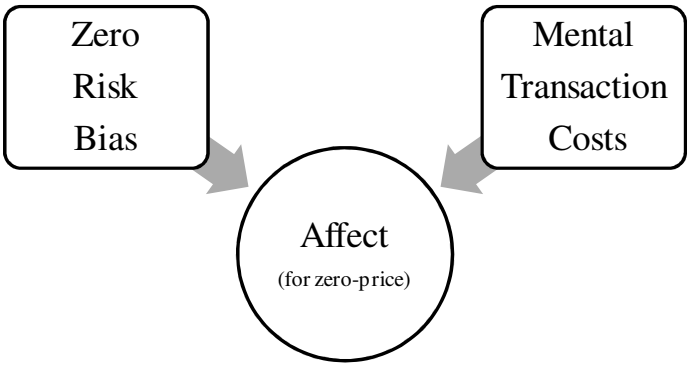

Figure 3 - Reasons for affect for zero-price

Consumers may consider free product as a way to reduce to zero the probability of buyer's remorse making zero-risk bias one underlying mechanism that leads to affect. The other cause might be the fact that people are looking for ways to economize on their mental effort. The association of free products and reduced mental transaction costs can lead to affect for zero-price.

2.6.3. Automatic Cognitive Process

An attitude is a hypothetical construct that represents an individual's degree of like or dislike for something. Attitudes are generally positive or negative judgments of an attitude object such as a person, place or event. Most attitudes are the result of either direct experience or observational learning from the environment (Coaley 2010) .

Automatic cognitive process appears as one general concept comprising all processes that, once started, do not need conscious monitoring as they run by themselves (Bargh & Chartrand 2000). They are characterized by implicitness, spontaneity, rapidity, efficiency and inevitability in the presence of triggering cues (Moors & De Houwer 2006).

Consumer contexts are conducive to automatic processing effects related to attitudes and there is evidence that a considerable amount of processing occurs in this unconscious manner (Dehaene et al. 2001). Fitzsimons et al. (2002) reviewed evidence for the role of non-conscious influences on consumer responses including affect and choice. Dijksterhuis et al. (2006) further argued for the role of the unconscious in the routine behavior of consumers and proposed that much of it involves automatic goal pursuit. The activation of that goal to act automatically evokes that specific behavior, labeled “habitual.” Conceptual accounts emphasizing conscious and careful information processing are unable to account for a large part of consumer choices. Instead, countless decisions are contextually or environmentally cue-induced and they either engage automatically activated attitudes or are completely devoid of deliberate attitude processing (Dijksterhuis et al. 2006).

In current marketplace interactions, consumers’ familiarity with brands, stores and products makes automatic processing very likely to occur in daily problem solving. This automatic processing also applies to the common repeat purchases of products with which consumers are involved (Hoyer 1984).

Since affect is one of the main causes presented for the attractiveness of free, we are going to concentrate on this kind of consumer response. For example, theories of category-based affect suggest that affective responses to stimuli can be a direct, automatic consequence of the act of categorization (Fiske 1982). When the category is

accessed, so too is the related affect which is then transferred automatically to the stimulus. For strong attitudes, the mere perception of the attitude object is often enough to automatically activate the attitude. Work on mere exposure effects (Zajonc 1968, 2001) also suggests that evaluations can be based upon implicit memory for stimuli, again leading to evaluations that occur non-consciously. Other researchers have focused on the degree to which attitude constructs can operate non-consciously or implicitly to impact behaviors in ways not recognized by conscious processing (Greenwald & Banaji 1995).

Finally, research in the ‘‘affect as information’’ stream has suggested that mood can impact judgments (Clore et al. 1994), at least when mood effects are not made salient, and thus are more likely to occur in an automatic, non-conscious fashion.

2.6.4. Implicit and explicit measures of attitudes

There is one attitude construct. Implicit and explicit measures are just different ways of measuring the same thing (Fazio & Olson 2003). Dual process theorists, e.g., within the MODE model (Fazio 1990) and the heuristic-systematic model (Chen & Chaiken 1999), agree that attitudes are produced jointly as a function of deliberate and spontaneous processing. Explicit attitudes are thought to measure deliberate processing and implicit attitudes are thought to measure spontaneous processing.

Explicit measures of attitudes rely on individuals' self-reported assessments of the specific attributes or their intentions regarding potential behaviors and choices they face. Responses are often registered on scales to express the degree to which the subjects possess an attribute or plan to engage in a particular behavior (Coaley 2010). This approach assumes that individuals have conscious access to the relevant constructs in memory. Oskamp & Schultz (2005) review several widely acknowledged problems with explicit measures. For instance, explicit measures may induce poor comprehension due to complex or unclear wording, perceived pressure to provide socially acceptable answers, misplaced propensity to indiscriminately agree to items regardless of content, or extremity of response. Implicit measures are less exposed to such methodological shortcomings.

Implicit measures hold the advantage that individuals may not realize what is being measured and may not be able to consciously correct their answers within the allotted time constraints (De Houwer et al. 2009, 2010). Automatic processing occurs in the absence of particular processing goals on the part of the individual or operates even when the person is unaware of the object prompting the process. In spite of the divergence in framework, there is evidence that implicit and explicit methods in a consumption context are reasonably well aligned and correlate highly (Dimofte 2010).
This study was based on an implicit measure - response latency - but it was complemented with some explicit measurements. The objective was to bring to light other possible effects and to make sure that what we intended to implicitly measure was not being influenced by other relevant factors. A possible correlation with the variables collected from the actual experiment – choice, inconsistency, response latency, etc. – can give more clues to better understand the subject.

2.6.5. Response Latency

Implicit measures of attitudes are often structured to assess whether information processing is facilitated (i.e., shorter latencies) or hindered (i.e., longer latencies) by the presentation of an attitude object (Gawronski & Bodenhausen 2007). Facilitation (or impairment) reflects the compatibility (or confliction) between the process engaged by the activation of the attitude and some other processing demand.
One of the most powerful and useful tools for studying automatic processes in judgment and choice is response-latency analysis. This approach has been used to measure judgment strength (Houston & Fazio 1989), measure automatic judgment activation (Fazio, Sanbonmatsu, et al. 1986), and to distinguish between ‘‘real’’ previously-formed judgments stored in memory versus ‘‘artificial’’ measurement-induced or constructed judgments (Fazio, Lenn, et al. 1984). Response-latency measures are superior to other measures in many respects. They are less reactive, less obtrusive, less susceptible to demand effects, and they also better predict persistence and resistance (Bassili 1996).

The automatic nature of the activation and processing makes respondents' control over their immediate evaluations almost impossible (Powell & Fazio 1984). In addition, research on attitude accessibility has demonstrated that strong attitudes speed up responses, suggesting the automatic activation of affect (Fazio, Sanbonmatsu, et al. 1986).

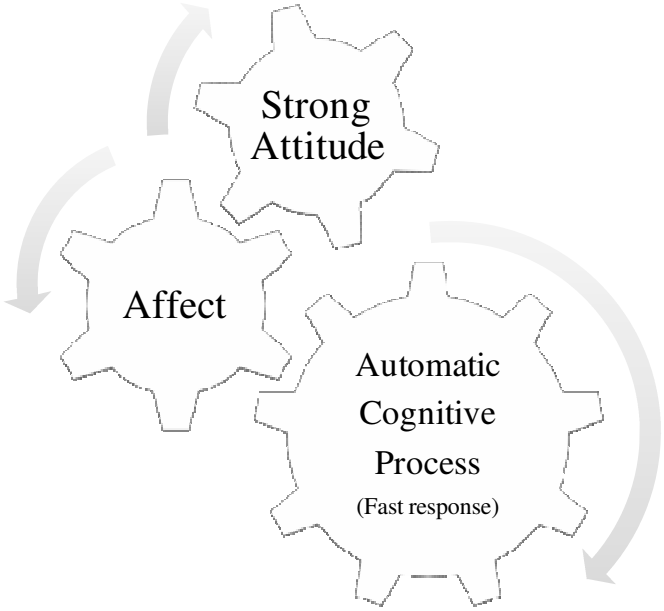

Figure 4 - Relationship between attitudes, affect and response speed

Considering the evidence from the automatic cognitive processes described, if affect accounts for the over-reaction to free products, then we should have shorter latencies when subjects are confronted with free products. Furthermore, faster responses would also be consistent with lower mental transaction costs. When offered something free, people would not have to answer the "Is it worth it" question and might activate a "nothing to lose" heuristic sparing mental effort.

This leads us to our main hypotheses:

H1: A free product makes the response faster.

2.6.6. Self-reported preferences

This study was complemented with some explicit measurements. Various kinds of rating scales have been developed to measure attitudes directly. The most widely used is the Likert Scale.

Likert (1932) developed the principle of measuring attitudes by asking people to respond to a series of statements about a topic, in terms of the extent to which they agree with them, therefore giving insight into the cognitive and affective components of attitudes.

2.7. Variety seeking or consistency seeking

Shampanier's et al (2007) study is based on an aggregate level analysis. If we were to sequentially expose subjects to both conditions – free and standard – in a random order we could collect more information to help understand the allure of free. For instance, we could evaluate if the conditions' order have an impact on choice consistency or response latency.

Consumers making repeated selections among a set of options often need to decide whether to stick with a favorite or switch to something different. A key finding in previous research is that people are often motivated to choose variety (Ratner, Kahn, et al. 1999). Consumers often seek variety in order to manage the declining utility from recent consumption of similar items (Inman 2001; Fishbach et al. 2011), to meet internal needs for stimulation (Raju 1980) and to make an impression on others that they are interesting and unique rather than closed-minded or boring (Ariely & Levav 2000; Ratner & Kahn 2002).

Other researchers suggest that consumers are motivated to seek consistency and exhibit stable preferences. Behavioral consistency allows one to follow stable preferences and exhibit loyalty. In addition, individuals infer their own preferences by monitoring their own past behaviors and then choosing similar subsequent actions (Aronson 1997). Consumers sometimes desire to enact loyal behaviors toward brands that have performed well in the past (Oliver 1999) and such behavior is driven by an emotional connection to the brand or company (M. D. Johnson et al. 2006).

3. Methodology

3.1. Experimental Method

The use of experimental methods in economics is a relatively recent development. Peer reviewed articles using experimental methods were almost nonexistent until the mid-1960s and surpassed 50 annually for the first time in 1982. By 1998, the number of experimental papers published per year exceeded 200 (Camerer & Loewenstein 2004).

Lab experiments allow the investigator to influence the set of prices, budget sets, information sets, and actions available to actors, and thus measure the impact of these factors on behavior within the context of the laboratory. It provides *ceteris paribus* observations of individual economic agents, which are otherwise difficult to obtain (Levitt & List 2007). For the purpose of this study - causal inference - the controlled conditions of the laboratory provide the best possible environment in which to abstract from other potentially confounding factors. This is known as the internal validity of laboratory experimentation.

Lab experiments can provide a crucial first understanding and suggest underlying mechanisms that might be at work when certain data patterns are observed. In this case, the observed data pattern is the demand at a price of zero that is many times higher than the demand at a very low price. This subject has been explored before using this methodology and we wanted to further investigate its causes. Unlike other subjects in economics, the data necessary to address these particular questions are not available in databases. Researchers have to use this type of methodology to get insights into the phenomenon.

To test our hypothesis, we examined how much time subjects take to reach a decision and whether they chose a free product even when they must forgo an option that, according to expected utility theory, they should find preferable. We contrasted two choice situations that involve a constant difference between two products' net benefits and used nonrandom aggregate preference inconsistency as a measure of over-reaction to the free product.

A nonrandom aggregate preference inconsistency exists when a group is incoherent in their preferences in a similar explainable manner. This differs from preference

heterogeneity in which model parameters account for differences in preferences between groups or individuals. Usually a study compares the distribution of choices across different experiments that were run with different samples and check for consistency with the model (Fehr & Schmidt 2006). This happens when, for instance, different contexts or question phrasings of identical choice situations lead to different choices and different model parameter estimates. By contrast, within-subject tests analyze individual-level decisions obtained in different experiments with the same sample (Blanco et al. 2010). This analysis will also be present by the introduction of the second moment of the experiment.

Studies show that judgments can change with mood, weather, and any number of random factors that a researcher cannot measure. The stochastic nature of preference in response to such modification is addressed in preference models by representing choice as a random variable (McCausland 2009). For instance, Random Utility theory includes a stochastic term allowing for random changes in preferences over repeated decisions. A significant finding is one that is evident even under the assumption of stochasticity in people's choices. We term preference inconsistency of a stochastic nature random preference inconsistency because it is frequently represented as a random variable in models.

In a similar setup as Shampanier's et al (2007) experiment, all subjects must choose between two options: buy a low-value product (e.g., one undifferentiated chocolate we will name "Red"), or buy a higher-value product (e.g., one Ferrero Roche). The variation across conditions that enables us to measure their reaction to the price of zero relies on two basic conditions: "standard" and "free." In the standard condition, the prices of both products are positive — Red costs € 0,05 and Ferrero Roche costs € 0,10. In the free condition, both prices are reduced by the same amount, so that the cheaper good becomes free - Red is free and the Ferrero is € 0,05.

In our free conditions, the cheaper product always weakly dominates a possible buying nothing alternative, because they share the same cost (zero) and clearly differ in their benefits (J. Huber & McCann 1982). In the cost conditions, no such asymmetric dominance relationship exists. We decided to exclude the "buying nothing" option to make sure the asymmetric dominance relationship does not interfere with our results.

3.2. Subjects

The experiment was conducted in November in two subsequent sessions at different Oporto University campuses with 150 students from two areas of knowledge: Humanities (n1=76) and Engineering (n2=74). The samples were drawn from the population of undergraduates and a member of each sample participated in only one session.

We recruited volunteers as participants in the experiment and not students from the researchers' own course, other courses in the department or even in the same campus. We were concerned with inducing demand effects in students knowledgeable of the theories we were trying to test. Moreover, we were looking for "true" volunteers and not "pretend" volunteers who are students in a class that feel compelled to participate and would decline to do so outside this context. Recruiting participants from across the university is a relatively painless way to avoid selection biases.

A final issue in the subject-pool concerns the use of students instead of the general population. In terms of economics experiments that test theories, this is not a problematic criticism – the economic theory is supposed to be general and to apply to anyone facing a decision-making process like the one described in the theory.

The day before the experiment, an email was sent to the student population inviting them to "participate in a scientific study about decision making." We decided to keep details to a minimum in order to curtail any possible self-selection bias. In addition, we did not want to use any kind of deception just to attract more subjects. One of the general accepted rules in experimental economics is that the researcher must not deceive their participants. This prohibition on deception includes deception about the purpose of the experiment, the payoff the participants will earn, or the characterization of the participants' counterparts. The validity of an economic experiment rests on the link between behavior and incentives. If that link is weakened, the experiment becomes an inferior test of the economic theory it is designed to address. If participants are deceived about that link, the validity of their decisions is called into doubt. A second reason deception is disfavored has to do with the public-goods nature of trust in the experimenter. If participants are routinely deceived in experiments, they will begin to

distrust the experimenter's statements. This lack of trust could lead the participants to change their behavior in future experiments.

3.3. Procedures

A booth in a classroom contained two upside-down cardboard boxes, one for each condition – free or standard. Below each of these boxes were two glass containers half-full of chocolates with a large label indicating the price. In the case of the zero price, the label indicated "grátis" – "free" in Portuguese.

Before entering the room, the participants were briefed with minimal context. We chose this for three reasons. First, as discussed before, context can add systematic bias or demand effects. For example, if participants in aggregate think they should select food from well-known brands for safety reasons then describing (framing) the decision in terms of choosing between a well-known and a unknown brand might increase the likelihood of choosing the former rather than the latter. This would change the responses in a systematic way. Second, context often adds variance to the data. This additional noise might not change the average or aggregate decision, but it can impact the variance of those decisions, reducing the likelihood of detecting statistically significant differences between treatments of the experiment. Finally, the theory being developed is supposed to apply generally, so those experiments should not rely on a particular context.

The standard text for the briefing outside the classroom was the following:

"This is a simulation of a real buying situation where you must choose between two objects with different prices. You can quit at any time without paying anything. The whole procedure will take 5 to 10 minutes. The experiment will be videotaped for academic purposes and ultimately deleted. It will not be viewed by anyone besides the conductors of the experiment. Do you want to proceed?"

We were aware of the likely impact of the Hawthorne effect amplified by the presence of the camcorder. This difficulty was weighted against the bias introduced in the reaction time by the presence of someone with a stopwatch in the room and the

difficulty of accurately and consistently measuring time on-the-fly without the advantage given by a replay. We believe this deferred data collection setup was the superior one between the only two options we regarded as ethical.

The camcorder was positioned at 2.5 meters in height and behind the subject to minimize intrusiveness and aimed at the cardboard boxes giving the option of avoiding having one's face filmed if he/she didn't deliberately face the camera.

When the subject entered the classroom, he/she was assigned to one of the conditions (free or standard) based on a randomly generated order prepared beforehand. Afterwards, more information was given by the researcher:

"Below this box are two items with a price. After I remove the box you can choose one of the items. If you choose the most expensive item of each box you will pay 15 cents. This is the maximum amount you can spend. After I remove the box you must decide and pick up the one you choose. You cannot ask questions during the experiment. Do you have any questions now? Do you want to proceed?"

Since one of the variables was the speed of the decision, we wanted to minimize the temptation to interact with the researcher when the clock was ticking. When the researcher exposed the chocolates, he faced sideways to discourage any questions. This was critical because we wanted to measure the lapsed time between the instant the chocolates were exposed and the moment the subject picked one of them.

After the subject had selected his chocolate, the first moment of the experiment ended.

The second moment was the repetition of the experiment with the other condition (free or standard).

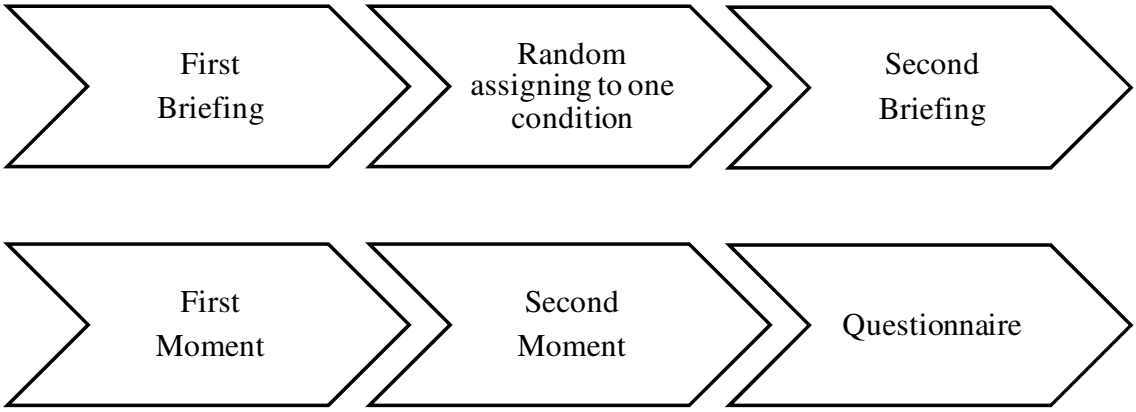

Figure 5 - Sequential steps in the methodology

During the experiment there was a frequent re-supply of chocolates in order to maintain the half-full condition and the balance between the glass containers. The goal is to prevent inference by the subject - based on the unevenness between the containers - on the choices of previous subjects and to make the conditions as similar as possible for each participant.

3.4. Revealed Preferences

Economic theories describe and predict decisions individuals will make in the presence of payoffs. It is critical for theory testing that the participants actually face the payoffs assumed by the theory. The fact that individuals cooperate in social dilemmas when there are no payoff consequences from their actions is simply not informative. Economic theory makes no predictions of what individuals will say they would do and only states what they will do when faced with a given decision and the resulting payoffs. The hypothetical bias is well documented (Hensher 2010) and would almost certainly have an effect not only on the choices but on the reaction time. Therefore, we could not tell people that they weren't going to pay. We wanted to make sure that people understood this is not a hypothetical purchase but a real one and that the cost of the goods would be very small. We didn't want people to feel any kind of deception.

After the participants had chosen the chocolates we had the option to refuse the payment and offer the selected chocolates as a gift since the variables had already been

captured. We felt that this behavior would confuse the participants and seem suspicious because just seconds before we insisted it wasn't hypothetical, and that they would have to pay. Therefore, in the name of congruence, we received the payment from the participants.

After the payment each participant was asked to complete a one-page questionnaire (appendix). As mentioned before, Likert-type scales use fixed choice response formats and are designed to measure attitudes or opinions. These ordinal scales measure levels of agreement or disagreement. A Likert-type scale assumes that the strength/intensity of experience is linear, i.e. on a continuum from strongly agree to strongly disagree, and makes the assumption that attitudes can be measured (Oppenheim 1998). Respondents may be offered a choice of five to seven or even nine pre-coded responses with the neutral point being neither agree nor disagree. Subjects were asked to rate on a Likert scale their liking for chocolate and for bonbons. If the subjects responded positively, the perceived applicability of the affirmation *"I like chocolate but should not eat it"* was also rated by them. An open-ended question to elicit their favorite brands of chocolates was then used with the objective of identifying subjects who consider "Ferrero Roche" on their favorite list. It is clear that subjects were primed by the exposure to this brand just before the questionnaire and it is reasonable to expect a much higher rate of remembrance than the real top of mind favorite before the experiment. Nevertheless, the objective was not to find a top of mind favorite but to evaluate if the fact that this brand was a favorite had an impact on choice, on consistency of choices or on response latency.

Before leaving the room the participants received a short explanation on the objectives of the experiment and the importance of their participation. They were also given the opportunity to ask further questions. In the end, the participants were asked not to share any information about the experiment with their colleagues and to hide the chocolates in order to maintain the validity of the experiment uncompromised.

4. Results and Discussion

4.1. Outliers

Outliers are response times generated by processes that are not the one(s) being studied. A single extremely long outlier can increase the mean, inflate the standard deviation, and change measures of shape such as skewness by a large degree (Wagner 2009). The processes that generate outliers in response latency can be fast guesses, guesses that are based on the subject's estimate of the typical time to respond, multiple runs of the process that is actually under study, the subject's inattention, or guesses based on the subject's failure to reach a decision (Ratcliff 1993). In these contexts and for most theoretical or empirical purposes, it is desirable to eliminate outliers from the data. However, eliminating outliers requires unambiguously identifying them. The problem is that the distribution of response times from the real processes under study overlaps, to a great extent, the distribution of outlier response times. As a result, the best we can hope to do is to reduce the effects of potential outliers while eliminating as little as possible the data of real interest.

Luce (1991) demonstrated that genuine Response Latencies (RL) have a minimum value of at least 100 ms. It is the time needed for physiological processes such as stimulus perception and motor responses. Even the fastest response time (1320ms) did not get close to these values and seemed perfectly reasonable. We were not concerned with the existence of those fast guesses.

Response Latencies in the middle of the distribution due to spurious processes are impossible to identify, because they are intermixed with genuine RL. There is nothing that can be done beyond tight experimental control during the task itself to attenuate the effects of these responses.

It is quite common for some RL to be slow and these RL can strongly influence the outcome of hypothesis tests. The aim is to lessen the impact of such outliers by using statistical transformations of the data that minimize their effects or by trimming them out of the data.

Transforming RL to speed (inverse RL) normalizes the distribution somewhat, reduces the effect of slow outliers, and therefore generally maintains good power (Ratcliff 1993). Transforming data by using the logarithm of each RL normalizes the distribution more than the inverse transformation, although the effect of long RL is not attenuated to the same extent as the inverse, and therefore power is reduced relative to the inverse transformation. There are also issues of interpretation after transformation of a variable, because the relationship among the variables has been changed.

Cutoffs eliminate slow RL by excluding data longer than some absolute time, some percentage of the data, or data that are some proportion of standard deviations above the mean. No universal rule can be used to establish absolute cutoffs because they are highly dependent on the particular data that were observed. Consequently, cutoffs are often based on the standard deviation (Ratcliff 1993).

After careful consideration and histogram analysis, we decided to exclude all individuals that had at least in one of the two moments a RL greater than three standard deviations above the mean. We replayed the video recording of those extreme observations and they corresponded to situations where the subjects did not follow the instructions fully - asking questions during the timed experiment, for example – or did something outside the standard procedure like picking two chocolates to examine in detail. We felt assured that the exclusion of those observations was the right choice. This resulted in the elimination of 6 observations which represent 4% of the total sample size.

4.2. Attractiveness of free

When considering the first moment of the experiment, nonrandom aggregate preference inconsistency can be used as a measure of over or under-reaction to the free product. The first clear result is the support of Shampanier's et al (2007) conclusion that a small difference in price has a considerable influence on demand if it represents a difference between a positive price and zero. In spite of the same price difference between chocolates in both situations, the free "Red" attracted 34.2% of the participants against 18.9% when it was not free. We made the test for difference of means (without

assuming equal variance) and the results indicate that there is a statistically significant relationship between the price setup and the choice of chocolate (t = 2.14 and two tailed p = 0.034). Participants reacted as if a free Red had more intrinsic value than a positively priced Red.

When considering the second moment of the experiment we can evaluate behavior on an individual level. Subjects changed their choice of chocolate in 38.9% of the cases between the two moments. This gives support to previous studies that point out that consumers making repeated selections among a set of options are often motivated to choose variety (Ratner, Kahn, et al. 1999). The following chart indicates the number of chocolate changing subjects in the multiple possible outcomes and their representativeness.

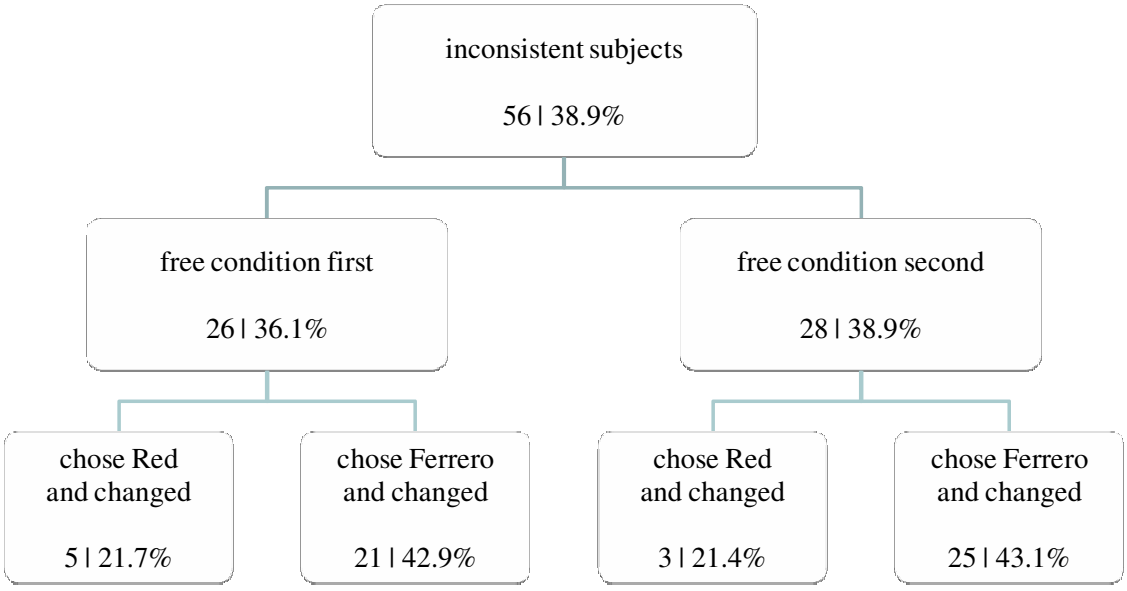

Figure 6 - Number of subjects that changed their choice between moments and their representativeness

When the experiment started with the free/non-free combination (free condition), 36.1% changed their choice of chocolate for the second moment. When the experiment started with the non-free/non-free combination (standard condition), 38.9% changed their choice of chocolate for the second moment. With a t = 0.34 and a two-tailed p = 0.73, the results suggest that there is no statistically significant relationship between the order of the experiment and the propensity to change the chosen chocolate between moments.

This suggests that the condition's order does not have an impact on choice consistency. In other words, we probably do not have more chances of persuading an individual to change his choice if we present the free chocolate condition in the second moment.

Another result was that subjects seemed more willing to change their choice if they had chosen the Ferrero (43%) in the first moment instead of the Red (22%). The sample was too small to do separate conclusive tests by not assuming the irrelevance of the order of the conditions ($t=-1.75$, $p=0.08$ for the free condition first). Given the evidence presented, we decided for that assumption and consider all the 56 subjects that changed their choice together in one group. With a $t = 2.55$ and a $p = 0.01$, the results suggest that there is a statistically significant difference between the proportions. People who chose Ferrero changed more. One possible explanation is rooted in the fact that, unlike Red, Ferrero is a well known brand and the majority of the participants have tasted this chocolate before. In that case, and since variety seeking is often linked with the desire to experience new products (Kahn 1995), the wish to taste an unknown chocolate could be the reason behind this inconsistent behavior. People might like Ferrero but want to try another chocolate for variety and for a chance that they might like it even more. Furthermore, there is the possibility that people know they do not like Ferrero and so will consistently chose an unknown chocolate that they might eventually like.

4.3. Response Latency

Response Latency (RL), the elapsed decision time, is a common dependent variable. Conducting an Analysis of Variance (ANOVA) on the sample may not be effective, due to the particular characteristics of RL data. Importantly, these distributions are not normal distributions but rather rise rapidly on the left and have a long positive tail on the right. We can see an example in the following histogram.

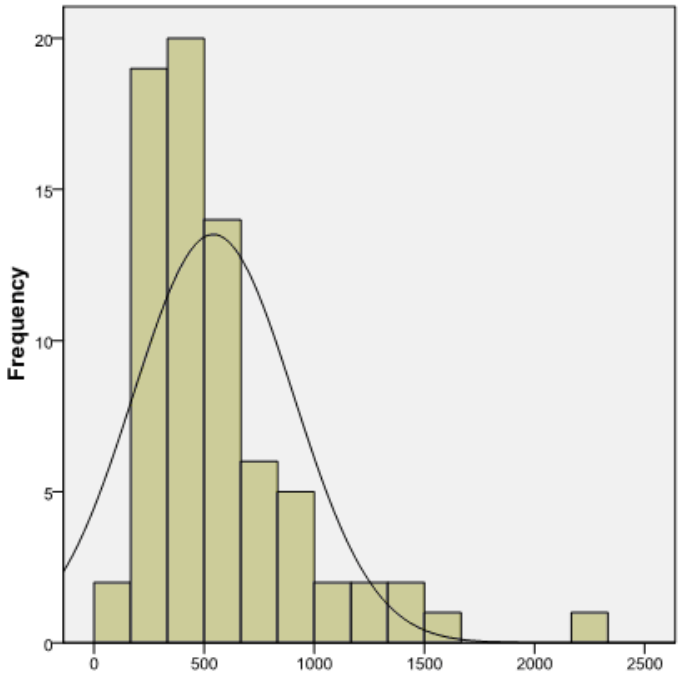

Figure 7 - Histogram of Response Latency in the standard condition (unit: cs - hundredths of seconds).

Neither the mean nor the standard deviation is a robust measure. The mean is not reflective of the typical response if the distribution is skewed, because the mean is distorted in the direction of the skew. The standard deviation can be greatly increased by a relatively low number of slow RL. Therefore, many researchers report the median RL as a central tendency parameter, because it is less susceptible to departures from normality (i.e., robust). A difficulty with using the median is that unlike the sample mean, it is a biased estimator of the population median when the population is skewed: the true population median will, on average, be underestimated. However, this is a

minor problem in our experiment because we are comparing conditions with the same number of trials, so the bias is approximately equal across conditions.

In the first moment of the experiment, median latencies in groups “free” and “standard” were 488 centiseconds (cs) and 448 cs respectively. The median subject in the free condition took longer then the one in the control condition. However, we ran non-parametric tests and could not conclude that the distributions in the two groups differed significantly (Mann-Whitney U = 2337, Z=-1.019, p = 0.31).

In the second moment, median latencies in groups “free” and “standard” were 381 cs and 503 cs respectively. The median subject in the free condition took less than the one in the control condition and the results were significant (Mann-Whitney U = 1960, Z=-2.523, p = 0.01). This evidence is consistent with the hypothesis that affect and lower mental transaction costs accounts for the over-reaction to free products. People do not have to answer the “Is it worth it?” question and may activate a “nothing to lose” heuristic sparing mental effort.

It is important to acknowledge the strong possibility of carryover effects i.e., the second moment in the experiment being conditioned by the first. For instance, repeated measure designs are almost always affected by practice effects. Subjects can become faster at a task over time or, conversely, become slower through boredom and fatigue. This is one of the reasons why we did not compare RL between moments.

Considering the limitations of an analysis based solely on the median, we decided to analyze the whole distribution, thereby discovering effects that would otherwise be missed. Response Latency distributions are similar to the ex-Gaussian distribution (Luce 1986), which is a convolution of a Gaussian and an exponential distribution that has been shown to fit empirical RL distributions well (e.g., Balota & Spieler, 2008; 1999). This distribution has three parameters. The mean and the standard deviation of Gaussian - the left hump - are described by mu (μ) and sigma (δ), respectively. Tau (τ) describes both the mean and the standard deviation of the exponential component - the right tail. The ex-Gaussian probability density function is written as

$$f(x \mid \mu,\sigma,\tau) = \frac{1}{\tau}\exp\left(\frac{\mu}{\tau}+\frac{\sigma^2}{2\tau^2}-\frac{x}{\tau}\right)\Phi\left(\frac{x-\mu-\sigma^2/\tau}{\sigma}\right).$$

One difficulty with the ex-Gaussian function is that there is no arithmetic or other simple way to derive the parameters of the underlying processes from the observable data. To estimate the unobservable parameters, an iterative procedure is used to find the parameter values for which the shape of the probability function best fits the frequency distribution of data. DISTRIB is a MATLAB toolbox comprising the necessary functions to fit the ex-Gaussian Probability Distribution Function (PDF) using maximum likelihood estimation (Lagarias et al. 1999). Egfit is a function that implements a robust search algorithm to fit the ex-Gaussian PDF to a frequency distribution (Lacouture & Cousineau 2008).

Since median latency analysis was inconclusive for the first moment of the experiment, we wanted to analyze the between-group differences using the ex-Gaussian parameters. The MATLAB parameters output for the first moment were:

Parameter	mu (μ)	sigma (δ)	tau (τ)
Free condition	204,270	53,992	403,423
Standard condition	219,381	55,719	312,855

Figure 8 - Ex-Gaussian Parameter for the first moment of the experiment (Unit: cs - hundredths of seconds).

The Gaussian component can be conceptualized as the transduction component, i.e., the sum of the time required by the sensory process and the time required to physically make the response (Luce, 1986). The exponential process can be seen as the decision component; i.e., the time required deciding which response to make. With this in mind, our objective of obtaining a proxy for time required to decide should be centered on this exponential part of the distribution. However, we must recognize that associating particular cognitive processes with the ex-Gaussian parameters is not free of critics. Some research points out that the interpretation of ex-Gaussian parameters is

problematic (Matzke & Wagenmakers 2009), with no clear correspondence between the parameters of the ex-Gaussian function and those of a widely accepted cognitive model of binary choice reaction time tasks (Ratcliff & Rouder 1998; Rouder et al. 2008). As a result, the initial analysis in terms of ex-Gaussian parameters shown here is useful in that it tells us there is a difference in distribution shape that may be driven by the conditions of the experiment. It also matches the earlier analyses that have highlighted a change in median RL. Nevertheless, as with the median RL, the ex-Gaussian distributional characterization is simply that, a characterization.

Ex-Gaussian parameters were individually entered into one-way ANOVAs. Neither mu ($F(1,142) = 1.715$; $p=0.19$) nor sigma ($F(1,142)=1.215$; $p=0.27$), the normal component of the ex-Gaussian RL curve, was significantly different between groups. In a theoretical perspective, it was reasonable to expect that the distribution of the time required for the sensory process and the physical response would not be very different across conditions. A significant difference between groups was shown on the exponential part of the curve, tau ($F(1,142) = 4.811$; $p = 0.03$), suggesting that the subject in the free condition demonstrated a more positive skew in their distribution of RL. This was consistent with the hypothesis that mental effort and conscious reasoning is superior in the particular context of this experiment.

The MATLAB parameters output for the second moment of the experiment brought different results:

Parameter	mu (μ)	sigma (δ)	tau (τ)
Free condition	222,561	640,627	208,452
Standard condition	297,072	110,732	221,344

Figure 9 - Ex-Gaussian Parameter for the second moment of the experiment (Unit: cs - hundredths of seconds).

Both mu ($F(1,142)=5.225$; $p=0.03$) and sigma ($F(1,142)=8.577$; $p<0.01$) were significantly different between groups. However, tau ($F(1,142) = 1.841$; $p = 0.17$) was not significantly different across conditions. All the parameters were greater in the standard condition which is consistent with what we have seen in the median analysis.

The between-groups difference in tau suggests that the free condition increases mental effort and conscious reasoning. This is reasonable because an offer where people must evaluate if it is worth forgoing a free chocolate in favor of another chocolate with an attractive price is unusual. Consumers are used to offers of free goods where they only have to decide if they accept it or not. The evidence in these more common situations is for short response latency associated with automatic cognitive process and heuristics.

In the second moment we have the opposite result. After being exposed to the standard condition in the first moment, people are noticeably faster when a free chocolate is present. Considering that the first moment helped subjects become more comfortable with the task, it is reasonable to think that the salient features of the second moment – a free product – more easily activated an automatic process or heuristic.

Nevertheless, we must acknowledge that the use of implicit measures such as response latency has some limitations in itself. For example, the fact that a particular construct is assessed via an implicit measure does not necessarily imply that the construct is an implicit or nonconscious one. It may simply suggest that motivational influences that occur downstream from attitude elicitation play a key role (Fazio & Towles-Schwen 1999). At the same time, different implicit measures of the same construct sometimes do not correlate very highly leading some researchers to question their validity (Fazio & Olson 2003; Olson et al. 2007; Payne et al. 2008).

4.4. Questionnaire

The questionnaire (appendix) combines diverse information on self-reported preferences related to the experiment. A possible correlation with the variables collected from the actual experiment – choice, inconsistency, response latency, etc. – can give more clues to better understand the subject of the study and even uncover some potential effect one might have missed. Subjects were asked to rate on a Likert scale their liking for chocolate and for bonbons. If the subjects responded positively, the

perceived applicability of the affirmation “I like chocolate but should not eat it” was also rated by them. An open-ended question to elicit their favorite brands of chocolates was used with the objective of identifying subjects who include “Ferrero Roche” on their favorites.

The correct use of the coefficient of correlation depends heavily on the assumptions made with respect to the nature of the data. The distributions of both variables related by the coefficient of correlation should be normal and the scatter-plots should be linear and homoscedastic. In situations like this one where those assumptions are violated, Pearson correlations coefficients become inadequate to explain a given relationship (Frankfort-Nachmias & Leon-Guerrero 2005). In this situation, it is better to use nonparametric correlations.

A rank-order correlation coefficient that makes no assumptions about the distribution of the actual values is Kendall’s Tau-b. Kendall’s Tau-b like other closely related rank-order correlation coefficients (e.g., Goodman’s and Kruskal’s Gamma) are calculated as a ratio. In the numerator is a ratio which denotes the difference between the number of all “concordant” and “discordant” pairs (Frankfort-Nachmias & Leon-Guerrero 2005).

The following table shows Kendall's tau-b correlation coefficients between the variables of the observed behavior during the experiment and the self-reported preferences.

Kendall's tau-b correlation coefficient and p-value	Likes Chocolate	Likes Bonbons	"I like chocolate but should not eat it"	Favorite Brand Ferrero Roche
Choice	**,058**	**,041**	**,053**	**,326**
	,621	,725	,627	,008
Inconcistency	**,094**	**,076**	**,057**	**-,027**
	,256	,355	,458	,748
Response Latency	**,001**	**-,008**	**-,030**	**,018**
	,993	,902	,634	,802

Figure 10 - Correlation coefficient table with Kendall's tau-b (bold) and corresponding p-value

In terms of actual choice, the results were not significantly correlated with the subject’s rating of their general liking of chocolate (K tau-b=0.058; p=0.62) and of bonbons (K tau-b=0.041; p=0.73). The same is true for the perceived applicability of the affirmation “I like chocolate but should not eat it” (K tau-b=0.053; p=0.63). Unsurprisingly, the

choice of chocolates is correlated with fact that the subject indicated “Ferrero Roche” as one of his favorite brands.

In terms of consistency and response latency, the correlations were not significant with the reported preferences. The fact that favorite brand does not correlate with choice inconsistency gives further support to the explanation for the observed behavior that people who chose Ferrero first, changed more. People might like Ferrero but want to try another chocolate for variety. A favorite brand does not imply consistency in these sequential experiments.

Overall, the questionnaire did not bring other significant insights to our study.

4.5. Limitations

One possible limitation of this experiment is the fact that the experimental conditions were restricted to low priced products. It is reasonable to question whether the effects occur when the decisions involve larger sums of money. Shampanier et al (2007) ran a survey with a similar design, but regarding the purchase of an LCD flat-panel television. The four conditions varied in terms of prices, such that a Sharp LCD was always $599 more expensive than a Philips LCD, and the prices of both sets decreased by approximately $100 across conditions. The conditions were 299 vs. 898, 199 vs. 798, 99 vs. 698, and 0 vs. 598. Results generally resembled their previous findings. A shift in demand is apparent only when the price is reduced to zero. Otherwise, the effects of price reductions do not have a significant influence on the relative demand for the two televisions. Despite being self-reported preferences from a survey prone to hypothetical bias (unlike revealed preferences in our experiment), their results suggest that the effect of the price of zero is not limited to small prices and meaningless decisions.

5. Conclusion

Shampanier et al (2007) showed that when faced with a choice between two products, one of which is free, people overreact to the free product. People behave as if zero prices meant not only a low cost of buying the product, but also its increased valuation. Our experiment supports this conclusion, showing that a small difference in price has a substantial and disproportionate influence on demand if it represents a difference between a small positive price and zero.

In comparison with the abovementioned paper, our experiment had additional features including a sequential selection from each condition, measuring response latency and a questionnaire.

In the sequential experiment, subjects often changed their choice of chocolate between the two moments. This gives support to previous studies that point out that consumers making repeated selections are often motivated to choose variety. There was no evidence of a relationship between the order of the experiment and the inconsistency in the choice of chocolates between moments.

The evidence from the response latency analysis was mixed and did not lead to a clear conclusion. We should keep in mind two potential opposite effects that might tend to cancel each other out. On one hand, affect (and associated automatic processes) can contribute to faster times. On the other, the peculiar nature of this free condition and the perceived difficulty of the task might obstruct the alternative shortcut of heuristics and encourage a more conscious and slower response. The results depend on the stronger effect. We found that the first and the second moment of the experiment had opposing results. In the first moment, people were slower when a free chocolate was present suggesting that the unusual question effect was stronger then a potentially triggered heuristic effect. After being exposed to the standard condition in the first moment, people were noticeably faster in the free condition. Considering that the first moment helped subjects become more comfortable with the task, it is reasonable to suggest that the salient features of the second moment – a free product – might have activated an automatic process that increased the speed of response.

The questionnaire combined diverse information on self-reported preferences. A possible correlation with the variables collected from the actual experiment could bring significant information to the subject. Overall, the correlations were not significant with the reported preferences. The fact that favorite brand does not correlate with choice inconsistency gives support to the proposed reason why people who chose Ferrero first, changed more. Unlike Red, Ferrero is a well known brand and the majority of the participants have tasted before. The desire to taste a new chocolate may be the reason behind this inconsistent behavior. People might like Ferrero but want to try another chocolate for variety and for a chance that they might like it even more. A favorite brand does not imply consistency in these sequential experiments.

This study adds additional evidence to previous findings that show that free is a unique price. Although our results are consistent with the view that the zero-price effect may be explained by affect, the price of zero remains a complex and rich domain, and all the forces described may come into play in different situations. Therefore, considerable additional work is needed to better understand the complexities of zero prices.

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Appendix

U.PORTO

FEP FACULDADE DE ECONOMIA UNIVERSIDADE DO PORTO

Questionário sobre comportamento do consumidor

Solicitamos a sua colaboração no preenchimento deste questionário sobre o seu comportamento quando está a fazer compras. Não existem respostas certas ou erradas. Pedimos que seja preciso(a) e sincero(a). A colaboração é voluntária e anónima, pelo que pedimos que não se identifique em qualquer parte do questionário.

Sexo: **Masculino** ☐ **Feminino** ☐ **Idade:** ____

Sobre Chocolate:	Não gosto nada 1	Não gosto 2	Nem gosto, nem desgosto 3	Gosto 4	Gosto muito 5
Gosta de chocolate?	☐	☐	☐	☐	☐
Gosta de bombons de chocolate?	☐	☐	☐	☐	☐

Se respondeu que gosta ou que gosta muito de chocolate:	Não se aplica nada a mim 1	2	3	4	Aplica-se completamente a mim. 5
Eu gosto de chocolate mas não devo comer.	☐	☐	☐	☐	☐

Quais as suas marcas preferidas de chocolate?	

Sobre si próprio:	Discordo Fortemente 1	Discordo 2	Não concordo, nem discordo 3	Concordo 4	Concordo Fortemente 5
É divertido comprar de forma espontânea.	☐	☐	☐	☐	☐
Eu não compro até ter a certeza que é uma verdadeira pechincha.	☐	☐	☐	☐	☐
Eu evito comprar coisas que não estão na minha lista de compras.	☐	☐	☐	☐	☐
O tempo que demoro para encontrar preços mais baixos normalmente não vale o esforço.	☐	☐	☐	☐	☐
Eu nunca compraria em mais do que uma loja para encontrar preços mais baixos.	☐	☐	☐	☐	☐
Para mim, comprar alimentos é uma ocorrência espontânea.	☐	☐	☐	☐	☐
Mesmo quando vejo algo de que realmente gosto, eu não compro a menos que seja uma compra planeada.	☐	☐	☐	☐	☐
Interessa-me bastante preços baixos mas também me interessa a qualidade do produto.	☐	☐	☐	☐	☐
O dinheiro poupado por encontrar preços mais baixos não vale o tempo e esforço.	☐	☐	☐	☐	☐
Não quero correr riscos desnecessários.	☐	☐	☐	☐	☐
Quando estou a comprar alimentos comparo os preços de diferentes marcas para ter a certeza que obtenho o máximo pelo dinheiro gasto.	☐	☐	☐	☐	☐
No que diz respeito à compra de alimentos, geralmente compro por impulso.	☐	☐	☐	☐	☐
Quando estou a comprar um produto, tento sempre maximizar a qualidade que obtenho pelo dinheiro que gasto.	☐	☐	☐	☐	☐
Eu não gosto de correr riscos.	☐	☐	☐	☐	☐
Em termos gerais, considero-me um comprador impulsivo.	☐	☐	☐	☐	☐
Normalmente, quando estou a comprar alimentos, comparo o preço por kg das marcas que normalmente compro.	☐	☐	☐	☐	☐
Eu compro alimentos em mais de uma loja para aproveitar preços mais baixos.	☐	☐	☐	☐	☐
Para mim, comprar alimentos pode ser algo inesperado.	☐	☐	☐	☐	☐
Quando vou às compras, eu compro coisas que não tinha a intenção de comprar.	☐	☐	☐	☐	☐
Eu verifico sempre os preços para ter sempre a certeza que obtenho o máximo pelo dinheiro gasto.	☐	☐	☐	☐	☐
Comparando com outras pessoas, eu gosto de arriscar.	☐	☐	☐	☐	☐
Eu não estou disposto a fazer um esforço extra para encontrar preços mais baixos.	☐	☐	☐	☐	☐
Comparando com outras pessoas, eu gosto de "viver a vida no limite".	☐	☐	☐	☐	☐

Obrigado pela sua colaboração.