

Lilla Lipták

**THE EFFECT OF EXTERNAL REFERENCE PRICE ON CONSUMERS'
PRICE EVALUATION AND DECISION-MAKING**

PhD Dissertation Theses

Szeged, 2023

University of Szeged
Faculty of Economics and Business Administration
Doctoral School of Economics

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Supervisors:

Dr. habil. Szabolcs Prónay
Associate professor
University of Szeged
Faculty of Economics and Business Administration

Dr. habil. Péter Kovács
Associate professor
University of Szeged
Faculty of Economics and Business Administration

Szeged, 2023

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1. Relevance of the topic

In recent decades, the consumer market has multiplied, and now countless products and services are available globally. Because of the internet and the globalization, most consumers can access and buy goods from anywhere at any time. Amazon, which is currently the largest e-commerce company in the world, sells more than 12 million products worldwide on its platform. In this consumer environment, it is extremely difficult, even almost impossible, to choose the most favorable offer. In addition, the emergence and increasing use of dynamic pricing technologies make this environment even more complex. Therefore, it is more difficult for consumers to compare offers and make decisions, as they often see prices in a personalized way based on their previous purchases and searches. Furthermore, they can meet countless personalized promotions. In this environment the role of pricing and its inherent marketing potential undergoes rapid and significant transformations.

In addition to these, because of various economic and political processes, inflation has currently surged enormously in several countries, unfortunately also in Hungary, and the forint has weakened significantly, which also affects the value of currencies used in international trade. Thus, prices are constantly and rapidly changing, making it complicated to follow. For this reason, nowadays, it is very difficult for consumers to rely on their previous knowledge or on the price points that they had used to. In such an environment, the role of external reference prices is amplified. These are external price information, which can be the prices of products in the same product category that provides the basis for making comparisons and judging how good the price of a given product is. Or they can be the original prices displayed besides the sale price of a product.

For these reasons, the focus of the current doctoral dissertation is on the examination of external reference prices, since a deep understanding of this topic is deemed important not only in the current situation, but also in general, since external price information have a great influence on consumers. Therefore, it is extremely relevant to examine the subject.

2. Dissertation aims and literature review

To understand the role of prices, it is necessary to examine those mechanisms and biases associated with price evaluation that can have an impact on consumers' decision-making. In this dissertation a pricing-related phenomena is examined in the context of perceptual biases studied in behavioral economics – thus providing a new approach and theoretical basis for pricing. The study of price psychological phenomena in the literature has not been directly

linked to behavioral economic heuristics or biases. Therefore, in this dissertation, the novelty of the study of pricing is given by this theoretical connection, which was one of the primary goals of the current work. Therefore the main research question is: *How do perceptual biases - framing, priming, loss aversion and reference point effect - influence consumers' price evaluations and decision-making through external reference prices?* The focus of my research is always on perceptual biases in connection with external reference prices; however, in my dissertation, my goal was not only to examine the influence of external reference prices on price evaluation, but also to study other price-related factors, such as price consciousness or price observation. Therefore, the secondary research question of my research is this: *How do other factors associated with price evaluation - such as price awareness, price sensitivity, price observation, price recall and brand loyalty or taste - affect price evaluation?*

The dissertation was based on two main theoretic foundations, the theories of behavioral economics and pricing, especially price psychology. These two theories were linked to prove their connections with this research. In fact, the foundations of the dissertation are laid by behavioral economics, which states that consumers do not make rational decisions (Simon 1982), but are influenced by a number of factors during the decision-making process. These can be emotional, cultural, or social influences (Hámori 2003), but in many cases heuristics (simplifications) and associated biases occur that divert consumers from rational decision-making (Tversky - Kahneman 1974; Kahneman 2013). The so-called reference point can also distort our decision, among other things. This is nothing more than a reference point, which we can make a comparison against. Based on this we can evaluate and make a decision about something (Tversky - Kahneman 1974; Hámori 2003; Rabin 2008; Kahneman 2013). Translating the concept into pricing, we can call this a reference price, a price which we can compare to. Based on this comparison, we evaluate the price of other products or the goodness of an offer, and then decide whether to buy a product or which product alternative to purchase (Rekettye 2011; Kotler - Keller 2012). This is how behavioral economics connects with the other major theory of the dissertation, - price psychology - in particular with external reference prices, which provide a point of reference for comparing prices. Based on this, the two theories can be connected. In my opinion concepts related to price psychology can be paralleled with general behavioral economics and other psychological theories. According to price psychology, when an individual sees a price, he perceives and processes it with the help of cognitive processes. This can be called price perception. After that, consumers make comparisons and evaluate the offer. This is price evaluation. Then, depending on how someone perceived and evaluated the price, the consumer makes the purchase decision (Rekettye 2011). However, this

process can be influenced by a number of (distorting) factors that can affect how the consumer perceives the price. These factors can either be the placement of the price, its display, a highlight with a different color (Rekettie 2012) or the wording of the way the offer is communicated. In addition, individual and other factors (brand, macroeconomic factors, and habits) can also influence price evaluation. These phenomena cannot be considered novel in the literature, however, previously they have not been studied under a behavioral economics approach. Therefore, the goal of this study is to trace the biases that arise in case of consumer decisions about prices back to the phenomena already identified in behavioral economics, thus linking it to the theories of pricing and price psychology.

The effect of external reference prices, as can be seen from the theoretic prologue, was examined only from the consumer's perspective, under the consumer behavior approach. In other words, this research does not intend to examine corporate sales in relation to external reference prices, or to approach the topic from the cost side, since it would only be achievable to examine it in case of a given product of a particular company. This study sets out to examine the influencing factors at the level of the individual, so the exploration of the macroeconomic aspects of these phenomena is outside of this dissertation's framework. Finally, it is worth to mention that the process of consumer decision-making is very complex, but in this paper, only that part which can be related to price evaluation is being examined.

3. Theoretical model and hypotheses

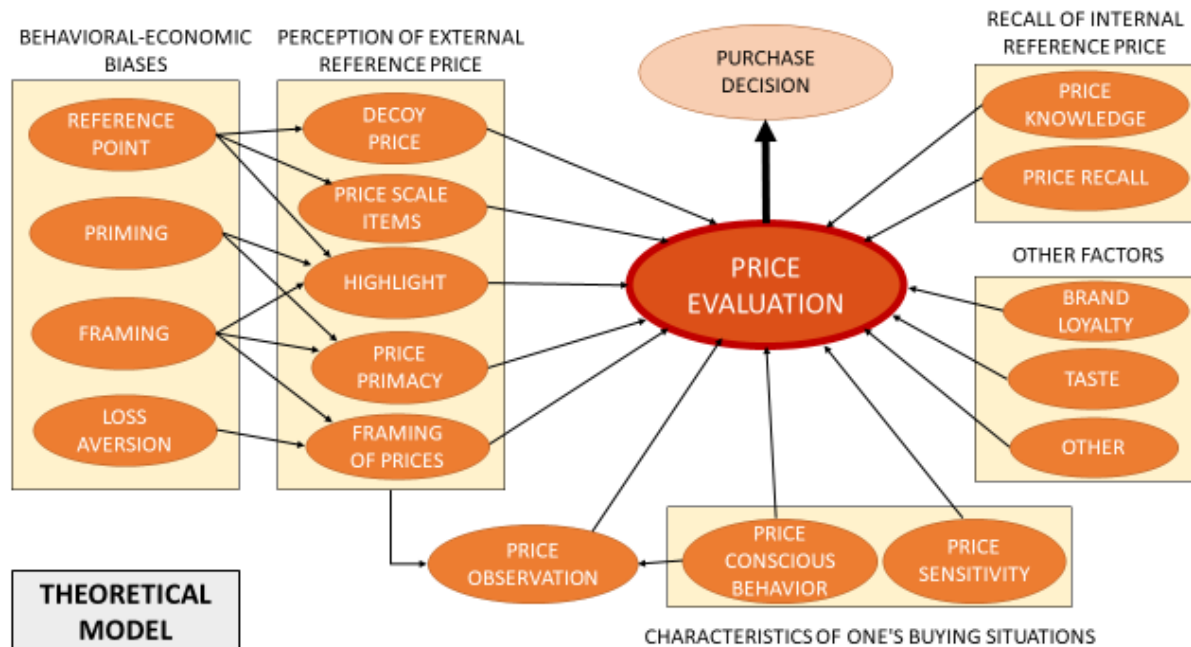
Based on the literature processed during the dissertation, a theoretical model was compiled that contains the relations between price psychology concepts in a complex way, and also connects them with behavioral economic phenomena and biases (Figure 1). One of the main results of the thesis is this model. Currently, there is no such approach in the literature that captures consumer decision-making through the relation of behavioral economics and pricing. This chapter aims to present the theoretical model and the hypotheses that were examined in the current doctoral thesis based on the model.

3.1. Describing the theoretical model

In the theoretical model, all the relevant phenomena and concepts described in the literature that can be linked to external reference prices and have an impact on the price evaluation of consumers and thus on their choice were included. The model will further be described and explained with the detailed definition of each factor in the theory, including their connection to each other.

Fist, the four main concepts of the model and their connections are described, because these relationships are especially important in case of the consumers. These concepts are: bias, price perception, price evaluation and consumer decision.

Figure 1: Theoretical model of price evaluation



Source: own source

I define **price perception** as a cognitive process when the consumer recognizes and processes the seen price or prices (Rekettye 2011). In other words, the **perception of external reference prices** is one of the major factors in the three-step process. Then, as a result of the perception, the processed information is evaluated by the consumer by making comparisons and based on that the consumer can determine how good the seen price or offer. The other case of evaluation is when more than one price information is given to the consumers, and he has to give an estimate about how much he thinks the given product category costs on average. This is what I call **price evaluation** in my model, based on the literature (Rekettye 2011). As a result of the price evaluation, the consumer decides whether he or she thinks the product or service is worth buying or which one is worth buying and the **purchase decision** is made.

It can be seen that every concept in the model goes back to these three steps. Every factor can be traced back either to price perception and, through it indirectly to price evaluation, or directly on price evaluation, and through them the factors has an indirect effect on consumers' decision. In my model, price evaluation is the central factor, since everything has an affect on this, and then, as the thick arrow shows, through it we come to the purchase decision. As it can be seen in the model, the process may be influenced by factors that can bias

the choice of the consumer even at the stage of price perception. Based on the literature, I call these in my model **behavioral economic biases** (Tversky – Kahneman 1974).

Of course, not only these biases, but also the specific buying characteristics of an individual, such as price sensitivity or the level of price-conscious behavior, can affect the evaluation and, through it, the final decision. By **price-conscious behavior**, in my model I refer to how much attention a certain consumer pays to prices, promotions and at what price he buys a product. While I interpret **price sensitivity**, similarly to the literature (Rekettie 2011), as a feature of the consumer that shows how price change affects an individual's willingness to buy.

Furthermore, it is also important to mention that price evaluation is highly influenced not only by the external but also by the **internal reference price**. Regarding the internal reference price, I put two factors into my model based on the literature. One of them is **price knowledge**, which essentially determines how well consumers are aware of the price of a given product, i.e. whether we can tell how much a product costs in the store (Vanhuele – Dr  ze 2002; Monroe 2003). This can also be considered as an internal reference price, which we recall from our memory. When it is accurate, it can be said that the consumer has high price knowledge (Cheng – Monroe 2013). In connection with the internal reference price, the other factor that needs to be mentioned is **price recall**, which shows - in the literature (Monroe 2003) and in my model- how accurately we can recall the prices of recently purchased products. On one hand, it is important, because it can have an anchor effect on the internal reference price and on the other hand it can also be linked to price consciousness. As it can be seen, these three concepts are closely intertwined.

Before I explain the factors and related biases connected to external reference price perception in details, I would like to explain two other categories that have been included in the model. I called one of these **price observation**. This is an attribution of an individual which shows how much he or she observes prices, i.e., how long and how many times his/her gaze lingers on price information. This can also be influenced by the visualization of the offer, i.e., the perception of external reference prices, as well as by how price conscious the individual is. It is also important to examine, whether the consumer look at the prices at all or take prices into account, because this can have an impact on the evaluation and therefore on the decision-making. Finally, it should be mentioned that in reality an individual's decision-making mechanism can be influenced not only by price-related factors, but also by a number of other determinants which can or should be added to certain models depending on the aim of the investigation. In my model I included these as **other factors**. Their impact can also be important, however, in my own research, I have not covered them, but I would like to

investigate them in my future research. These may include, but are not limited to, an individual's **brand loyalty**, brand attitudes, the consumer's **taste**, the composition of the product and, last but not least, the consumer's product involvement, which shows the importance of which product is chosen within a certain product category. In addition to these, there are many other factors, such as cultural or macroeconomic factors, that could also be included in the model, depending on what the goal or focus of the research is. So, "other factors" can include any factors that may be relevant to the particular research or model. Since the current research focused more on price-related factors, these demographic and macroeconomic factors in the model or in the literature were not explained in details.

In the following, behavioral economic biases and their relationship to price perception are investigated, which are both included in the model. The definition of the reference point is the most important of these in relation to the model and research, since this, as it will be seen, can be directly or indirectly paralleled with all phenomena. The reason behind this is that a reference point is always some kind of a benchmark which we make comparisons against and evaluate something based on it. Therefore, it plays a big role in evaluations (Kahneman 2013; Ariely 2011). This can be the evaluation of a light effect, a sound effect or any sensation, however, in case of prices, this point can be called **reference price** (Niedrich et al. 2001), which concept automatically links this behavioral economic phenomenon to pricing. The reference price can be either external or internal. In my research I focused on the **external reference price**, as I wanted to examine whether the display and framing of external price information (Rekettie 2011) has an impact on consumers' perception of prices, and thus on their price evaluation and purchasing decisions.

As it can be seen, in my model, the reference point can be associated with several external reference price perception factors, in fact, it affects directly or at least indirectly all of those listed in the model, however, only the direct effects are indicated in the figure with arrows. On the one hand, reference point is related to **decoy prices**, which are special external reference prices that belong to a product that we do not intend to sell. Instead, we place the decoy in the offer only to provide a reference point for comparing products and thus make the product we want to sell seem a better option (Weiser 2016; Thaler – Sunstein 2011). Thus, this can have an impact on consumers' price evaluation and, ultimately, on their choice. Reference point can also be considered in relation to the elements of the price scale, because, as the Range Theory states, during evaluation and decision-making, consumers do not make comparisons based on only one stimulus, but on a range of stimuli. In case of prices, this means that the range of prices, and in case of external reference prices, the prices of the products seen in the store can

all bias the perception of consumers (Niedrich et al. 2001), and thus which product they will buy. In addition, the reference point and price can have an impact in cases where a particular product is highlighted among several within an offer.

This brings us to the following two behavioral economics phenomena that have been included in the model and are also related to highlighting. These are **priming** and **framing** (Tversky – Kahneman 1981; Thaler – Sunstein 2011). I explain these two together, because it is difficult to separate them completely even based on the literature. However, framing is a broader concept and can cover more things. On the one hand, it can mean the formulation and communication of a problem or situation, which can be presented in a positive or negative way. On the other hand, we can talk about framing in the context of visual representation. Therefore, we can also call framing the highlighting or the placement of a product or offer, which can influence the perception of the consumer that leads to different judgements. Therefore, in my research, I also considered those cases where placement or highlighting can have such an effect as framing. The other phenomena is priming which is defined in the model as a special kind of highlighting that attracts the attention of the customer to a certain product thereby biases the perception and decision of the consumer about an offer, a price or other products.

In my opinion both priming and framing can be identified in association with price highlights and price primacy, as factors which have an effect on external price perception. In my model, **price highlighting** can mean a situation where within a multi-product offer a certain product or its price is highlighted by a colorful frame or some kind of attention grabber (Santana et al. 2020). It can also mean when we display either the original or sale price within a special offer with a different color and font size (Weiser 2016; Coulter – Coulter 2005). It can be seen that in the first case we can definitely talk about priming, since the highlighting of a certain product and its price attracts consumers' attention, so it has a good chance of becoming a reference point when later judging other products. The other definition which can be connected to priming and framing is **price primacy**. According to the literature (Karmarkar et al. 2015), price primacy occurs when the price is placed at the top of the offer, before the rest of the information regarding the product or offer. Therefore, this can also be considered as a type of framing. Moreover, since this is the first information that the consumer perceives, we can also consider this placement as priming, since the offer is more likely to be judged by the consumer based on the price and not the other way around. In my opinion, these factors of my model can be connected along the logics which have been explained here. Another type of framing, as I have already mentioned, is in the negative or positive wording the communication. It is also possible to use framing in case of different price offers, namely multidimensional prices. In my

model, the “**framing of prices**” factor indicates how a multidimensional price offer (Rekettie 2012) is formulated. This framing can influence the choice of consumers, since people do not like to lose, but the more they like to win. This is called **loss aversion** (Kahneman – Tversky 1984; Kahneman 2013), which is also a bias and together with framing, can affect the perception and evaluation of multidimensional prices and, through them, consumers’ decision. From these, it can be assumed, that consumers will find more favorable those offers which are positively framed and creating a sense of gaining something, than those with negative wording.

It can be seen that the model is complex, and one factor often affects many others, or they can even overlap and have a common effect on price perception and price evaluation. However, the differences between the factors were clarified and the two main theories of the thesis were connected with them. Doing so, complex model was created that can provide help and a good starting point in the future for professionals and researchers engaged in pricing, price research or price psychology.

3.2. Hypotheses and related theories

In the primary research, all the relationships presented in the theoretical model could not be examined. Therefore, the impact of external reference prices and related biases were in the focus of the research that sought to examine them from as many aspects as possible. Thus, the hypotheses are related to this kind of phenomena.

***H1:** Consumers would rather purchase the offer, which contains gains, than the one which contains losses.*

The first hypothesis was created based on several interrelated price psychology and behavioral economics literatures. On the one hand, according to the Prospect Theory, we can word any problem in a positive or negative way. This is called framing. Prospect Theory also states that people are loss-averse, which means, they do not like situations where they feel they have lost something, but prefer situations where they perceive that they have won or gained something by their choice (Tversky – Kahneman 1981). These two concepts are closely related, since positive wording implies a sense of profit, while a negative one creates a sense of loss in the consumer. We can use this concept for multidimensional prices. We call multidimensional prices those prices, where the final price is expressed in several sets of numbers, numerical or even non-numerical information. Therefore, consumers need to do calculations in order to determine the final price. Thus, the interpretation and comparison of such prices is much more complicated (Rekettie 2011; Estelami 2003). From our daily lives, we know that prices are often presented in multidimensional form. In such cases, negative framing is when other costs

appear in addition to the price of a product at the time of purchase (e.g., shipping costs). These additional factors can be perceived as additional costs, which are losses. In contrast, we can usually meet offers with an absolute or percentage discount from an original price or free delivery offers. In these cases, we can talk about positive framing, because consumers can perceive the discount or free shipping as a gain. In my research, I investigated whether the framing of a multidimensional price has an effect of the consumer's choice when the products and the final prices are the same, and the difference is only in the wording of the offer and therefore, the perception of gains or losses. My assumption is that consumers would rather choose the offer that is framed positively and perceived by gain rather than the one with negative framing.

H2: Consumers...

H2a: *evaluate an offer better...*

H2b: *would rather buy the product on sale...*

... when the original price is highlighted instead of the sale price.

In the second hypothesis, I examined whether highlighting the original or discounted price within a promotion has a more positive influence on consumers' ratings and purchase intentions. According to the literature, the font size and the color of the price can influence consumers' price perception and price evaluation (Rekettie 2012). I found this phenomenon interesting to examine, since in everyday life we tend to see that the sale price is highlighted with a larger font size and an eye-catching color, while the literature recommends highlighting the original price instead (extreme position). This way, due to the perceptual contrast, the consumers understand the discount better and perceive the discount even larger (Weiser 2016; Coulter – Coulter 2005).

H3: If the price is placed at the end of a complex offer, after all the other information...

H3a: *consumers tend to evaluate the offer better,*

H3b: *consumers would rather buy the offer,*

... than in case of an offer where the price is placed on the top.

I created my third hypothesis based on the literature of price primacy. Research in neuromarketing prove that consumers evaluate an offer differently when they see its price first and the other information after, compared to an offer when they see the product or the other information first and then the price. In the first case, consumer tend to focus on the price and evaluate whether the product is worth it. In contrast, in the other case, consumers evaluate whether the product is attractive to them, whether they like it based on its description or properties (Karmarkar et al. 2015).

H4: *Changing the end points of a price ranges has an influence on consumers' price evaluation.*

H4a: *Those consumers who receive a price range with a larger high-end point evaluates the mean price of the product higher on average.*

H4b: *Those consumers who receive a price range with a smaller low-end point evaluates the mean price of the product lower on average.*

The fourth hypothesis aims to test whether Range Theory can be connected with external reference prices. Range Theory can be linked to internal reference prices based on the literature. It states that when we evaluate the price of a product, we are not only comparing it to a specific price, but we are recalling several prices we have seen before from our memory, thus we use a range of internal reference prices as a basis for comparison. Furthermore, research has also shown that the values at the end of the price range that can act as an anchor (Janiszewski – Lichtenstein 1999). However, the literature also reveals that not only internal but also external reference prices have an impact on our evaluation (Rekettye 2012). Therefore, the aim was to examine, in case of specific offers (products and related prices), whether the changes in the price of the cheapest or most expensive products have an impact on consumers' price evaluation when they see external reference prices. I wanted to know, whether an end-price can act as an anchor when participants are required to estimate the average price of a given product.

H5: *When highlighting a more expensive product within a price scale consumers tend to evaluate the mean price higher, even when the offers consist of the same products and prices.*

With my fifth hypothesis I aimed to examine whether highlighting has an effect on consumers' price evaluation when they see the same products and prices, but different product is highlighted. By highlight, I mean here that one of the products within the offer is framed with a red square. Here price range appears as a factor, which in this case is the same for the two groups, as well as highlighting, which factor have already been described in the previous hypotheses. Among the behavioral economic biases, priming can also be mentioned here, since highlighting can be perceived as a kind of pre-setting (Thaler – Sunstein 2011). Highlighting a product can influence the perception of the price of other products, thus affecting both consumers' evaluation and choice.

H6: *When placing an over-priced decoy product into the offer consumers tend to choose a bit more expensive but better products.*

The last hypothesis is based on decoy products and their decoy prices. As it mentioned in the literature, a decoy price is a special external reference price that is connected to a product which we do not intend to sell, we only include it in the product range because we want to make another product look better (based on the comparison), so consumers will rather buy it. The

reason behind this is that the decoy product is similar to the product, which wanted to be sold, but its properties or price it is a slightly less favorable (Weiser 2016). In the current research, I examined how the application of these products and prices into an offer affects the buying decision of consumers.

It is important to mention that in the research, I examined not only the above explained hypotheses, but also other correlations. For example, during eye tracking, I was able to test in an exploratory way a number of assumptions related to eye movements and other phenomena. However, my main goal was to be able to find interesting results and come to a conclusion regarding each hypothesis.

4. Methodology of primary research

In this section, the methodology of the primary research is explained, which consisted of two parts. The aim of the study was to find answer to the following research question: *How do behavioral economics' perceptual biases influence consumer price evaluation and decision through external reference prices?* In order to find an answer to this question, I did several researches and worked with several methodologies. Based on the theoretical model I created and presented above, I also set up a research models related to each of my research. In both cases these contained those factors and relationships that I examined during the certain research. The models also include factors that I examined in both research, but there are some I could only measure in one of them, for example, with the use of eye tracking data.

In the following, I will present my research one by one, in chronological and logical order, since my later eye tracking research was based on the earlier, questionnaire-based survey. With the results of eye tracking, I tried to interpret the results of the survey and to identify its errors and shortcomings.

4.1. Methodology of quantitative research

In the first phase of my research, I conducted an online interview in December 2020. I used arbitrary and snowball methods to distribute the questionnaire to university students. My goal with these methods was to reach as many people as possible, and get as many responses as I can. So I could draw more generalizable conclusions because of the large number of sample items. The data collection was successful, and after cleaning the data, I had a sample of 1574 people. During the research I tried to examine the hypotheses detailed above with the help of stimulus images. I analyzed the data using IBM SPSS and Microsoft Excel programs. The analyses mainly included distribution tests, cross-table analyses and mean comparisons.

However, since the sampling was not random, I could not examine inductive statistical measurements such as mean tests and other significance levels, because of methodological reasons.

This questionnaire could be called an experimental questionnaire, because it was not a classic survey. The respondents received images of different offers and they either had to evaluate or tell whether they would buy the given product. There were cases when they had to choose between offers or estimate the average price of the given product in the store, after they have seen the products and their prices. The questionnaire contained experimental elements, however, not in a traditional shopping situation, but in the form of an online questionnaire. At the very beginning of the questionnaire, there was a question that I used to randomly classify the respondents into two groups (groups X and Y). In all cases, the groups received similar, but not the same stimulus images. The stimulus images, as will be seen in the presentation of the results, only differed in certain prices, in the display or placement of prices. This way I could look at the differences of the two groups, based on their responses and estimates, and identify the impact of the external reference price related biases.

4.2. Methodology of qualitative research

The results obtained during the previous questionnaire based research proved that the topic I studied is interesting from both a scientific and practical point of view, and it is really worth researching. Since the questionnaire raised a number of additional questions in my mind, and some results contradicted the literature, I wanted to examine the same offers and stimuli using another, more qualitative method. In June 2021, I conducted an eye tracking experiment, which I combined with in-depth interviews and an attitude questionnaire. I did this both to be able to interpret the results of my online questionnaire better and to identify its errors and shortcomings. For the experiment, 26 volunteer university students applied from the University of Szeged. Similarly to the questionnaire method, I randomly divided them into two equal groups (13-13 people). The data was recorded using Tobii Pro X2-30 fixed eye camera, and for analyzing the data, I could use the corresponding Tobii Pro Lab software, from which I could export not only Excel tables, but also heat maps.

My eye tracking research was both exploratory and comprehensive, and included the same stimuli images and questions as the online questionnaire survey. For deeper understanding, besides eye tracking, the experiment also included an in-depth interviews and a questionnaire, similarly to the research method of Korpás and Szabó (2019). Unlike to the authors, I started the experiment with the stimulus images, followed by the in-depth interview,

where I also tested the participants' price recall, i.e. I asked the participants to remember the prices of certain products or the value of discounts they have just seen. Then Participants had to fill out a short, paper-based questionnaire in which they had to answer demographic questions and attitudinal questions in connection with their price-conscious behavior. I considered the examination of price-conscious behavior important to be included into this research because; the lack of this was the major shortcoming of the questionnaire and limited the deeper analysis of the data. The attitude questions included ten 1 to 5 Likert scale questions, where the higher value indicated that the given statement was more characteristic of the participant. I made seven of these statements, while three were taken from the frugality scale of Lastovicka et al. (1999), which originally contained eight claims, but only three of them were relevant to my research. The reason why the questionnaire was at the end of the research was that I did not want its questions to draw the attention of respondents to the role of prices and thus make them focus more on the prices during the eye tracking. This way the participants were not aware until the in-depth interview that the research was about the role of price in consumer choice. In addition to the answers, eye camera results also gave me the opportunity to examine the eye movements of the participants, thus determining which information they observed the longest or more frequent.

As it can be seen, during my two research, I used both a mixed method and a multi-method approach. While the latter means reaching a respondent with multiple methods of data collection, the former means applying quantitative and qualitative methods side by side and linking their results (Neulinger 2016). In my case, the entire research is based on a mixed methodology, while in-depth interviews and attitude questionnaire combined with eye tracking can be considered multi-methodological research within the entire research.

5. The structure of the dissertation

In the first theoretical chapter of my dissertation, I discuss the formation of behavioral economics, its main findings, characteristics and how it differs from traditional economics. Then, after the theoretical introduction, in the second chapter, I specifically turn to the main theories of the field of science. Here I present the main heuristics and several biases, focusing on those that are relevant to my own research topic. After these I explain Prospect Theory, which is an alternative model for describing the process of consumer decision-making. At the end of the chapter, I highlight the importance of this discipline and its future possibilities.

After, in the fourth chapter I concentrate on prices and price psychology. First, I define price perception and the factors that affect price processing, and then I explain what price

evaluation is. Within the topic of price evaluation, I describe the concept of the reference prices, its related theories and the concepts related to price threshold in detail. At the end of the chapter, I also talk about the concept of price sensitivity.

At the end of the theoretical part, I present my theoretical model and I summarize how the concepts I have described are related to each other. Here, as you have seen, I present not only the relationship between price psychological factors, but also how behavioral-economic biases appear in connection with external reference prices. Doing so, I connect my two theory with each other.

After presenting the model, I describe my own primary research, which contains two studies. I present them in a chronological and logical order. The aim of my research was to identify the concepts and factors described in the theory and to establish the relationships between them. I wanted to link behavioral economic biases to pricing.

In the dissertation first, I describe the methodology of my online questionnaire, its model, hypotheses and the sample related to this research. Then I present the results, conclusions and suggestions. After this, I describe the next phase of my primary research which had an explanatory and exploratory role. This is eye tracking research combined with in-depth interviews and an attitude questionnaire. First, I discuss the methodology of eye camera and the question of appropriate sample size in detail. Only after this comes the presentation of my research. Here, I also present my own methodology and assumptions first. After I present the characteristics of my sample, and then I explain the results. At the end of eye tracking research, I also summarize the results and try to formulate conclusions and suggestions based on them.

At the end of the dissertation, I summarize my thoughts and draw up my theses based on the combined results of the two studies. In connection with each result, I also formulate future research directions and suggestions for the practical applicability. These are explained in the next chapter. At the end of my dissertation, I talk about the limitations of my research and present the novelties and significance of my work.

6. Main results, theses, discussion and future research directions

In this chapter I try to present and summarize the results of the two research together by the theses I have formulated. These are presented in Table 1. I have created the theses based on the previously formulated hypotheses. However, in addition to these, I was able to formulate other results during my research, so I divided this chapter into two subsections according to such logic.

6.1. Theses and related results, future research directions

Table 1: Theses and related products under investigation

Thesis	Product(s) under investigation
1.: In case of multidimensional prices, the majority prefer offers with negative framing which are simpler to calculate.	unisex jacket, margherita pizza
2.: In case of a special offer, it is important to display both the original and the sale price, but it is irrelevant for the price evaluation which one is highlighted.	Milka chocolate
3.: The placement of a price in a complex offer does not necessarily affect the evaluation of the price and the intention to purchase, but it does affect the consumer's focus on the price when considering the offer.	Prague trip
4.: Changing the end point of the range for external reference prices affects the price evaluation of consumers. The estimated mean price is anchored by the endpoint towards its own value.	1 liter of milk mineral water
5.: In case of a multi-product offer, the highlighting of a particular product affects the price evaluation of the product category by anchoring the estimated mean price of the product towards the value of the highlighted product.	liquid soap
6.: The placement of decoy prices into a product offer has a controversial effect on consumers' product choice.	hair drier hamburger
7.: Consumers who make their decision based on the price look at prices more frequently and longer.	milk, mineral water, soap, hair drier, hamburger
8.: Consumers who consider themselves to be more price conscious look at prices less often and for shorter time.	all products
9.: In case of price recall, clear patterns can be identified.	all products
10.: The prices observed have a greater anchoring effect on the evaluation of those who observe prices better.	milk, mineral water, soap

Source: own source

Thesis 1: In case of multidimensional prices, the majority prefer offers with negative framing, which are simpler to calculate.

On the one hand, in case of the framing of multidimensional prices, in both research, I rejected my previous assumption, which said that the majority of participants will choose the offer with positive framing, i.e., where consumers see information that generate a sense of gaining, instead of the negative framing. In both questionnaire and eye tracking research, there were more people who chose the negatively framed option for both pizza and unisex jackets. However, in those cases when people saw two gain information in the positively framed offer, a higher proportion of them chose the positively framed option than in the other group, where they had only one gain information. From the in-depth interviews and the open questions of the questionnaire it came out that many people chose the negatively framed option because it seemed cheaper to them due to the low initial price. In addition to this, several people mentioned that in this case it was much easier and clearer for them to calculate the final price from the multidimensional price information, so they chose it because of the faster and easier calculation. Therefore, it can be concluded that for those who are less affected by discounts and more likely to calculate the price of a product, it is better to display multidimensional prices with negative framing which is easy to calculate. Alternatively, we might think about positive framings that are easy to count. For example, we can display the discount of the offer in absolute value instead of percentage. However, it can be seen that there is a separation of another group of people who choose an offer just because of the discount or free shipping. Therefore, in practice, it is important to take into account both the product category and the characteristics of our target group when formulating an offer. For example, for customers where more analytical and more deliberate thinking and decision-making is assumed, the use of negative framing is likely to be more appropriate in case of multidimensional pricing. While for impulse buyers and consumers who are more influenced by emotions, the use of positive framing seems to be a good choice.

Thesis 2: In case of a special offer, it is important to display both the original and the sale price, but it is irrelevant for the price evaluation, which one is highlighted.

I examined the effect of highlighting the original and sale price on consumers' choice and evaluation with an example of a Milka chocolate. I assumed that in the group where the original price was highlighted, there would be a higher ratio of people who would buy the product and evaluate the offer better on average. The results showed that high ratio of people would buy the product in both groups at the sale price and both the offer were evaluated good. However, it is important to mention that based on eye tracking, it can be seen that whichever highlight is taken into account, consumers always observed the original price more. Therefore,

it can be concluded that the original price should be displayed as an external reference point in a promotional offer, because people usually decide based on comparisons. Furthermore, this result offers a good initial point for future research. In my opinion, it would be interesting to examine how the consumers would be influenced if the original price within a promotional offer was displayed or not. As a limitation of this result, it is important to mention that I actually displayed the chocolate at a discounted price, since I used real prices, so it was a good deal in real life. Therefore, it is not surprising that most people would have considered the offer good and would have bought the product.

Thesis 3: The placement of a price in a complex offer does not necessarily affect the evaluation of the price and the intention to purchase, but it does affect the consumer's focus on the price when considering the offer.

In connection with this thesis, I examined how the placement of the price affects the evaluation of the offer and the intention to buy in the case of a complex offer. The stimulus image included a trip to Prague. In one group the price was placed at the top of the offer and in the other at the end. The results of both the questionnaire and the eye tracking research showed that there were no significant differences between the two groups when evaluating the offer on a Likert scale of 1-5. The choice, i.e., whether to pay for the trip, did not differ in case of the groups. However, it turned out from the in-depth interviews that the reasons of those who would not have paid for the trip were personal preferences (for example, irrelevant content in the package), while there were only a few who considered the price high and rejected the offer because of that. Price placement did not influence the decision; however, the heat maps showed that those who had the price at the top were much more focused on it, and observed it longer and more frequently on average than those who had the price below.

As a practical suggestion, I can say that when we want to emphasize the price within a complex offer, it is better to place it to the top of the offer. However, when the price is a little higher, not so favorable or the offer is not on sale, then it is better to communicate the price at the bottom, since this way consumers will focus less on the price and more on the content of the offer. In the future, this phenomenon could be examined in such an aspect. I mean, it would be interesting to see whether the placement of an external reference price within an offer has an impact on consumer behavior when consumers consider the offer a good deal, and when it is considered to be an overpriced offer. With these kinds of tests, the results could be clarified and differentiated, and more precise practical suggestions could be formulated.

Thesis 4: Changing the end point of the range for external reference prices affects the price evaluation of consumers. The estimated mean price is anchored by the endpoint towards its own value.

On the first stimuli picture of these research participants saw and offer of milks and their prices, and the difference between the two groups was only in the price of the most expensive product. The questionnaire results showed that when estimating the mean price of the product, a higher estimate was given on average in the group where the price of the most expensive product was higher. In case of the eye tracking, it was the other way around, although it turned out from the in-depth interviews that in the group where the lower price had been displayed, those participants who decided based on the brand or habit and not the price, were overrepresented. They would buy a more expensive product by default, so in their case the internal reference price had an anchor effect on their final estimate. This and the low number of participants may explain this contradictory result.

In the case of the other stimuli pictures, which contained mineral waters and their prices, the price of the cheapest product differed between the two groups. I found here (during both research) that in the group where the price of the cheapest product was higher, people estimated the price of a liter of mineral water higher. In case of the eye results, where, as I mentioned before, there were more people who did not consider prices during the decision-making, the estimation was even higher and that is why the differences between the average estimates were much greater between the groups than in case of the questionnaire results. Eye tracking results showed that, contrary to the literature, the prices of middle products were viewed much longer and more often and the prices of the end products got less and shorter observation. Furthermore, it can also be stated that the case of milks, those who looked at the price of the most expensive product longer, estimated the mean price of the product higher. Similar can be stated in case of mineral waters. Those who looked at the cheapest price longer estimated the mean price of the product lower. Thus, with the beware of the small sample, it can be said that those who took into consideration the end-prices, had been influenced by them during their estimations. As a limitation, it is also worth to mention that in case of eye tracking, the comparison of mean estimates is methodologically inadequate due to the small sample. Therefore, these results may only show the directions for future research.

Overall, as a practical suggestion, I could say that those who decide according to price are more affected by the change of the endings of a price scale, while in case of those who choose by habit or brand, it has little or no influence on the price evaluation. For this reason, it may be a good idea to segment our target group based on this and display the offers and prices

accordingly. For example, in the online space it is possible to accurately determine the properties of a segment by analyzing big data and tracking previous online purchase. These makes possible to display offers (products and prices) individually or by target group by using dynamic pricing techniques. As a future research direction, I could say that in real life, products and their prices are not always placed in ascending order, so the cheapest and most expensive product is not necessarily on the edge on store shelves. Although it is easy to apply such an arrangement online, I think it may also be interesting to examine how changing the ends of the price scale affects consumers when we do not put products in ascending order by price. As a further research opportunity, it is also possible to investigate whether changing products rather than prices (for example, changing the price of a private label product and the cheapest branded product) has any effect on price evaluation or consumer choice.

Thesis 5: In case of a multi-product offer, the highlighting of a particular product affects the price evaluation of the product category by anchoring the estimated mean price of the product towards the value of the highlighted product.

During my examination I had one more phenomenon in connection with price scales. However, in this case I examined the effect of highlighting a certain product within the range on consumers' price evaluation. In both of my research, I found that highlighting had a significant biasing effect on the estimation of the mean price of the product, even though the same products and prices were included on the stimuli pictures for both groups. In both cases, the highlighted product anchored the groups' price estimates towards the value of its own price. The heat maps also showed that the highlighted product was the most observed by the participants. Not surprisingly, in the group where the cheaper product was highlighted more people would have bought the product and considered it a better offer. As a practical suggestion, it can be said that when we highlight a product because we want to sell it, it is better to include the product into an offer where it is closer to the lower end of the price scale and there are more more expensive products in the offer than cheaper. It can be also mentioned, that because of the highlighting, the certain product is the most noticed and observed. Based on the comparison of this product to other products, consumers can decide whether it is a good offer for them or not. When talking about future research, it would be interesting to examine the phenomenon in an arrangement when the products are presented in random and not an ascending order.

Thesis 6: The placement of decoy prices into a product offer has a controversial effect on consumers' product choice.

At the end of my research, I investigated the effect of decoy prices in two product categories in two different ways. In the first case, I examined whether the placement of a decoy

price into the product range has an influence on the choice of consumers in the two groups. I assumed that the decoy product - which is overpriced and considered a worse option within the offer - makes more people in the group where it was placed to choose from the more expensive products than in the other group (where there were no decoy price). The results of both studies disproved my assumption, as the majority in both groups would have chosen the more expensive products, regardless of whether there was a decoy or not in the offer. During the in-depth interviews, I found that this result was probably influenced by the choice of the product category (hairdryer) and the formulation of the question. In my research, due to the male participants, the question was formulated in a way whether they would buy the hairdryer for a female relative. Many people said that they would not buy a poor-quality, cheaper product as a gift. In addition, the majority also stated that it is an electronic device and they prefer to spend more on it because they consider the more expensive electronics more durable than cheaper ones. It is difficult to formulate practical suggestion on this basis, because, as it could be seen, several things have biased the results. Therefore, I rather think that it would be important and interesting to examine the phenomenon in several product categories in the future. This would make it possible to come up with practical suggestions for certain product categories.

In the other example, all participants of the research saw the same burger offers. With these stimuli pictures, I examined the influence of decoy prices, but this time all participants received the same offers, first with three and then with four hamburgers. The latter contained an overpriced cheeseburger, which was the decoy product. My assumption was that the decoy product would make more participants to choose the more expensive burgers when the decoy product is placed into the offer. My assumption was also disproved in both research. When the decoy product was added to the offer, many people choose this overpriced product instead of other better worth it burgers. First, this result was surprising, but the in-depth interviews revealed that even in the three-burger offer, that burger which I wanted to sell in the four-burger offer with the help of the decoy product, was not pricy enough. That is why most people have chosen it by default. It was also interesting to see that the appearance of the decoy product made people completely forgot about the prices. Many of them chose the decoy, which was cheeseburger, since they said that they love cheese, and did not care about the price anymore. Therefore, it can be said that the choice of the cheeseburger was far from rational decision-making. This explains the similarly contradictory results obtained during the questionnaire. Thus, it can be said that this product was not the best choice for examining the phenomenon either, so it is not possible to formulate practical application on this basis. Therefore, I would

like to research phantom prices in the future in case of different products categories, or even with focus group interviews.

Thesis 7: Consumers who make their decision based on the price look at prices more frequently and longer.

The last three theses were formulated based on the results of the eye-tracking experiment where I was able to obtain additional information because of the special research methodology, and I could investigate further correlations. When examining the eye-camera results for the price scale and decoy price stimuli pictures, during the in-depth interview I asked the participants to choose between the products they saw and to explain why they would buy the exact product. Based on this, I was able to create two groups, those who chose based on price and those who did not take price into account but chose based on quality, brand, design or some other preference. This question and the eye-camera methodology results gave me the opportunity to investigate whether those who choose according to price look at prices longer and more often. In case of the stimuli pictures of milks, mineral waters, soaps, hair dryers and hamburgers, I found that those who decide by price look at prices longer and more often than those who do not decide by price.

Thesis 8: Consumers who consider themselves to be more price conscious look at prices less often and for shorter time.

During the eye-tracking experiment, participants also completed an attitude questionnaire on price-conscious behavior, where they were asked to rate on a 1-5 Likert scale how the statements were true for them. Based on this, I was able to divide the participants into more and less price-conscious groups. This grouping, together with the eye-camera data, gave me the opportunity to examine whether the more price-conscious ones looked at prices more often and for longer time. I examined this relationship in case of all the stimulus images. In most cases, I found that those who are more price-conscious look at prices less often and for shorter periods of time, contrary to my assumption. In a few cases I found no correlation between the variables based on linear correlation coefficients, but overall it was shown that the more price-conscious observe prices less.

Thesis 9: In case of price recall, clear patterns can be identified.

During the eye-tracking research, after the participants finished the eye-tracking part and had seen all the stimuli pictures, I asked them to recall certain prices of products they have seen just a few minutes before. This way I could determine how accurately they could recall the prices (and other numerical information) of the stimuli pictures. I measured the accuracy of price recall for each product and calculated its correlation with the length and frequency of price

observations. The results of this study were inconclusive. For the jacket, Prague trip and hair dryer examples, I found a positive correlation between recall accuracy and the duration and number of times the price was observed. For the other examples (pizza, milk, mineral water, soap, chocolate, hamburger), either the linear correlation coefficient magnitude was so low that no relationship could be found between price observation and recall accuracy, or the relationship was weak and negative. These results; however, show well-identifiable patterns. It can be stated that for products that are less familiar, more complex or have larger prices, the length and frequency of price observations clearly has a positive impact on the ability to recall the prices seen.

Another pattern I found on price recall, which is also consistent with the literature (Kenesei 2005), is that consumers recall smaller prices or other numerical information more accurately. While for larger values they tend to round up and concentrate on the left side of the value, remembering only the beginning or the magnitude of the prices more likely, thus recall is more inaccurate than for small values.

Furthermore, I could also examine the accuracy of price recall between the groups (which I made based on the in-depth interview) who made their decisions based on the price and those who did not. I compared the groups by the average duration and number of fixations on price. I found that in case of those who made their decisions based on the prices the duration and the frequency of price observation were higher in case of all stimuli pictures. Thus, it can be concluded that those who observe prices more are those who make their decisions according to them.

Thesis 10: The prices observed have a greater anchoring effect on the evaluation of those who observe prices better.

My final thesis was also based on the results of the eye-tracking experiment. The eye-tracking research allowed me to examine the relationship between the length of time participants spent observing prices and, for certain products (milk, mineral water, soap), I asked them to estimate what they thought the average price of a given product in the shop was.

The results showed that, for milk, those who looked at the price of the most expensive product for a longer period of time, estimated the average price of the product in the shop to be higher. For mineral waters, those who looked longer at the cheapest product's price estimated the average price of the product lower. In case of soaps, both groups looked at the price of the highlighted product the longest, with the average price in both cases moving towards the price of the flagship product. Thus, it can be said that the anchor effect was present in all three cases.

6.2. Further results and other future research directions

In connection with the results, it is worth to mention further correlations that are not closely related to the hypotheses and theses, but provide important additional information regarding consumer behavior in relation to prices and reveal further relations between the factors of the theoretical model. For example, I found mostly negative correlations between price awareness and the length and number of fixations spent on prices. In addition, the results were not clear on price recall. Based on this, it cannot be said that those who looked at prices or a particular price more or for a longer time was able to recall certain prices better. However, it has been proven, as stated in the literature, that smaller numerical values and numbers can be recalled more accurately, while larger numbers tend to be rounded and remembered on magnitude, so the degree of recall error is greater in case of them (Kenesei 2005; Rekettye 2011).

As a result of the two research, I came to the conclusion that it is worth to continue research on external reference prices and examining them separately for several products in case of each phenomenon. From of all the phenomena mentioned above, the study of the impact of changing price ranges and placing decoy prices in the offer on price evaluation was the most interesting for me, which is practically also relevant area. Furthermore, in case of the other examples where the emphasis was on the display of prices, the results were often contradictory to each other and to the literature.

First, in case of framing multidimensional prices I found for both product categories and in both of my researches that a higher proportion of participants chose the negatively framed offer, which creates a sense of loss. This contradicts the theory of loss aversion, which states that people hate to lose, thus, from two options they typically choose the one that gives them a sense of gaining (Kahneman – Tversky 1984). However, in case of multidimensional prices, eye tracking results confirmed the literature finding that consumers tend to concentrate on one element of the multidimensional price – which is mostly price – and ignore the other components (Estelami 2003; Kim – Kachersky 2006). Based on my research, I can distinguish two main groups. One of these includes consumers who preferred the negatively framed offer, because it made simpler to calculate the final price and gave a biased perception because of the lower initial price. While the other group, as the literature assumes, due to the sense of gaining and loss aversion, considered the multidimensional price with positive framing, (including discounts and free shipping) to be better. Although the former group included more people based on my research, the latter was also represented in a high proportion. However, it is clear

that in both cases, the multidimensional price has a biased effect on consumer evaluation, but the two groups are affected differently by the framings. Furthermore, in case of those who preferred negative framing loss aversion also appeared, but differently. Many of these people do not trust discounts, since they believe that they only mislead consumers.

In case of highlighting the sale and the original price, the literature claims, on the one hand, that the color or font size of the price can also influence price perception and price evaluation (Rekettie 2011). On the other hand, due to extreme exposure, highlighting the original price help consumers to understand the discount better and perceive it greater (Weiser 2016; Coulter – Coulter 2005). In my research, I could not verify these claims about Milka chocolate, since members of both groups, regardless of the highlight, considered the offer good and would have bought the product. Means that in this example the highlighting as a kind of framing had no effect on either the evaluation or the decision. This was probably due to the real life offer and small price difference, which was special for the given. In addition, I found that highlighting a price as a priming did not change whether consumers observed the sale price or the original price better. Based on the eye tracking results, in both cases more emphasis was on the original price. Thus, it has been proven and important that the display of the original price as an external reference price within a sale offer has a big importance. The indication of reference points is important as consumers use them during the evaluation. This means that the reference point effect prevailed during my research and its influence was stronger than the effect of priming.

In relation to price placement and price primacy, according to the literature, consumers evaluate an offer where the price is placed at the end of the offer better, because they judge the price based on the offer and not the other way around. Thus, they would rather buy it (Karmarkar et al. 2019). However, in my example of a trip to Prague I could not find any differences regarding this, because the evaluation and the willingness to buy the trip was similar in the two groups. However, eye tracking has revealed that in the group when the price was placed on top of the offer, people were more distracted by it and observed it more frequently and longer. In other words, in relation to price primacy, I could identify the effect of priming, because when price was placed at the top of the offer it completely changed the behavior of consumers.

Based on my experience I am not sure whether these phenomena can be investigated well by a questionnaire, but should be researched either by field observation or by some other qualitative method, such as series of in-depth interviews or focus group interviews, for different consumer segments. In the future, I would like to conduct these.

In-depth interviews revealed that even in case of well-known FMCG products, there are many non-price-related factors that can influence consumers' decisions. Based on the interviews, I tried to collect these because in my future research I would like to consider them as influencing factors. Furthermore, the interviews revealed that the products and prices used in connection with the decoy pricing also need to be reconsidered. For example, a group discussion should be helpful to set appropriate prices for products before the research. Unfortunately, it found that some the examples I used were not priced well, and some of the products were not suitable to investigate the phenomenon.

7. Limitations of the research

Of course, my research had its limitations. On the one hand, the samples of my primary research were not representative and sampling was not random. Therefore, I could not generalize, so my results are valid only for my own samples. Furthermore, due to non-random sampling in the questionnaire research, I was unable to use inductive statistical tests (for example, independent mean tests with two samples) because of methodological reasons. For the eye tracking university students could apply voluntarily. The experiment was shared among most of the faculties; however, mostly economy students took part, which can also bias the results of this research. In my questionnaire, I also asked university students. I broadcasted the questionnaire among them using arbitrary and snowball methods, since I tried to make my sample as large as possible. Although my sample is not representative, I believe that the results of a survey of 1574 people give an almost generalizable picture of university students in Hungary. Nevertheless, I think that it would be useful to do the research in the future on a random sample or on other target groups, along the previously mentioned future research directions. On a random sample, the results could also be examined by inductive statistical analyses.

As a limitation of the research, it can be mentioned that in eye tracking experiment, I could ask only 26 people. Although the literature (Nielsen – Pernice 2009) already considers this sample size to be adequate in some exploratory cases, but some people believe that the results can only be generalized from at least 30-40 participants (Bercea 2013, Lázár – Szűcs 2020).

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The author's publications related to the dissertation

- Lipták L. - Prónay Sz. (2022): Investigating the effect of external reference prices' representation on consumer behavior with eye tracking method. ER-CEREI - under publication
- Lipták L. (2022): A külső referenciaár hatása a fogyasztók árészlelésére. *Marketing & Menedzsment*, 55, EMOK különszám, 19-29. o.
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