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Customer behavior in the market of airline tickets

Do people rely on imitation as a form of decision making when buying airline tickets and is the prospect theory applicable?

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Abstract

Buying an airline ticket for your next holiday can feel like a complicated and risky task. This study investigates how customers decide to buy airline tickets under the conditions of complexity and risk. Using an experiment (N = 141) it compares the the behavior of customers who sampled other customers prior to buying airline tickets to those who were making decision independently. Adding insights of the prospect theory, it finds that imitation is used instead of rational decision making in the case of new customers. The results imply that customers of airline tickets react strategically on price fluctuations.

Statement of Originality

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Chapter 1

Introduction

Buying an airline ticket for your next holiday can feel like a complicated and risky task. Due to dynamic pricing models or revenue management, often used by airlines, prices can vary within a wide range and could change every day. Airlines could use different revenue management techniques, all with the common aim: dynamically adjusting fares in real time such that airlines can maximize their revenue.

Dynamic pricing models make use of a principle called market segmentation. This is the process of dividing the market in subsets of customers that behave in the same way, first mentioned by Smith (1956). The different subsets of customers tend to have different preferences and therefore different willingness to pay for certain products. In order to maximize revenue the pricing of products is customized to the subset of consumers. Market segmentation is used in many different industries (Cleophas and Frank, 2011), among which the airline industry.

For these pricing models to work for revenue maximization, there must be a clear understanding of the behavior of customers. An important component of the behavior is risk attitude. More specifically how risk-seeking customers are when buying an airline ticket and how such risk-seeking behavior could be triggered.

There are two primary aims of this study. The first aim of the experiment is to compare the behavior of people who sampled behavior of other customers prior to buying an airline ticket to those who have not gotten the opportunity to sample. There were other studies showing presence of imitation, which biases the rational decision making (Offerman and Schotter, 2009; Schlag, 1998; Banerjee, 1992; Jablonka et al., 1995), but no experiments were done especially focusing on the airline ticket industry. The question arises if customers in the airline industry, who have the opportunity to sample, use the simple behavioral rule of imitating the best as a form of decision making instead of making a rational choice based on the information given. Do customers rely on imitation as a form of decision making in buying airline tickets?

The second aim of this experiment is if the prospect theory, introduced by Kahneman and Tversky (1979), can help to explain customer behavior in the airline industry. The prospect theory is a description of decision making under risk and states that people value losses more than gains and that people overestimate small probabilities. This results in risk-averse behavior when gains have moderate probabilities and risk-seeking behavior when losses have moderate probabilities. There were other studies showing presence of the prospect theory in different industries (Kühberger et al., 1999; Fatas et al., 2007), which biases the rational decision making, but no experiments were done especially focusing on the airline ticket industry. The question arises if buyers of an airline ticket have the feeling of losing, does this trigger risk seeking behavior? Is the prospect theory applicable on the behavior of people buying airline tickets?

Both theories, imitation and the prospect theory, fall within the broader context of research on bounded rationality and are originally founded in the field of psychology (Kahneman and Tversky, 1979). Afterwards, as discussed above, these theories were explored in different industries however the amount of research on bounded rationality in revenue management appears to be limited. By means of an experiment, this study aims to explore the decision behavior of customers in the airline industry and therefore see if imitation and the prospect theory are applicable in this specific field.

The overall structure of the study takes the form of six chapters. Chapter 2 begins with a description of theoretical literature underlying the research, and focuses on how bounded rationality, especially imitation and the prospect theory are viewed in previous literature. Customer behavior in revenue management and the similarities of buying an airline ticket with the so called secretary game is defined as well in this chapter. Chapter 3 explains the experimental layout used for this study. The underlying intuition of the experiment and several hypotheses are stated in this chapter. In Chapter 4 the experiment data is explored and structured. Afterwards, the results are interpreted in Chapter 5. Finally, the conclusion gives a summary of the findings, limitations and suggestions for further research.

Chapter 2

Literature Review

2.1 Customer behavior in revenue management

In the field of operations research it is common to characterize customer demand exogenously (Shen and Su, 2007). In this method, market size is often represented by using a demand distribution function. However, if customer demand is defined in exogenously, the individual customers are assumed to be passive. Such passive customers do not actively engage in any decision making process. However, it is doubtful whether all customers, typically in the airline industry, are passive decision makers. On the contrary, research in revenue management shows that customers behave strategically, when evaluating alternative options and making choices (Li et al., 2014). Li et al. (2014) find that indeed some of the customers in the airline industry behave strategically. This finding triggered the interest in revenue management research to investigate such 'customer behavior' more deeply. In an environment where firms have an opportunity to price discriminate, such as the airline industry, it is natural for customers to expect price fluctuations. Therefore it is also possible for customers to react strategically to these price fluctuations. Accordingly, this chapter outlines the existing literature on strategic customer behavior in the airline industry with focus on strategic waiting.

In the airline industry customers have a basic choice to buy a ticket now or wait for a better price with the risk that prices may go up. The practice of customers delaying purchases to a future point in time is often referred to as inter-temporal substitution. Traditionally, this issue was neglected completely in the revenue management models that assumed that demand at each instant is either realized directly or lost forever. There was no option for customers to 'wait' for the future possible purchase opportunities. However some literature (Anderson and Wilson, 2003; Zhou et al., 2005; Shen and Su, 2007) has begun to pay increasing attention to the particular issue of strategic waiting.

This 'waiting-strategy' - inter-temporal substitution - is a part of the broader strategic customer behavior. Although strategic customer behavior in revenue management could be a broader concept, this study explores the inter-temporal substitution specifically. In order to fully understand this strategic customer behavior, the first step is to model how customers respond to the dynamic pricing strategies.

Several studies try to capture this behavior. Some assume that a firm uses an established and known dynamic pricing strategy and then investigate the behavior of customers who behave strategically in this setting. Possible established dynamic pricing strategies are the expected marginal seat revenue (EMSR) policy, introduced by Belobaba (1989), and the pricing policy (GVR) introduced by Gallego and Van Ryzin (1994). It is important to understand both policies and how customers respond to them, since these policies have a big impact on the practical implementations of revenue management systems.

Anderson and Wilson (2003) were one of the first ones to address the problem of strategic customer behavior. They set up a model in which prices are determined by the EMSR model (Belobaba, 1989). The ESMR model assumes that a firm has a fixed capacity and sets a protection limit that determines the maximum number of units sold to a low-revenue demand arriving earlier. In terms of the airline industry, we can consider this an early booking discount. The leftover units are then sold at a higher price to the high-revenue demand arriving later. Thus, prices of airline tickets get higher as less seats are available in the plane. There is nonetheless a probability that some of the units remain unsold at the end of this pricing strategy procedure, which means that some of the units need to be discounted again. For the airline industry, these units can be seen as last-minute deals which do not always occur. However, if the probability of this so called 'last-minute' discount is high enough, some of the high-revenue customers may be willing to take the risk of a somewhat higher price and wait for a last-minute discount. Anderson and Wilson (2003) investigate the revenue implications of this strategic waiting behavior of customers and find that indeed a customer may decide to wait before buying a ticket in order to wait for a possible lower price.

Zhou et al. (2005) also address the strategic customer behavior in airline industry. Instead of focusing on the EMSR model as Anderson and Wilson (2003) did, the authors focus on the dynamic pricing policy of Gallego and Van Ryzin (1994), the GVR policy. They find that customers only and immediately purchase a unit if the current price is below a certain threshold. Zhou et al. (2005) argue that this threshold depends on the customers valuations and leftover time to the flight. Applying this strategy to the multiple strategic customers, the authors find that strategic waiting may benefit the seller. Although it may cause some of the high-revenue customers to pay a lower price, some of the strategic customers faced with a too high price are not immediately lost as they may be still recovered at lower prices.

In the study of Shen and Su (2007) it is argued that if a firm fails to account for the strategic customer behavior, the firm could experience a substantial loss in revenue. Therefore it is essential to understand and model this strategic customer behavior. Since the existing literature focuses on the behavior of customers operating in a single dynamic pricing policy it is insightful to broaden investigation if the customer behavior beyond a single policy. In that regards, the literature on bounded rationality provides a further basis for investigating whether customers behave 'rationally' when purchasing airline tickets.

2.2 Bounded rationality

There has been much research on behavior when under uncertainty. Uncertainty is considered a state in which a decision maker has incomplete information, resulting in the insufficient knowledge about which choice leads to which outcome. The aspect of uncertainty that refers to the situations where the possible outcomes are known is often revered to as risk. There are several models to describe the behavior of choice. The first model known dates from 17th century, and is nowadays known as the expected value model. It multiplies a possible value in uncertainty with the probability of receiving that certain value, resulting in the expected value. By this model decision makers could maximize the expected value of their decision.

But an expected value model does not always predict the choices of decision makers correctly. Suppose a decision maker, with an average income, is in a situation where he can receive A) 100.000 right away or B) have a 50 % change of receiving 10 and a 50 % change of receiving 500.000. Using the expected value method, option B would be preferable, however most individuals faced with the problem stated above would prefer option A (Platt and Huettel, 2008). This behavior of appreciating certainty more even though this behavior has a lower expected value than the uncertain possibility is called risk aversion.

Bernoulli (1738) observed these inconsistencies with the expected value model and proposed to use subjective value, or utility, instead of real value, which resulted in expected utility. A decision maker is assumed to maximize his or her own expected utility. Simon (1955, 1972, 1979) pointed out some faults in this theory and proposed a model where utility maximization was replaced by satisfaction maximization. Although expected utility or expected satisfaction proved to be a powerful framework for choice under uncertainty, it still did not provide answers to some of the 'real-world' problems in decision making. For instance, Camerer (1998) points out ten 'real-world' problems in decision making that cannot be represented in terms of expected utility because the distribution of outcomes is unknown. For instance, a decision maker needs to make a choice between buying house A or buying house B, but the decision cannot possibly know all the consequences of choosing house A or B. The outcomes of a decision are not entirely known, in other words the choice needs to made under ambiguity which limits the explanatory ability of the expected utility model.

In order to account for this lack of representation Kahneman and Tversky (1979) proposed the Prospect Theory. They found that in general people are risk averse when they could make a possible gain and risk seeking when they are facing a possible loss. However when the probability gets very small or the values get very small, these tendencies seem to reverse. Kahneman and Tversky (1979) captured this behavior in a value function that is concave for possible gains and convex for possible losses. Also the value function is steeper for a certain level losses than for the same level of gains and small possibilities are over weighted compared to middle and high possibilities. Thus, instead of valuing the final outcome, the prospect theory values potential losses or gains. Kahneman and Tversky (Kahneman, 2003; Kahneman and Tversky, 1979; Kahneman and Frederick, 2002; Tversky and Kahneman, 1992), set the foundation of studies on bounded rationality.

The current approach of behavioral economics is that decision makers should be viewed as bounded rational. This means that decision makers are not always capable of making a rational choice or not inclined to do so. Instead, they rely on a number of decision making techniques and heuristics. But still, economist often provide criticism on this part of behavioral economics, often because it mostly generates a list of errors and biases of existing models and the lack of offering a coherent model for describing the non-rational behavior.

In this section some of the current literature on bounded rationality is discussed, focusing on the prospect theory and imitation behavior. The outline of this chapter is as follows: in the next section the 2-system of choice is explained, and in the second section the prospect theory will be elaborated. Section 3 provides a summary of the current literature on imitation and the last section of this chapter discusses the existing literature of bounded rationality in the airline industry or revenue management.

2.2.1 Two-system

This chapter follows the explanation of cognition, as proposed by Kahneman (2003). Prior to Kahneman (2003), James (1890) proposed several theories suggesting that human reasoning involves two distinct processing systems: one that is quick, effortless, associative, and intuitive and another one that is slow, effortful, analytical, and deliberate. Kahneman (2003) defines them as the 'fast system' intuition and the 'slow system' reasoning. Both modes of thinking are used interchangeably, but each mode has its advantages and disadvantages.

Intuition is often the first and more fast, automatic and effortless system. Most of the thoughts and actions are done intuitively (Epstein, 2003; Hayes et al., 2002). An example of intuition decision is one feeling reluctant to eat a chocolate in the shape of an insect or any other shape which may indicate something dirty and not appropriate for eating. Another example is when someone smiles if a sarcastic joke is made, the intuition of that person decides that the comedian isn't serious.

Reasoning is the second and more slow, effortful but flexible system. Reasoning is used as a decision mode in more difficult or unknown decisions. An example of reasoning system is filling in a tax-form or computing the result of 168/24. Both systems are illustrated in Figure 2.1.

As mentioned before, effortless thought is the 'norm', however system 2 monitors the quality of the mental operations of system 1. According to this logic, one does not express every intuition that comes up in mind, but is able to filter every passing thought or an impulse. However, this filtering is often lax, and sometimes fails to filter outer some intuitive judgments that may be erroneous (Kahneman and Frederick, 2002). A well known example of this possible fault in the system is provided by Langer et al. (1978), referred to as 'mindless-behavior'. Langer et al. (1978) conducted an experiment which showed the outcomes of several excuses of a person who tried to cut in line at a copying machine. The outcome was that almost every excuse without a general form of explanation was rejected, and every excuse with a general form

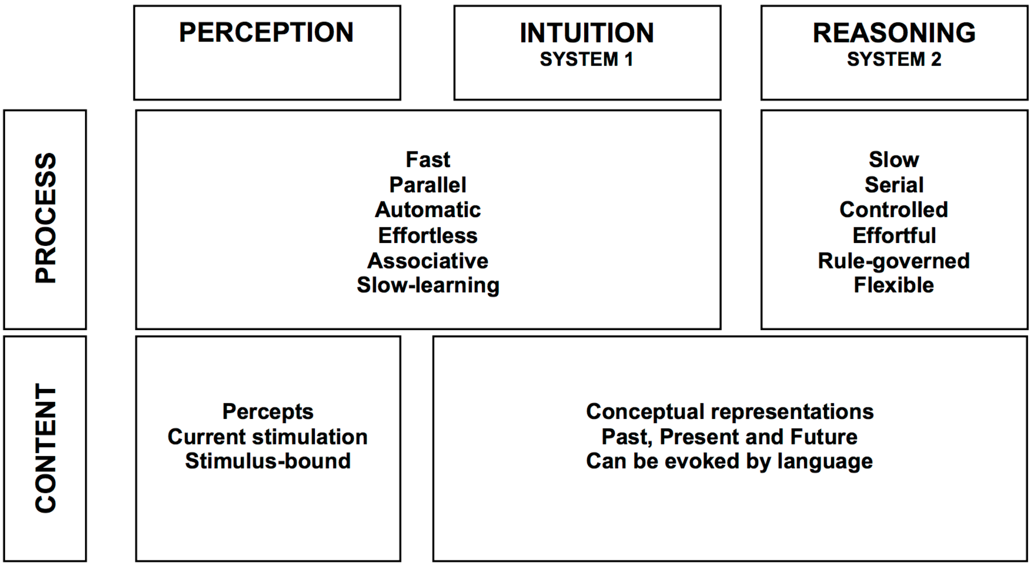

Figure 2.1: Two system.

of explanation was accepted. This led to striking superficial results, as the following excuse ”Excuse me, may I use the Xerox machine?” was rejected more often than an equivalent but more structured excuse ”Excuse me, may I use the Xerox machine because I want to make copies”. This example illustrates that system 2 sometimes fails to monitor the quality of the mental operations of system 1 correctly.

There are many more examples of non-rational decision making possibly due to faults in this two system. Some of these faults are captured in the field of bounded rationality. In the next 2 sections we discuss the prospect theory and imitation behavior.

2.2.2 The prospect theory

Another component of bounded rationality is the widely known prospect theory, introduced by Kahneman and Tversky (1979). Until then, it was assumed that irrational behavior is lawless and that could not be modeled in any coherent system. Economical research therefore focused on the aspects of behavior that could be seen as rational. Rational behavior was thus far the best approximation of descriptive behavior available (Arrow, 1951). These descriptive theories lasted until 1979, when Kahneman and Tversky (1979) introduced the prospect theory and fundamentally changed the way of thinking in decision theory (Wakker, 2010).

The prospect theory states that intuition (System 1, Figure 2.1) outcomes of decision making are reference-dependent, meaning that the reaction to a given stimulus is partly determined by the context of the prior and concurrent stimuli. For example, the role of a prior stimuli is recognizable in the sensation of heat when immersing a hand in water. Immersing the hand in water of 20°C feels more warm, if the hand was immersed on beforehand in cooler water. The opposite happens if the hand was immersed on beforehand in warmer water - now the same 20°C feels much cooler. Thus, the prior stimuli effects the sensation of the temperature of the water of 20°C.

The same happens with the feeling of brightness in Figure 2.2. If only the first row of squares is shown, the luminance of each middle, smaller square do not appear equally bright. Due to the larger squares around the middle, smaller squares that differ in color, the left smaller square appears to be brighter than the right smaller square. However, as we can see from the second row, the four smaller squares are actually evenly bright. The different current stimuli, depicted by the different colors of the larger squares around the small squares, provide an illusion of different brightness.

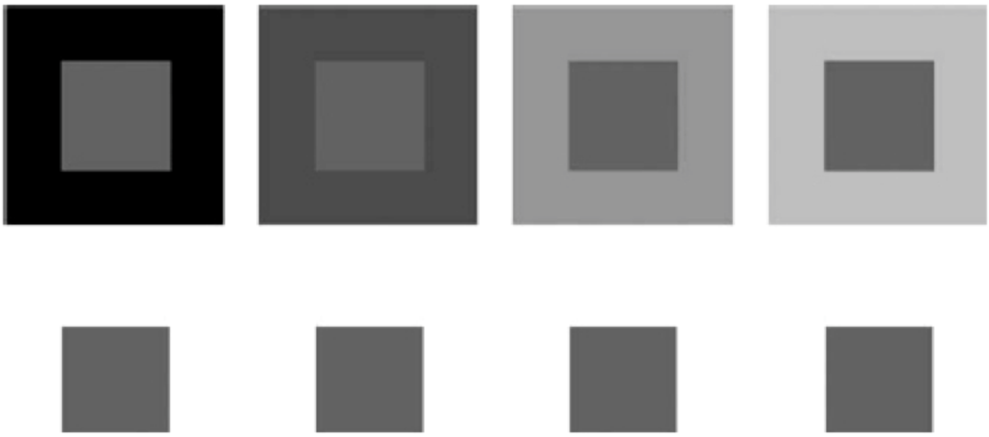

Figure 2.2: Reference-dependence in different states

But does this phenomenon of reference dependence also appear in situation where people are expected to be rational? Kahneman and Tversky (1979) conducted several experiments to show the presence of reference point in decision-making and constructed the prospect theory. The setup of an example of such experiments are presented in Figure 2.3. The article Kahneman and Tversky (1979) brings evidence that only few people take the gamble stated in Problem 1. Kahneman and Tversky (1979) claim that most people reject such a gamble, unless a possible win is at least twice the size of the possible loss. The answer to the second question in Problem 1 appears to be negative. A change of wealth does not affect the risk aversion of the participants. In problem 2 (Figure 2.3), the gamble appears much more attractive compared to the sure loss of \$100. Experimental results (Kahneman and Tversky, 1979) indicates that people are more inclined to take the risk, instead of the sure loss of \$100. Again the answer to the second question in Problem 2 appears to be negative. However, if you add \$100 wealth to the second problem, the problem becomes the first problem, though in the first problem people tend to be risk averse while in the second problem people act in a risk-seeking manner. The choices people make are apparently reference-dependent, and in this example the different references are losses or gains.

Kahneman and Tversky (1979) conclude that the switch from risk aversion to risk seeking behavior could not be explained by the utility representation of wealth (Bernoulli, 1738) or

Problem 1
Would you accept this gamble?

50% chance to win $150
50% chance to lose $100

Would your choice change if your overall wealth were lower by $100?

Problem 2
Which would you choose?
lose $100 with certainty
or
50% chance to win $50
50% chance to lose $200

Would your choice change if your overall wealth were higher by $100?

Figure 2.3: Experiment risk aversion

the satisfaction representation (Simon, 1955, 1979). Valuation of loss and gains are apparently reference dependent, hence Kahneman and Tversky (1979) propose an alternative theory of risk, in which the carriers are changes of wealth, i.e. gains and losses, instead of states of wealth.

The prospect theory can be explained from the shape of the value function, as is shown in Figure 2.4. As already mentioned, the value function is defined on losses and gains. Kahneman and Tversky (1979) indicate 3 important characteristics of this shape:

1. In the domain of gains, people favor risk-averse behavior. As can be seen from the results of problem 1.

2. In the domain of losses, people favor risk-seeking behavior. This follows from the results of problem 2.

3. Most important the value function is sharply kinked at the reference point and steeper for the losses than for the gains, by a factor 2-2.5. (Tversky and Kahneman, 1992). Hence, people tend to overweight small percentages, explaining the existence of lotteries, and underestimate large percentages, explaining the existence of insurances.

Tversky and Kahneman (1992) were the first ones to argue that rationality in a competitive setting is not a requirement to survive. Survival in such a setting is very common without being completely rational. Also, not being completely rational does not result is complete chaos, but is actually quite orderly. However, not all uncertainties have the same effect on people. As an example, individuals tend to be more rational towards the bets in the area of their expertise, compared to a different area.

The question arises if people who show strategic behavior in buying airline tickets, show the discussed aspects of the prospect theory as well. The prospect theory allows to investigate whether consumers show higher risk-seeking behavior when they feel like they experienced a loss.

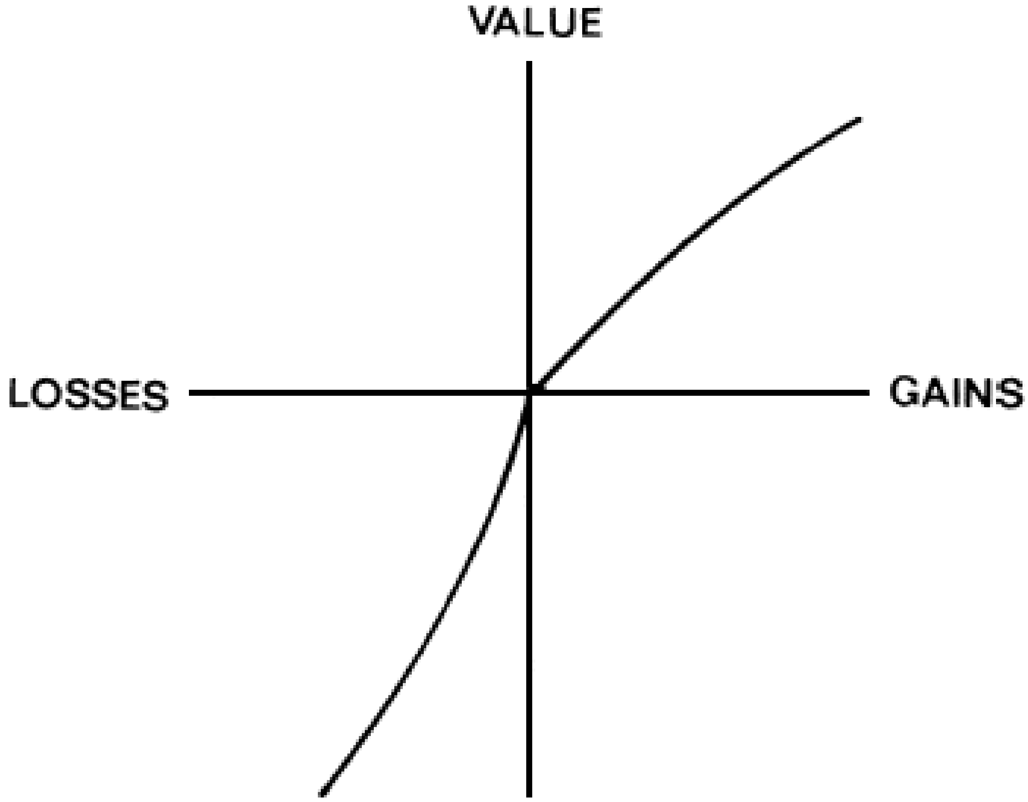

Figure 2.4: The prospect theory: value function for changes of states

2.2.3 Imitation as a form of decision making

Imitation is the act of copying the action of others and is also sometimes referred to as the poor man's rationality. This is due to the fact that if a decision maker was fully rational and capable of making the necessary calculations in order maximize their utility, one would not need to imitate anyone (Offerman and Schotter, 2009). Many studies of this behavior, consider individuals who select actions by imitating others instead using the more sophisticated way of decision making (Banerjee, 1992; Schlag, 1998; Jablonka et al., 1995).

Offerman and Schotter (2009) claim that individuals that feel the need to imitate are either not able to do all the necessary calculations needed to make a rational choice, or do not have the time or inclination to do so. Thus, imitation is integrated in the process of decision making, and constitutes a part of System 1 (see Figure 2.1) since system 2 is not used. Sometimes this leads to positives outcomes. For example when two firms compete in the same market with a similar product. When firm A invents a production process that is more efficient and cheaper compared to the original production process, is makes sense for firm B to try and repeat this new production process. This indicates that it sometimes makes sense to imitate.

However, imitation could also lead to the less desired outcomes. For instance, when individuals rely on imitation as a form of decision making when doing so involves a certain risk. Offerman and Schotter (2009) provide the following example: suppose a situation where luck plays a role in performance of participants. In such a situation, those who have the best performance, also faced the highest risk. If we rank the participants based on their performances, the ones on top of this list would be the onces who took the biggest gambles, but just happen to be the lucky ones. However the strategy of those on top of the list are nog necessarily the optimal ex ante strategy. Moreover, the once on the bottom of the ranking are the players with the same strategy but who were less lucky. If new participants have the possibility to imitate the best in this situation, they would imitate the 'big gamblers', resulting in the new participants to be 'big gamblers' as well, despite the fact that there is no guarantee that imitators will also get lucky.

The experiments of Offerman and Schotter (2009) demonstrate that the desire to imitate the best in situations where luck plays a role, may be so tempting that people fail to distinguish correctly between the different opportunities. Therefore Offerman and Schotter (2009) concludes that social sampling makes one look more risk seeking than others who do not have the opportunity to sample. The question arises if this phenomenon also occur with people who buy airline tickets. For the airline industry, investigating the presence of imitation allows to see if strategic customers may be influenced by the other customers which may affect their risk attitudes.

2.3 Secretary problem

During the early 1960's a simple experiment called the secretary problem, or the dowry problem, or the marriage problem got a lot of attention in the academia (Lindley, 1961; Dynkin, 1963; Chow et al., 1964; Gilbert and Mosteller, 1966). Many variations of the problem have been discussed but the simplest form of the secretary game is shortly explained below, due to the resemblances with the act of buying an airline ticket.

Suppose n applicants apply for a certain secretarial position. The applicants are interviewed sequentially, and in random order. If an applicant is hired, after an interview, it is not possible to hire any of the remaining applicants. However, it is possible to rank the applicant of the current interview compared to the applicants of the interviews whom are already turned down. Consider the following features:

1. Only one secretarial position is available
2. One knows the number of applicants, n, that apply for the position
3. The applicants are interviewed sequentially, and the sequence of the applicants is randomly determined
4. If an applicant is rejected, the decision cannot be recalled and one of remaining applicants needs to be hired. However, if an applicant is hired, the decision cannot be recalled and the remaining applicants are rejected

5. One can rank the already rejected applicants from best to worst, based on those interviewed so far. The simplest form of the secretary game doesn't allow any ties. The decision to hire an applicant is solely based on these relative ranks of the applicants interviewed so far.

6. One is only satisfied if one hires the best applicant. In payoffs:

$$D_{it} = \begin{cases} 1 & \text{if the hired applicant is best of all } n \\ 0 & \text{if the hired applicant isn't best of all } n \end{cases} \tag{2.1}$$

The simplest form of this game has a simple solution. A short summary is given here, for a more elaborate explanation I refer to the paper of Gilbert and Mosteller (1966). First one shows that choosing the first applicant is never optimal, but that it is wise to firstly reject the first $r-1$ applicants and then choose the next applicant who is best in ranking compared to the previously ranked ones. Now the question arises, what is the optimal r (number of participants to surely reject) to choose? The probability, $\phi_n(r)$, of selecting the best applicant is:

$$\phi_n(r) = \begin{cases} 1/n & \text{for } r = 1 \\ \sum_{j=r}^{n} P\Big(\text{j}^t h \text{ applicant is the best and you select it}\Big) & \text{for } r > 1 \end{cases} \tag{2.2}$$

For the derivation of this probability, see Gilbert and Mosteller (1966). The result is given below:

$$\phi_n(r) = \begin{cases} 1/n & \text{for } r = 1 \\ \sum_{j=r}^{n} \left(\frac{1}{n}\right)\left(\frac{r-1}{j-1}\right) = \left(\frac{r-1}{n}\right) \sum_{j=r}^{n} \left(\frac{1}{j-1}\right) & \text{for } r > 1 \end{cases} \tag{2.3}$$

Logically, the r that maximizes the probability of equation (3.1) is the optimal r. Many variations of the secretary problem are defined and solutions are provided, for a review see the article of Ferguson et al. (1989).

The strategic waiting behavior of the customers in the airline industry has many similarities with the secretary game of the previous section. A customer is interested in one ticket, which is just like an employer, who has only one job offer to fill, hence is only interested in one girl. Also if a customer decides to buy the ticket, logically the subsequent price offers are meaningless, which is also similar in the case of the employer, if the employer hires an applicant, the remaining applicants are rejected. Consider the following features of the strategic waiting behavior of customers, which can be called 'the ticket problem':

1. Only one ticket is needed, and the ticket needs to be bought before the departure day

2. One knows the days left (before departure), to buy the ticket n

3. The prices of the tickets are showed sequentially, however not necessarily randomly determined.

4. If one buys a ticket now, the decision can't be recalled and the remaining price offers until departure can't be bought. However, if one does not buy the ticket now, the decision can not either be recalled and one needs to buy one of the remaining price offers.

5. One can rank the previous price offers from the best to worst, based on the price offers received so far. However, this form of the problem does allow for possible ties, since it is possible that certain price offers appear several times. The decision to buy a ticket is solely based on these relative ranks of the previous price offers.

6. For simplicity suppose one is only satisfied if one buys the ticket for the cheapest price. In payoffs:

$$D_{it} = \begin{cases} 1 & \text{if the paid price, is the cheapest of all offers } n \\ 0 & \text{if the paid price, is not the cheapest of all offers } n \end{cases} \tag{2.4}$$

As can be seen the ticket problem has many similarities with the secretary game. However, it differs on two main points. First the ticket game does allow for possible ties, and the secretary doesn't. Second the prices offered to the customers in the airline industry can be hardly considered as randomly determined. As previously discussed airline companies make use of different pricing strategies to price the tickets, therefore the offered prices are surely not randomly determined. But can these offered prices can be 'viewed' as randomly determined? Customers who buy a ticket for the first time, may not be aware of the pricing strategies of the airline companies and the results of these pricing strategies on the ticket prices. These customers probably consider given prices as random. However, a customer with much experience in buying the same ticket over and over again, may learn the results of the pricing strategies and won't view the given prices as random. This is a big difference with the secretary game, as if the same secretary game is played over and over again.

Chapter 3

The Experiment

In this section the setup of the experiment is presented and the possible strategies are explained. The first section explains the setup of the experiment which is based on the secretary game, and the preciously discussed ticket game. In the last section the hypotheses of the research are discussed.

3.1 Set-up

To understand the strategic waiting behavior of customers in the airline industry, a website based experiment was created and distributed in the social network, via Whatsapp, Facebook and LinkedIn. The set-up of the experiment is in essence the explained ticket-problem of the previous chapter. The experiment received almost 205 participants, but only 141 of them completed the full experiment. The experiment lasted on average 7.3 minutes and the overall winner received €50. The participants were encouraged to enter the experiment via their computers, however the experiment could also be done on their phones. At the beginning of the experiments the participants were asked to answer 3 questions about risk, for eliciting their risk attitudes, see appendix.

After these questions, the participants received explanation of the game via the website, including a demo-video (see appendix). The participants need to play the same game 3 times in a row. In the game the participant received a screen which is similar to a popular ticket comparing site, Skyscanner. As mentioned the set-up of the game is the ticket-game, so participants need to buy one ticket, with $n = 15$ 'weeks' left to buy. The task of the game is to buy a flight tickets as cheap as possible. Each round (week) the following choice needs to be made:

- Buy the ticket in the current week and the remaining price offers until departure can not be bought
- Do not buy the ticket in the current week, hence obliged to buy at one of the remaining price offers

Notice, if a participant have not bought a ticket in week 15, one is obliged to buy the ticket then.

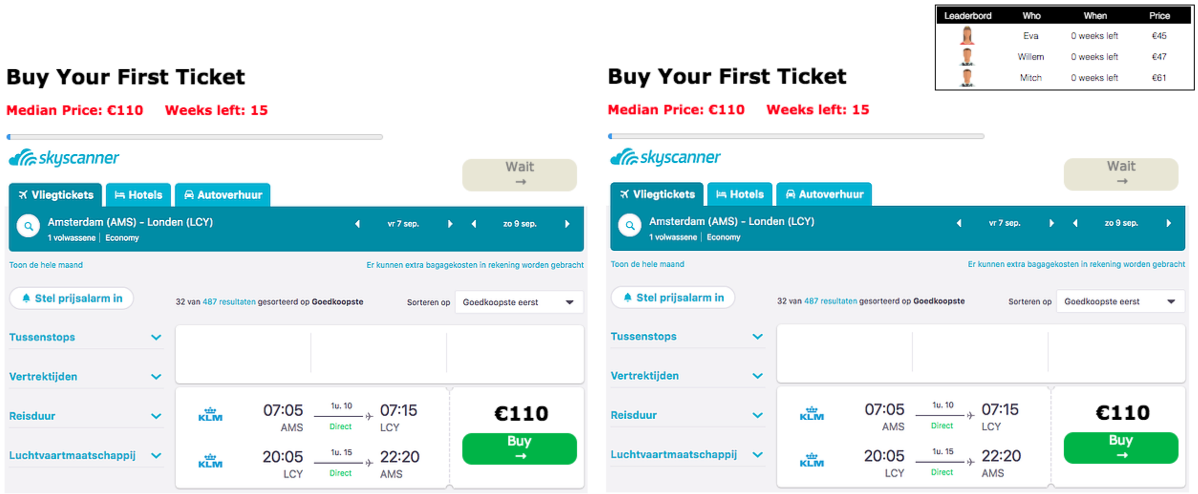

Figure 3.1: Possible screens of the game

In each game, every participant needs to buy a ticket from Amsterdam Schiphol (AMS) to Londen City Airport (LCY). All participants receive the information that the overall median price is equal to €110 and every game starts with this price, giving participants the opportunity to play risk neutral. This median price may not be the actual median price of a specific round a participant receives since the prices are partly randomized, however in general for all participants together it should be the median price. Half of the participants, randomly clustered, receive a scoreboard, with the results of the best previous participants in this game, as shown on the right in Figure 3.1. This group is called the imitation group, since it has the opportunity to sample the behavior of others. The other half of the participants does not see the scoreboard, hence it has no option to sample the behavior of the previous best players. This group is called the benchmark. If the player completes this game 3 times, the prices of the 3 tickets are summed and all the participants are ranked based on their total expenses. The participant with the lowest total expenses on July 20^{th} 2018, was contacted via e-mail and received €50.

The pricing strategy from all three games can be viewed in Figure 3.2. In order to get rid of any side effects, all participants received the same offer prices, however with a small range of €5 above of below this price to preserve variation in price offers. The chance of receiving a last-minute price in all 3 games is 20%, however the participants receive this information only in game 2 and game 3.

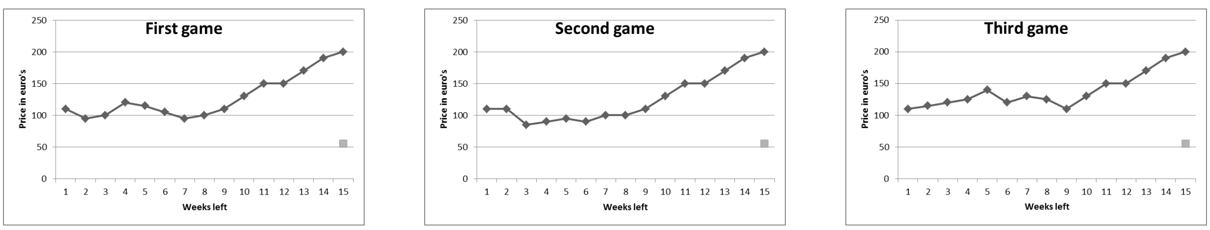

Figure 3.2: Price of the games

Suppose we consider the price offers to be randomly determined. And we assume that ties aren't possible. If we firstly reject $r-1$ price offers and then choose 'BUY' in the next week where the price offer is lower than all previous price offers, we have the following probability $\phi_n(r)$ of choosing the best price:

$$\phi_{15}(r) = \begin{cases} 1/15 & \text{for } r = 1 \\ \sum_{j=r}^{15} \left(\frac{1}{15}\right)\left(\frac{r-1}{j-1}\right) = \left(\frac{r-1}{15}\right)\sum_{j=r}^{n}\left(\frac{1}{j-1}\right) & \text{for } r > 1 \end{cases} \tag{3.1}$$

The result for all r, when n=15, can be viewed in Figure 3.3. We see that if $r = 6$ is chosen, an optimal probability of 39% can be achieved. This leads to the optimal strategy of declining the first 5 price offers, after which the subsequent price offers which is lowest in ranking should be bought. In Game 1 this will lead to buying the 7^th option of €95 ± 5, in Game 2 this will lead to the last or 15th option of 80% on €200 ± 5 or 20% on €55 ± 5 and in Game 3 this will lead to buying the 9^th option of €110 ± 5. However the assumption that price offers are randomly determined, neglect a possible last-minute price makes this unrealistic for at least the second and third game, where the chances of a last-minute price are given.

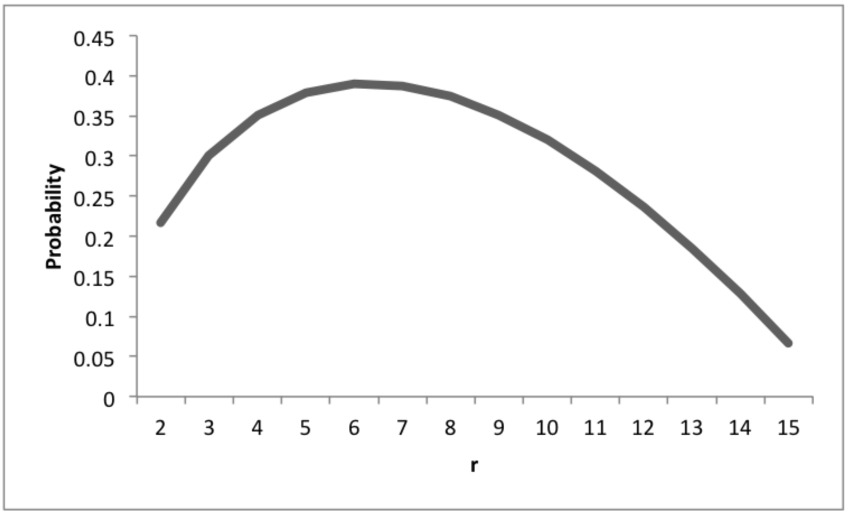

Figure 3.3: Probability that paid price is cheapest of all offers, n=15

Since participants of the game are aware of a possible last-minute the rational solutions has the limitation that is does not take into account this possibility. Since this possibility of a last-minute brings a higher chance of the lowest price being in the last week, the actual r with the highest expected payoff will probably be slightly higher than the discussed r above.

3.2 Hypotheses

The experiment as proposed divides participants in two different groups:

- **Imitation group:** receives a scoreboard with information about the best previous participants during all three games. This way, the imitation group has the possibility to sample the behavior of the best previous participants, and could rely on imitating as a form of decision making.

- **Benchmark group:** does not receive a scoreboard, with information about the best previous participants (price and how many weeks left), during all three games. This way, the benchmark group hasn't got the possibility to sample the behavior of the best previous participants, and can't rely on imitation as a form of decision making.

At the top of the scoreboard are always the participants who waited for the last minute and got lucky. However the scoreboard doesn't show the participants who waited for the last minute and didn't get lucky. The question now arises if the imitation group is more inclined to wait for the last minute. Does the imitation group rely on imitating the best, even if doing so involves a certain risk (not getting the last minute)? Based on the imitation theory explained before, this leads to the following hypotheses.

Hypotheses 1a: The median number of weeks left to buy the ticket is lower in the imitation group (participants who have the ability to sample) compared to the benchmark group (participants who do not have the ability to sample) for all 3 games.

Hypotheses 1b: Social sampling makes people look more risk seeking than people who do not have the opportunity to sample in buying airline tickets.

The experiment as proposed let participants play three different games:

- **Game 1:** Starts with random prices (as shown in Figure 3.2), no information about the possibility of a last minute discount. Ability to play 'risk free' in first round, 15 weeks left (price of €110).
- **Game 2:** Starts with low prices (as shown in Figure 3.2), information about the possibility of a last minute discount is given (20%). Ability to play 'risk free' at 15 weeks left and 6 weeks left (price of €110).
- **Game 3:** Starts with high prices (as shown in Figure 3.2), information about the possibility of a last minute discount is given (20%). Ability to play 'risk free' at 15 weeks left and 6 weeks left (price of €110).

Since the players in game 2 are targeted with low prices in the beginning, the feeling of winning may be present. The same happens in game 3, since the players are targeted with high prices in the beginning, the feeling of loss may be present. The question arises if due to this feeling of loss/winning participants are more/less inclined to wait for the last minute. Based on the prospect theory explained before, this leads to the following hypotheses.

Hypotheses 2a: The median number of weeks left to buy the ticket in game 3 is lower compared to game 2. Also people in game 2 are more likely to take the risk-free price of €110 with 6 weeks left compared to people in game 3.

Hypotheses 2b: People are more inclined to take a risk, when the feeling of loss is present. People are less inclined to take risk, when the feeling of winning is present.

Chapter 4

Data

4.1 Data preprocessing

In order to collect the data a website based experiment was created. In order to ensure the quality of the data, the website was first tested with a test group, to uncover any possible errors or unclarity in the program or in the explanation. All subjects of the test set were soon to be undergraduates at University of Amsterdam (UvA) and were obliged to take the test. 43 participants started the game and 29 participants finished it. In order to get full understanding of the behavior, only the participants that completed the game were included in the results. In this test set 13 females and 16 males finished, and the average duration was 7.1 minutes. Participants stated that after a few times, their understanding of the rules of the game has increased.

After some slight adjustments of erroneous code, the main data was collected. For over 9 days participants could join the game online. 205 participants started the game and 141 participants completed the game. In order to get full understanding of the behavior, only the participants that completed the game are included in the results. In this main database 71 males and 70 females participated, and the average duration was 7.3 minutes.

At the beginning of the experiments the participants were asked to answer 3 control questions about risk, for electing their risk attitudes, see appendix for the questions. Question 1 aims to filter out the contestants who have no knowledge about percentages, but these were not present in the main dataset. Question 2 and 3 are based on the test of Kahneman and Tversky (1979), the results found are in line with the results of Kahneman and Tversky (1979). Therefore one could conclude that the understanding and risk attitudes of the participants in the test set and the main set appear to be normal.

4.2 Exploratory data

Test set:

Since the test set were soon to be undergraduates, the average age of the test set was 19, see

Figure 4.1. Seven females and nine males were part of the benchmark group and six females and seven males were part of the imitation group. The benchmark group are the participants who receive the left screen in Figure 3.1, and haven't got the opportunity to sample the behavior of previous best participants. The imitation group are the participants who receive the right screen in 3.1, and have got the opportunity to sample the behavior of previous best participants.

Main set:

The average age of the participants in the main dataset is 29. However, the the group of people between the age of 18 and 30 contains 79% of the entire dataset, see Figure 4.1. 31 females and 42 males were part of the benchmark group and 39 females and 29 males were part of the imitation group. The benchmark group are the participants who receive the left screen in 3.1, and did not get the opportunity to sample the behavior of previous best participants. The imitation group are the participants who receive the right screen in 3.1, and have got the opportunity to sample the behavior of previous best participants.

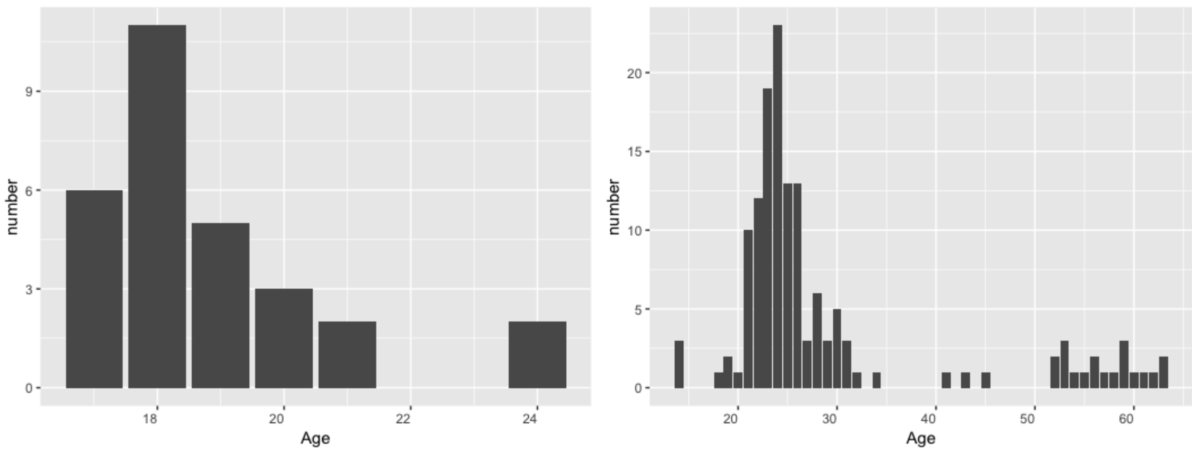

Figure 4.1: Age of the participants (left: test set, right: main set)

Test set:

Table 4.2 presents the results of the test set. In the first game the participants played, the differences between the benchmark group (without scoreboard) and the imitation group (with scoreboard) is especially noticeable for females. Since the median weeks left when the ticket was bought by females in the benchmark group was 9 weeks and the median weeks left for females in the imitation group was between 0 and 1 week. This large difference between the benchmark group and the imitation group wasn't really noticeable with males, since the median weeks left when the ticket was bought by males in both groups was 0 weeks.

In the second game the differences between the benchmark group (without scoreboard) and the imitation group (with scoreboard) were again especially noticeable with females. Since the median weeks left when the ticket was bought by females in the benchmark group was 14 weeks and the median weeks left when the ticket was bought by females in the imitation group was between 8 or 9 weeks. This large difference between the benchmark group and the imitation group was also a bit noticeable with males, since the median weeks left when the ticket was bought by males in the benchmark group was 12 weeks and for the imitation group 10 weeks. The overall difference of the benchmark group and imitation group for both, males and females, was also noticeable, namely between 12 and 13 weeks left for the benchmark group and 10 weeks left for the imitation group. It is also noticeable that overall the tickets in the game 2 are bought much earlier than the tickets in game 1.

In the third and final game the differences between the benchmark group (without scoreboard) and the imitation group (with scoreboard) not really noticeable. However for males a different results is seen. Previously the imitation group always waited longer to buy the ticket, for females, males and together. However for game 3, the imitation group of males has a mean of 6 weeks left when the ticket is bought, while the benchmark group has a median of 0 weeks left. Females do not seem to have this behavior. It is also noticeable that overall the tickets in the game 3 are bought much later than the tickets in game 2.

Since the test group has only 29 participants, the rest of the results will be based on the main database, which is almost 5 times as large as the test group.

Scoreboard	Gender	N	1 med	1 mean	2 med	2 mean	3 med	3 mean
0	Both	16	0.50	5.31	12.50	9.81	0.00	2.69
1	Both	13	0.00	4.08	10.00	7.92	0.00	3.31
Both	Female	13	1.00	5.31	13.00	9.00	0.00	3.38
Both	Male	16	0.00	4.31	11.00	8.94	0.00	2.62
0	Female	7	9.00	6.43	14.00	10.14	1.00	5.29
1	Female	6	0.50	4.00	8.50	7.67	0.00	1.17
0	Male	9	0.00	4.44	12.00	9.56	0.00	0.67
1	Male	7	0.00	4.14	10.00	8.14	6.00	5.14

Table 4.1: Test database: Median and mean of weeks left is ticket is bought by different groups

Main set: In Figure 4.2 the results of all 3 games are presented graphically, aggregated on the benchmark group (red) and the imitation group (blue). In the first game almost 67 % of the participants of the imitation group, waited for the last minute (0 weeks left). In the benchmark group only 42% waited for the last minute (0 weeks left). In the second game most of the participants of both groups bought the ticket in the third round (13 weeks left), and 30 % of the participants of the imitation group waited for the last minute (0 weeks left). In the benchmark group 27% waited for the last minute (0 weeks left). In the third game 51 % of the participants of the imitation group waited for the last minute (0 weeks left). In the benchmark group 50% waited for the last minute (0 weeks left).

Table 4.2 also presents the exploratory data for the main set. In the first game the participants played, the differences between the benchmark group (without scoreboard) and the imitation group (with scoreboard) were noticeable. Since the median weeks left when the ticket was bought in the benchmark group was 9 weeks and the median weeks left in the imitation group was 0 weeks. This large difference between the benchmark group and the imitation group

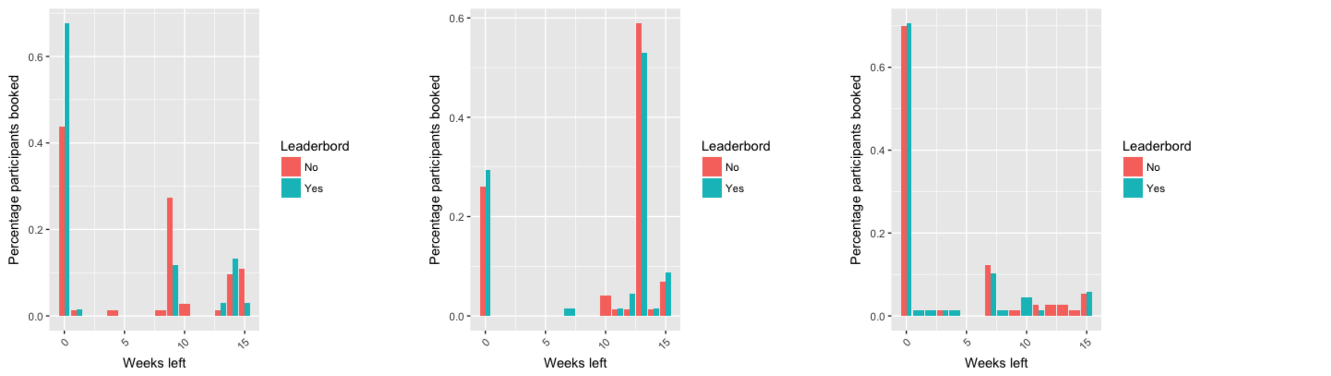

Figure 4.2: Percentage booked each week - Left to right: Game 1, Game 2, Game 3

was noticeable with males and females however like the test dataset the females showed a larger difference. For females the median weeks left when the ticket was bought in the benchmark group was 9 weeks and the median weeks left in the imitation group was 0 weeks. And for males the median weeks left when the ticket was bought in the benchmark group was 4 weeks and the median weeks left in the imitation group was 0 weeks. This is in line with data in the test dataset.

In the second game the differences between the benchmark group (without scoreboard) and the imitation group (with scoreboard) were not noticeable. All different subgroups had a median of 13 weeks left to buy the ticket. Overall, participants bought the tickets sooner in the second game compared to the first en last game. This is not in line with the test data set.

In the third and final game the differences between the benchmark group (without scoreboard) and the imitation group (with scoreboard) also were not noticeable. The reversed effect for males in the imitation group compared to males in the benchmark group, as seen in the test data set, was somewhat more noticeable in the mean weeks left when the tickets were bought, however the effect was not as strong a in the test dataset. It was also noticeable that overall the tickets in the third game are bought much later than the tickets in second game.

Scoreboard	Gender	N	1 med	1 mean	2 med	2 mean	3 med	3 mean
0	Both	73	9.00	6.08	13.00	9.60	0.00	3.03
1	Both	68	0.00	3.75	13.00	9.21	0.00	2.47
Both	Female	70	0.00	5.11	13.00	9.90	0.00	2.60
Both	Male	71	0.00	4.80	13.00	8.93	0.00	2.92
0	Female	31	9.00	6.90	13.00	10.45	0.00	3.42
1	Female	39	0.00	3.69	13.00	9.46	0.00	1.95
0	Male	42	4.00	5.48	13.00	8.98	0.00	2.74
1	Male	29	0.00	3.83	13.00	8.86	0.00	3.17

Table 4.2: Main database: Median and mean of the week ticket is bought by different groups

The aim of this study does not include the difference in risk attitudes between males and females, therefore further analysis does not distinguish these. However, the above exploratory data analysis does suggest a possible difference and this difference in risk attitudes for buying airline tickets between males and females is recommended for possible further research in the last section of this study.

Chapter 5

Results

The variable of interest in this experiment is the moment participants decide to buy the ticket. This possible dependent variable (y) is described as 'the number of weeks left, when the ticket is bought'. Since there is a clear ordering in this variable, it is not considered as a categorical variable, but rather as an ordinal or interval variable. The difference between an ordinal variable and an interval variable is that the intervals between the values of the interval variable is equally spaced and the intervals between the values of an ordinal variable are not equally spaced. The question arises if the dependent variable (y) ('the number of weeks left, when the ticket is bought'), is an ordinal or an interval variable. Since the spaces between each value of y is equally spaced (namely 1 week) one could assume that y is an interval variable. However the question arises if the difference between 10 weeks left and 8 weeks left is the same as the difference between 2 weeks left and 0 weeks left. In duration it is the same, namely 2 weeks, but the question arises if the interpretation is also the same. To neglect this discussion different test are used, for both types of variables.

To begin with, the first hypotheses is tested. Since we have 1 ordinal (maybe interval) dependent variable y and 1 independent variable (dummy for scoreboard vs no scoreboard) we consider the Wilcoxon-Mann Whitney test, which is applicable for ordinal and interval variables. The test is firstly applied two sided (if the median of the two groups are different) and afterwards one-sided (if the median of the imitation group is higher compared to the benchmark group). If we assume that we have an interval variable, we could also use 2 independent sample t-tests. The main results can be found in Table 5.1.

As can be seen from Table 5.1 for Game 1, the median weeks left to buy the ticket for the imitation group is significantly higher compared to the median weeks left to buy the ticket in the benchmark group. All 3 tests give evidence for a significant difference between both groups, with a significance level of at least 5% for Game 1. For the other two games no significant evidence is found that the median weeks left to buy the ticket in the imitation group is different compared to the benchmark group, with all 3 tests. Therefore the first hypotheses is rejected, since it states that there is a significance difference in all 3 games. However, notice that in Game 1 a significant difference is found.

Method	Game	Sided	P-value	Alternative hypotheses
Wilcoxon-Mann Whitney	1	two-sided	0.01283*	True location shift is not equal to 0
Wilcoxon-Mann Whitney	2	two-sided	0.8143	True location shift is not equal to 0
Wilcoxon-Mann Whitney	3	two-sided	0.7495	True location shift is not equal to 0
Wilcoxon-Mann Whitney	1	one-sided	0.006415*	True location shift is greater than 0
Wilcoxon-Mann Whitney	2	one-sided	0.4071	True location shift is greater than 0
Wilcoxon-Mann Whitney	3	one-sided	0.3747	True location shift is greater than 0
2 ind. sample T-test	1	two-sided	0.01965*	True difference mean not equal to 0
2 ind. sample T-test	2	two-sided	0.6925	True difference mean not equal to 0
2 ind. sample T-test	3	two-sided	0.4883	True difference mean not equal to 0

Table 5.1: Main database: Hypotheses 1

Hence the second hypotheses will be tested. Since we have one population participating in both games (game 2 and game 3) and we are interested in the difference of the ordinal dependent variable y of both games, we can again consider the Wilcoxon-Mann Whitney test, which is applicable for ordinal and interval variables. The test is firstly applied two sided (if the median of the two games are different) and afterwards one-sided (if the median of the game 3 is higher compared to median of game 2). If we assume that we have an interval variable, we could also use 2 independent sample t-tests. The results can be found in Table 5.2.

As can be seen from Table 5.2 for all 3 test the difference in median between Game 2 and Game 3 are significantly different. Meaning that the median weeks left to buy the ticket in Game 3 is significantly higher compared to the median weeks left to buy the ticket in game 2. Therefore the first part of the second hypotheses is accepted, since it states that the median number of weeks left to buy the ticket in Game 3 is lower compared to Game 2.

Method	Sided	P-value	Alternative hypotheses
Wilcoxon-Mann Whitney	two-sided	<2.2e-16*	True location shift is not equal to 0
Wilcoxon-Mann Whitney	one-sided	<2.2e-16*	True location shift is greater than 0
2 ind. sample T-test	two-sided	<2.2e-16*	True difference mean not equal to 0

Table 5.2: Main database: hypotheses 2

The second part of the second hypotheses states that people in Game 2 are more likely to take the risk-free price of €110 with 6 weeks left compared to people in Game 3. A Chi-square test of independence was calculated comparing the frequency of buying the risk-free price of €110 with 6 weeks left in Game 2 and Game 3. A significant interaction (with a significance level of 10%) was found, with a probability of $p = 0.054163$. Participants in Game 3 were more likely (13.3%) to buy the risk free price of €110 with 6 weeks left compared to people in Game 2 (2.5%). Therefore the second hypotheses is rejected, since it states people in Game 2 are more likely to take the risk-free price of €110 with 6 weeks left compared to people in Game 3. The findings of the first part and the second part of the second hypotheses are contradictory and therefore the overall second hypotheses is rejected.

Chapter 6

Conclusion

The first question in this study sought to determine if social sampling makes people look more risk seeking than people who do not have the opportunity to sample. From the information given in the results, we can conclude that for the first game the median of weeks left to buy the ticket is lower in the imitation group compared to the benchmark group. Therefore we can conclude that for the first game social sampling indeed makes people look more risk seeking than people who do not have the opportunity to sample. However for the other two games, we cannot conclude that the median of weeks left to buy the ticket is lower in the imitation group compared to the benchmark group. Therefore for the second and third game, social sampling does not make people look more risk seeking than people who do not have the opportunity to sample. Evidence is found that customers in the airline industry make use of imitation as a form of decision making, however this is not always the case.

The second question in this study sought to determine if people are more inclined to take a risk when the feeling of loss is present, and visa versa. From the information given in the results, one can conclude that people in game 3 (with a present feeling of loss) are more inclined to play on the last-minute compared to game 2 (with a present feeling of winning). However, from the results one can not conclude that people in game 2 (with a present feeling of winning) are more likely to take the risk-free price compared to people in game 3 (with a present feeling of losing). Therefore, these results are contradictory and no evidence is found that people are more inclined to take a risk, when the feeling of loss is present in the airline industry. However, we can conclude that irregularities have been found in the behavior of the different games indicating possible dependence of behavior of customers in the airline industry on the feeling of loss or winning.

The overall conclusion is that customers of airline tickets are not passive and show intertemporal substitution behavior (waiting behavior). This behavior could be triggered by certain aspects, like imitation possibilities and the feeling of loss or winning. Customers do not make rational choices but show behavior in line with bounded rationality theories. The possibility of imitation could make customers appear more risk seeking, however this possibility is not necessarily a guarantee of risk seeking behavior. The waiting behavior is also dependent on the feeling of loss or winning, however no evidence is found that people are more inclined to take a risk, when the feeling of loss is present in the airline industry.

A possible explanation for the reason that evidence for imitation was only found in the first game is the possibility that people appear to understand the game better, once it is often played. Therefore they do not need to rely on imitation as a form of decision making once they already played the game and understand the game. This is in line with the current thought in literature that if a decision maker was fully rational and capable of making the necessary calculations, one would not need to imitate. The possibility of imitation could make customers look more risk-seeking if a customer is new to buying this particular airline ticket. This could be of interest for airline tickets companies, since new customers could be triggered with possible last-minute deals if some examples of previous customers that received a last-minute are shown.

Since the contradictory findings of evidence for the prospect theory in the behavior of customers, the results are robust. The feeling of loss or winning might be not correctly simulated in this paper, however we find evidence of different behavior between the groups. Therefore, further research is required to understand this difference in waiting behavior with the different feelings of loss or winning.

Another finding worth mentioning is that males and females appear to behave differently on imitation in the airline industry. Since this is beyond the scope of this study, no further tests and research is done for this possible difference in this study. However this may be of big interest for airline companies and further research on this topic is required.

A limitation of this study is that the database of participants was already biased on age and the question arises if this resembles the entire population buying airline tickets. Therefore the results mentioned should be tested for a larger and more diffused test group. Also the setup of the experiment can be questioned. Since only the winner receives a price, risk seeking behavior is already triggered and the question arises whether or not this correctly simulates the behavior of people in the airline industry. For example suppose the lowest available price for a certain ticket is €60 and the highest possible price for that same ticket is €210. If one buys the ticket for a fairly low price of €70, in the current proposed ticket game a participant is not satisfied, since it is only satisfied with the lowest possible price of €60. It the current experiment it does not matter if the participant bought the ticket for the price of €70 or €210, since it is not able to win the game anymore. However, most likely in reality, a customer is more pleased with a price of €70 compared to the price of €210, and that difference is not represented in the current experiment. Another possible question about the set-up of this experiment is about the given median price. Is it realistic for a customer to have a median price, or is it more realistic for a customer to have sense of the range a ticket price could vary? Probably did the median price influence the participants of the experiment, since they knew that if they got targeted with high prices, they should also be targeted with low prices and visa versa. This influenced the behavior of participants, and the question arises if this reflects reality.

Also this study is limited by focusing only on imitation and the prospect theory, applied on inter-temporal substitution (waiting behavior) in an airline ticket environment. Maybe future research can explore other heuristics in decision making, still focusing on the airline industry. Understanding the behavior of customers while buying airline tickets is a great asset for airline companies, but also for customers. Since better understanding of behavior of customers, leads to better pricing models, which leads to a better customer serving. In the ideal pricing situation customers always pay the price for a ticket they are willing to pay and less seats will be unused, therefore the behavior of customers in the airline industry deserves more attention.

Appendix A

Risk aversion

At the beginning of the experiments the participants were asked to answer 3 control questions about risk, for electing their risk attitudes and understanding of percentages. Question 1 aims to filter out the contestants who have no knowledge about percentages, by means of the following question:

QUESTION 1: Consider the following options. which option would you prefer?

1. A: 10% chance to win €100
2. B: 90% chance to win €100

Question 2 and 3 are based on the test of Kahneman and Tversky (1979):

QUESTION 2: You will have 50% chance to win €150 and 50% chance to lose €100. Would you take this gamble?

1. Yes, I would take this gamble
2. No, I would not take this gamble

QUESTION 3: Consider the following options. which option would you prefer?

1. A: Lose €100 with certainty
2. B: 50% chance to win €50 and 50% chance to lose €200

The results found are in line with the results of Kahneman and Tversky (1979). Therefore one could conclude that the understanding and risk attitudes of the participants in the test set and the main set appear to be normal.

Appendix B

Screens and website

The experiment was launched on the following website: www.emmaimmink.wix.com/behaviourgame
The participants received the following screens in the corresponding order.

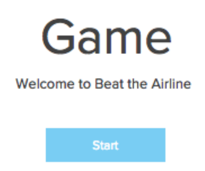

Figure B.1: Screen 1

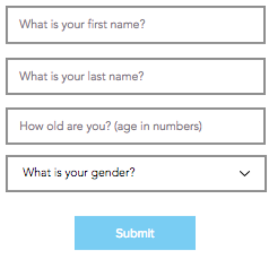

Figure B.2: Screen 2

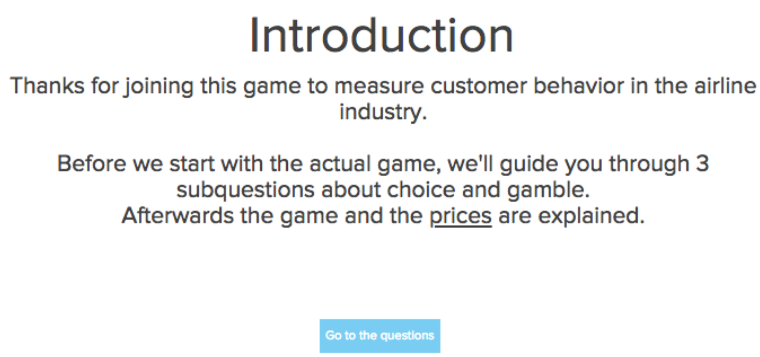

Figure B.3: Screen 3

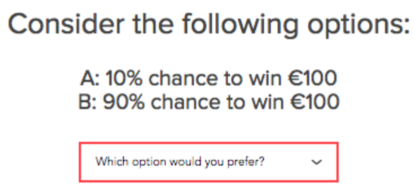

Figure B.4: Screen 4

Figure B.5: Screen 5

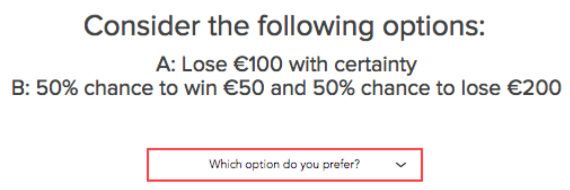

Figure B.6: Screen 6

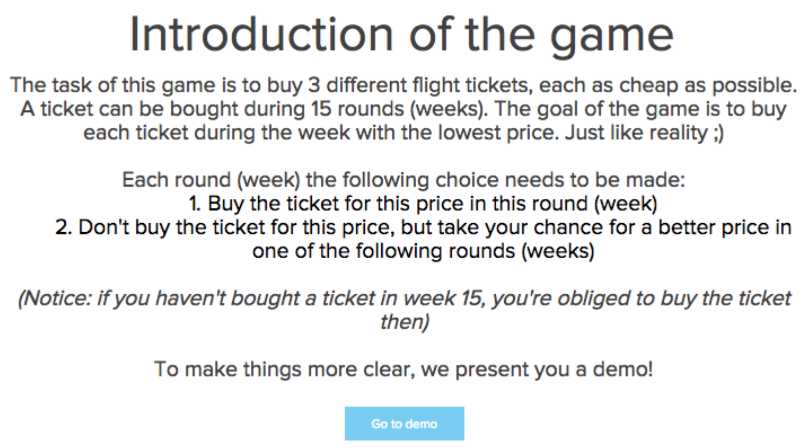

Figure B.7: Screen 7

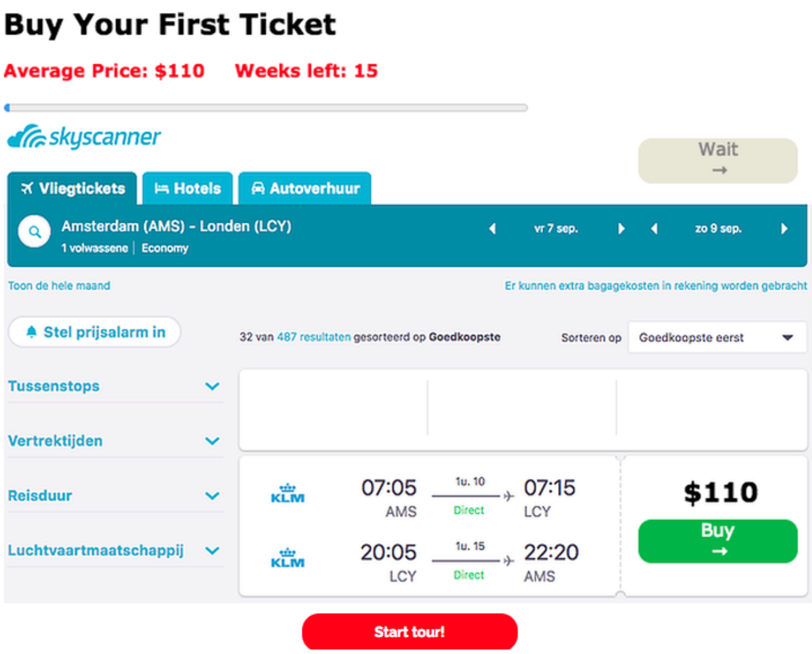

Figure B.8: Screen 8

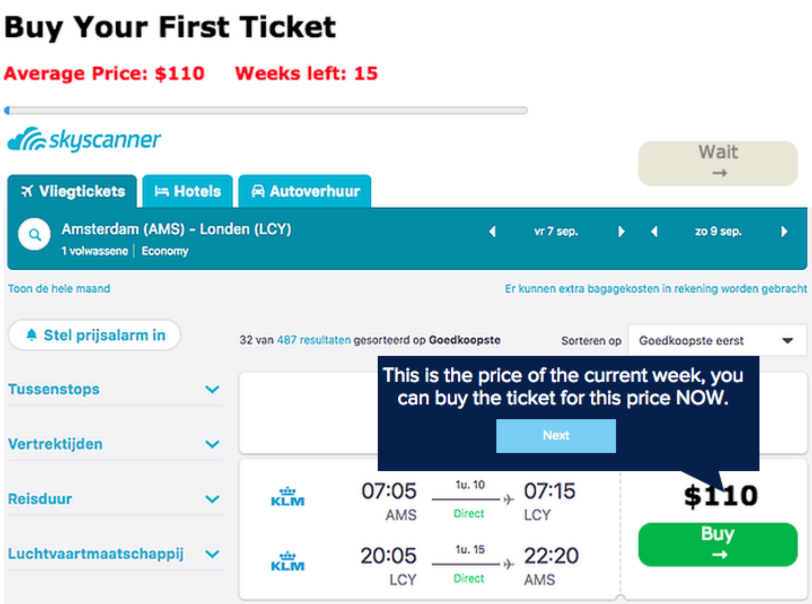

Figure B.9: Screen 9

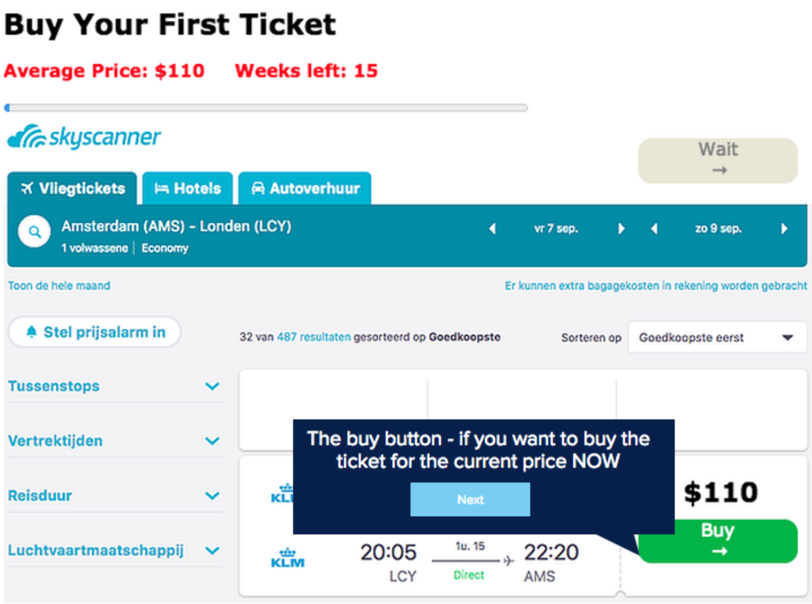

Figure B.10: Screen 10

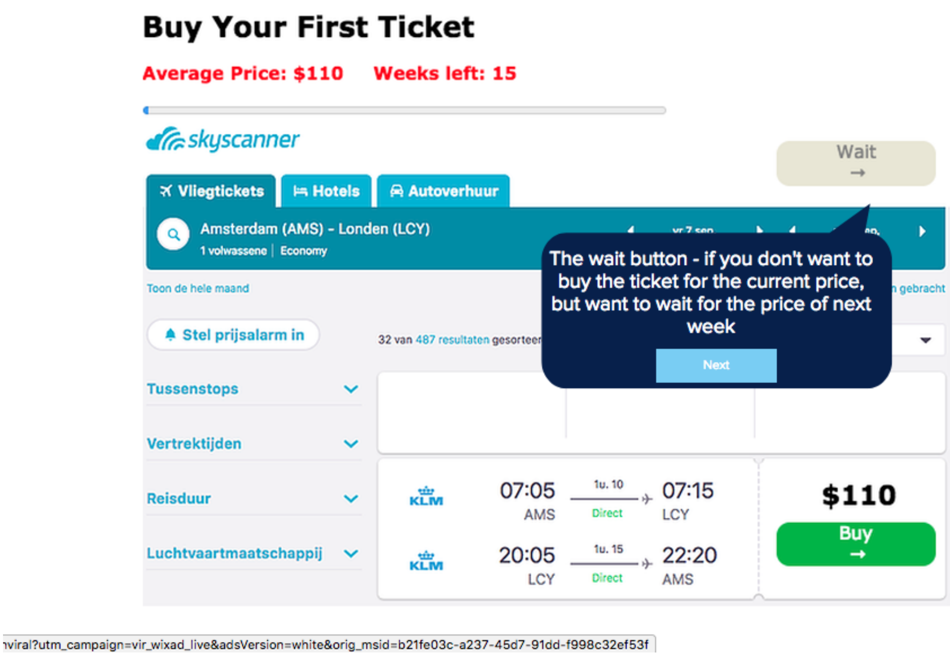

Figure B.11: Screen 11

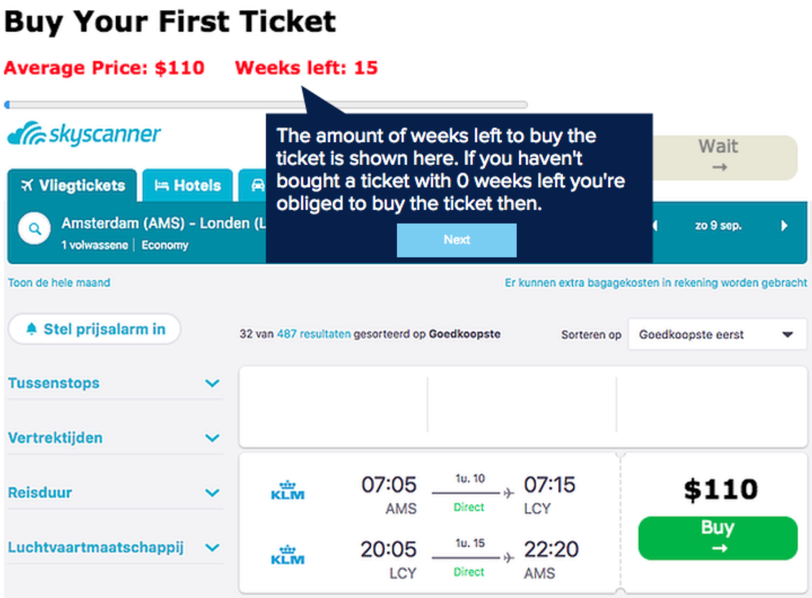

Figure B.12: Screen 12

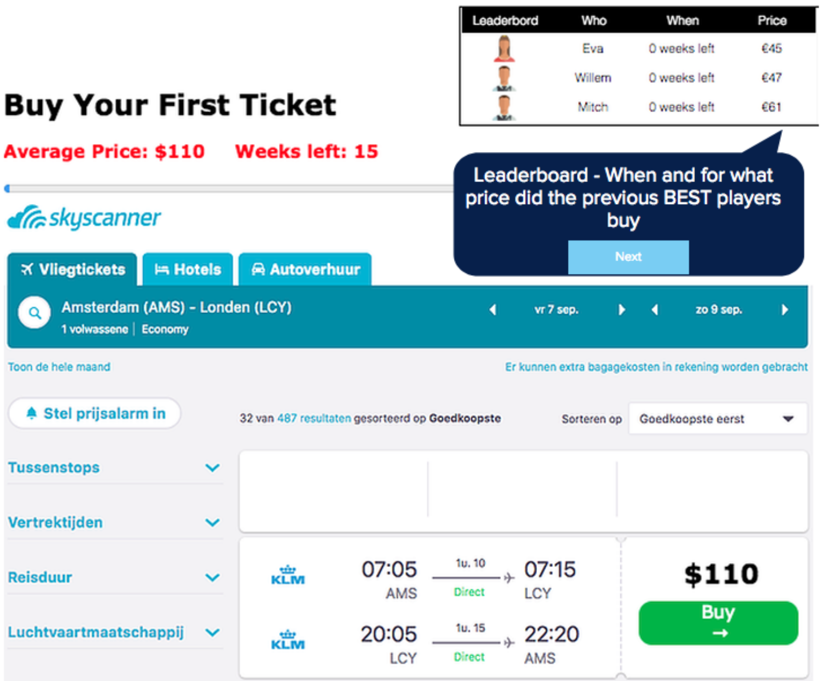

Figure B.13: Screen 13 - this scoreboard is only shown to the imitation group

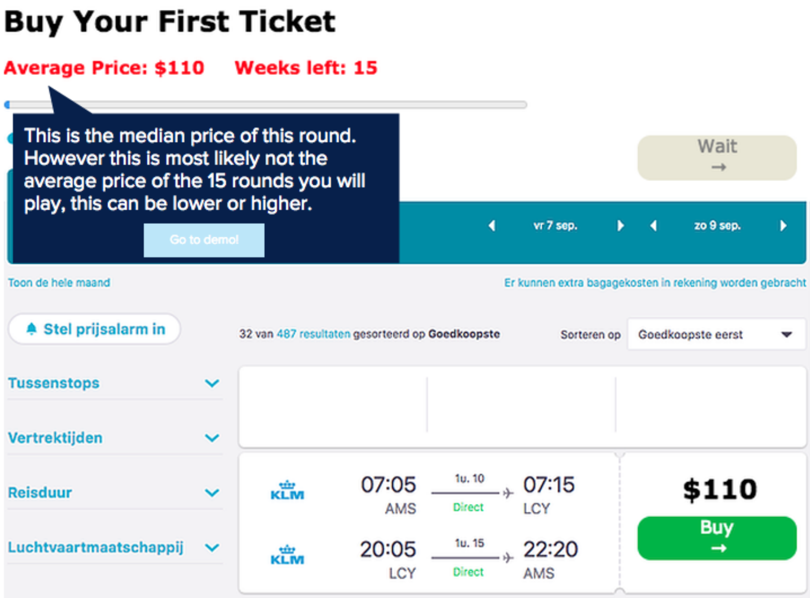

Figure B.14: Screen 14

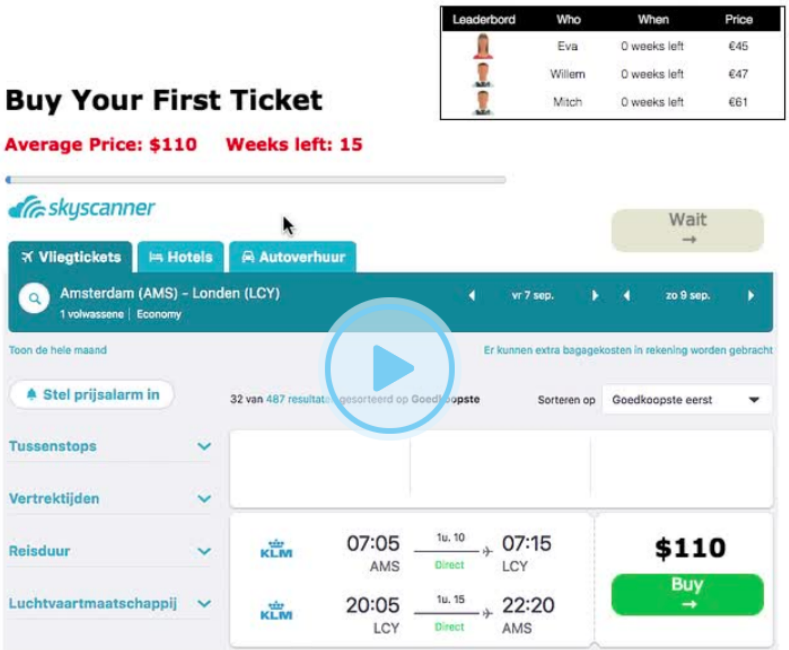

Figure B.15: Screen 15

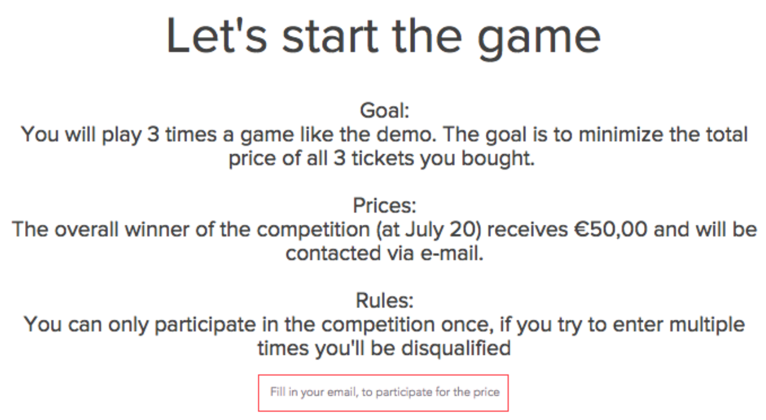

Figure B.16: Screen 16

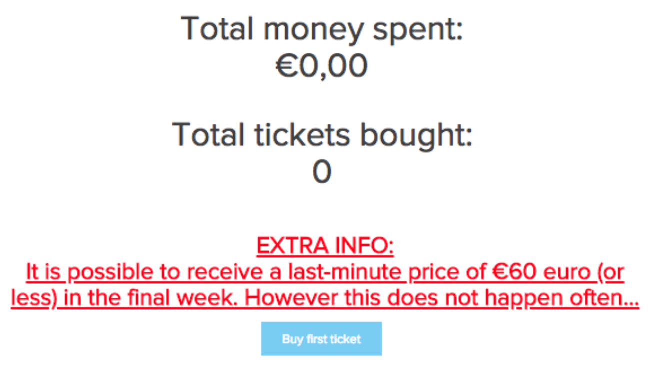

Figure B.17: Screen 17

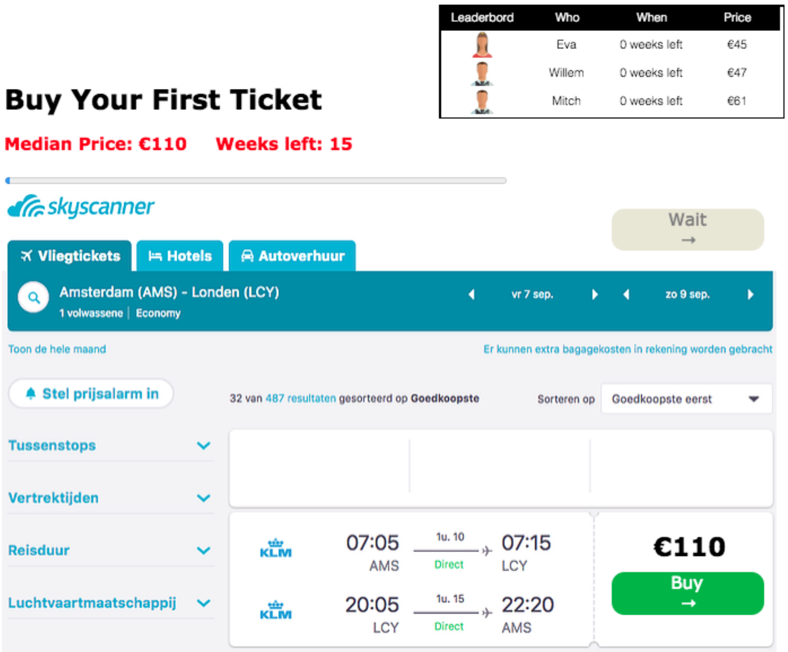

Figure B.18: Screen 18 - the scoreboard is only shown to the imitation group

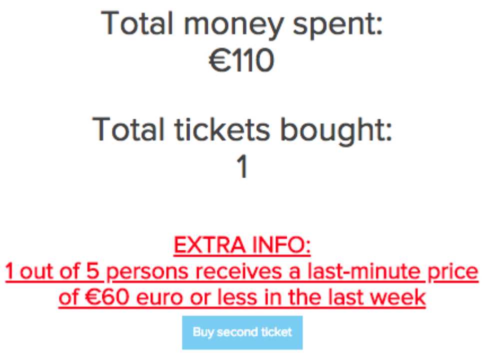

Figure B.19: Screen 19

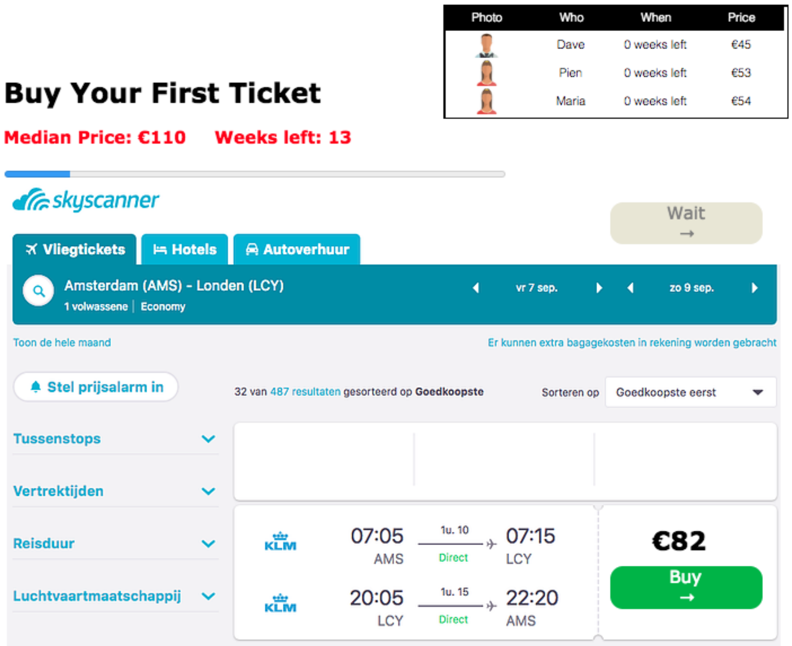

Figure B.20: Screen 20 - the scoreboard is only shown to the imitation group

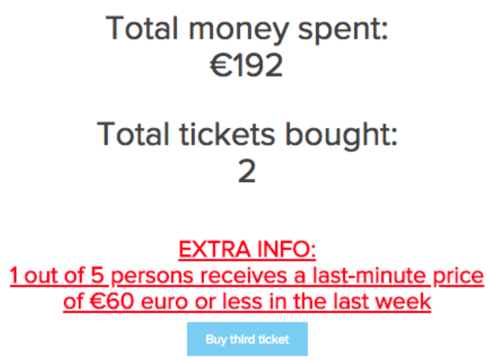

Figure B.21: Screen 21

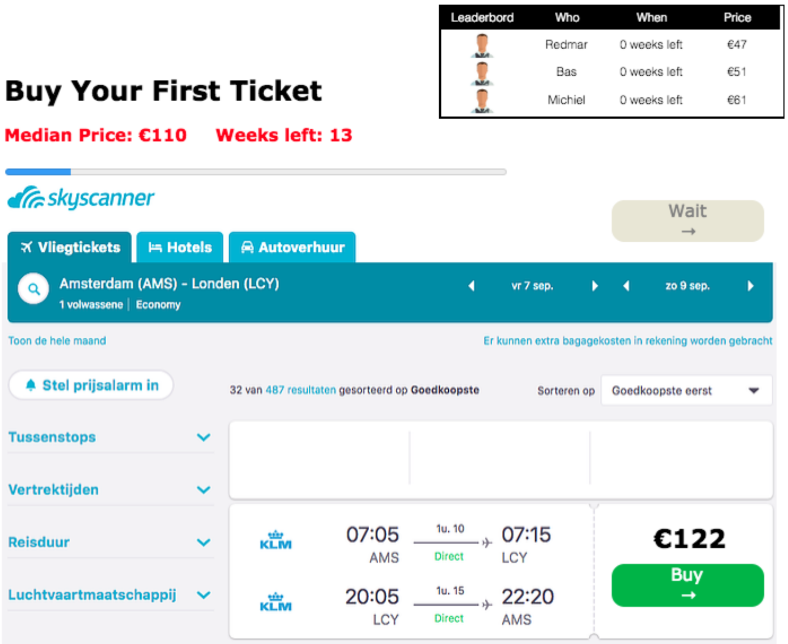

Figure B.22: Screen 22 - the scoreboard is only shown to the imitation group

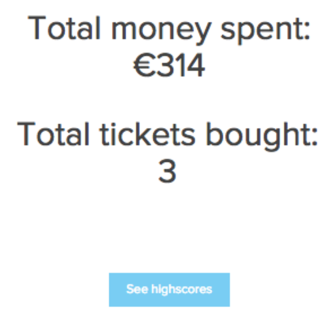

Figure B.23: Screen 23

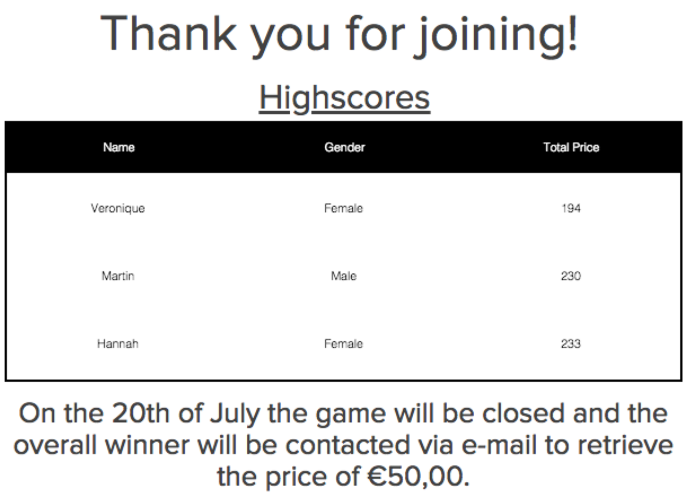

Figure B.24: Screen 24

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