

How Does Probability Impact Consumers' Choice?

The Case of Online Reviews

### Abstract

Consumers are frequently in situations that include evaluation of probability of the outcome of a choice. It is, therefore, essential to analyze how probability influences choice to fully understand consumer behavior. This paper investigates how probability discounting contributes to the understanding of the impact of online reviews on consumer choice. An experiment with 25 participants was conducted. Participants were presented with an online shopping scenario in which they had to choose between two online shops: one with (positive) customer reviews and higher product prices, and the other having lower prices, but no customer reviews at all. We employed a titration procedure over sales price for the web shop without customer reviews on delivery reliability and customer service was run over seven probability conditions. The point where participants switched between one web shop or another were recorded, and probability discounting factors calculated. Results highlight that online reviews are an indicator of successful online transactions (i.e. intention to buy), and therefore function as choice benchmarks. In the light of these results, the paper presents practical implications, as well as directions for future research.

*Keywords:* consumer choice, probability, probability discounting, online review, experimental study

In a consumer choice situation, probabilities are popping up everywhere. For example, consumers have to take into account the probability of the recommendation for a specific restaurant being correct. When buying a house, consumers have to take into account the probability of the information given by the relator being correct. When buying a used car, consumers have to evaluation the probability that the price asked for the care is around market price. When buying a pair of jeans online, consumers have to take into account the probability of the product quality presented on the web shop being correct, of being of the same mind of design when receiving them, and of other customers' reviews online being correct. According to Rachlin (1989, pp. 22-23), it is essential to understand probability to be able to understand choices, and he emphasize that; "Since our behavior undoubtedly depends on or reflects probabilities (objective and subjective), our conception of probability will determine how we should behave and our evaluation of other people's behavior."

Probability discounting is suggested as a concept when studying probability and choices (see Rachlin, Raineri, & Cross, 1991). Probability discounting refers to the reduction in the subjective value of a consequence as a function of a decreasing probability of its delivery. An outcome that has a greater probability of delivery tends to have a higher subjective value than those with a lower probability (McKerchar & Renda, 2012). For example, if somebody owed you \$10000, and there was only a 50% chance that the person was going to repay, you may be willing to accept \$5000 rather taking the risk of not getting any money back. Equally, if there was only a 25% chance the person was going to repay, then you may be willing to accept \$2500 instead of taking the chance of getting nothing.

There are various events in a consumer choice situation that indicates probability of a successful transaction, and, from the definition of probability discounting, alters the subjective

value of its consequence. One such event is online reviews, defined as a digital version of word-of-mouth (Chatterjee, 2001). Online review has become a major information source for consumers, and has shown to be an important implications for a wide range of management activities (see Dellarocas, Zhang, & Awad, 2007). From a consumer behavior standpoint, an online review indicates the probability of a successful transaction, and, from the definition of probability discounting, alters the subjective value of its consequence. Moreover, the subjective value of an outcome has an impact on consumers' choices in relation to buy (approach) or not buy (escape) (see Alhadeff, 1982). Thus, this paper addresses the following research question: How can probability discounting contribute to the understanding of the impact of online reviews on consumer choice?

The rest of the paper is structured as follows. First, the concept of probability discounting according to the standard discounted utility model is described. Then the experimental design is presented. Next, the findings are discussed and summarized. The paper concludes with a discussion of academic and managerial implications and directions for future research.

### **Choice and Probability Discounting**

According to the standard discounted utility model, a person's subjective value of a reward decreases as a function of uncertainty (Loewenstein & Prelec, 1992); moreover, this value would be expected to be a consistent linear function. In this simple model, the subjective value  $S$  of a an uncertain reward is given by

$$S = p V,$$

where  $p$  is the probability of reception of the reward and  $V$  is the subjective value of the reward in the case of a certain outcome. Hence, the subjective value of a transaction where we buy such an uncertain prospect at price  $P$  equals

$$Vp - P. \quad (1)$$

This model operates at an individual level. In this study, we analyze the experimental data at a group level. Hence, we define a group subjective value  $V$  of the reward. This is defined to be the price at which 50% of the population is willing to buy the product in the case of a certain outcome. Along this vein we can also define the group subjective value  $S$  of an uncertain reward.

In this study, the participants were presented with two different web shops which for the purpose of clarification is in this paper denoted web shop A and web shop B. Web shop A presented the percentage of positive feedback from customers regarding delivery reliability and customer service, while web shop B didn't. We define the "review score"

$$r = (\text{Percentage of positive feedback}) / 100$$

that measures the fraction of positive feedback.

We assume that the participants act as if  $r$  is the probability of a satisfying deliver from web shop A, and accordingly, we can use formula (1) with  $r$  substituted for  $p$  to estimate the subjective value of a buying deal with web shop A. Hence, since the price on web shop A is

invariably equal to NOK 4250, the group subjective value of the transaction offered by web shop A is

$$S = r V - 4250, \quad (2)$$

There is also an unspoken uncertainty associated with web shop B, and we hypothesize that the participants act as if there is a probability  $t$  for receiving the goods when buying them in web shop B. We can say that the value of  $t$  represents the trust in web shop B. Again, we can apply (1), which yields the group subjective value

$$S = t V - P, \quad (3)$$

when web shop B offers the price  $P$ .

When presented with a choice between buying in web shop A with review score  $r$  and price NOK 4250, and buying in web shop B for the price  $P$ , it follows from (2) and (3) that the group should be indifferent when

$$r V - 4250 = t V - P$$

i.e. when

$$P = (t V - 4250) - t V \quad (4)$$

This is a linear model of how the price of indifference  $P$  depends on the on the review score  $r$ . There are two unknown parameters, namely the group level subjective value  $V$  of a certain reward and the group level trust  $t$  in web shop  $B$ .

## **Method**

### **Participants**

Twenty-five undergraduate students, from Westerdals – Oslo School of Arts, Communication and Technology (Faculty of Technology), accepted an invitation to participate in an experimental study about consumer choice. There were 15 males and 10 females with an age-range from 17 to 54, with an average age of 23 years. Each participant was informed that the experiment would last up to 20 minutes; they were not offered any payment or incentives for participating.

### **Apparatus**

A simulated shopping microworld (see DiFonzo, Hantula, & Bordia, 1998) was programmed in MediaLab™ (version 2010) that presented the tasks and recorded data. The experiment was conducted in a PC-lab with 16 computers with Intel Xeon X3430 2.4 GHz processors, and 19-inch monitors and resolution of 1440 x 900 pixels. The monitors were arranged so that no participant could see the stimuli on other participants' monitors. A standard mouse was used to make choices.

### **Procedure**

Upon arrival at the PC-lab, each participant was led to one of the computers and was informed about their general rights as participants in the experiment. The experimenter then explained that all necessary information for the task would be presented via the monitor. Participants then completed the experiment alone. When the experiment was over, the

participants were asked if they had any questions regarding the experiment. They were also told that they could contact the experimenter if they had any questions about the experiment later.

Each session started with the following information (translated from Norwegian) on the computer monitor:

"The purpose of this experiment is to see how you make economic decisions. You will be presented different hypothetical situations, and based on the information you get you shall make some choices. No sensitive information about you will be gathered. It is voluntary to participate in the study, and you can at any time discontinue the experiment and leave the room where the study is taking place. Press "Continue" to confirm that you have read and understood the information above, and that you volunteer to participate in the experiment."

After reading the information regarding their general rights as participants, and pressing "Continue", a new text was presented for pre training with a standard classical discounting experiment as presented by Rachlin et al. (1991). The pre training session was conducted to make sure that participants are familiar with the titration procedure that is used in the main experiment sessions. When each participant had completed the pre training session, they were all presented with the following scenario (translated from Norwegian):

"Suppose you are going to buy a tablet. You have found two web shops where you can buy the product from. You recognize, however, that one of the web shops has customer reviews and higher product prices, and the other having lower prices, but no customer reviews at all. You will now be presented different choice situations where you shall choose which web shop you want to buy the tablet from: from the web shop which has customer reviews or from the one that does not have customer reviews. The choice



situations are independent of each other. It is therefore not appropriate to plan ahead. You should, in other words, assess each situation and choose to buy from the web shop that you find most appealing. Press "Continue" when you are ready to start."

The participants were, based on the information above, presented with different situations where they had to choose which web shop to buy the tablet from. The experiment consisted of seven conditions where other customer's reviews on the web shop A were; 95-, 90-, 70-, 50-, 30-, 10- and 5 percentage positive feedback from previous customers on delivery reliability and customer service. A sequence of two alternatives was presented on the monitor. For each pair, participants chose by selecting the preferred web shop with the mouse. This binary choice procedure is recommended as a "best practice" in discounting research, and has been used in experimental studies since the 1970s (Smith & Hantula, 2008). An illustration of how the stimulus card appeared is shown in Figure 1.

**You have now two alternative:**

**Buying the tablet from the web shop that has 70% positive feedback from previous customers on delivery reliability and customer service at price NOK 4250.**

**Buying the tablet from the web shop that do not has feedback from previous customers at price NOK 1700.**

**Which of the alternatives do you choose?**

Buy from the web shop with reviews

Buy from the web shop without reviews

*Figure 1:* Illustration example of condition number 3; web shop A with 70% positive feedback from previous customers on delivery reliability and customer service, and price NOK 4250, and web shop B price NOK 1700.

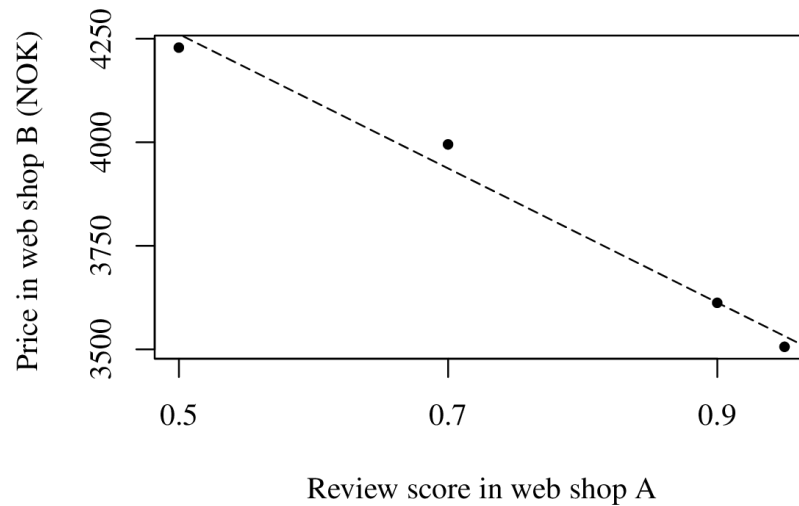
The price on the web shop B (without other customers reviews) were arranged as a psychophysical down-up titration procedure after Raineri and Rachlin (1993). The experiment first titrated down using the following proportions of NOK 4250 as the price; 1.0000, 0.9900, 0.9800, 0.9600, 0.9400, 0.9200, 0.9000, 0.8500, 0.8000, 0.7500, 0.7000, 0.6500, 0.6000, 0.5500, 0.5000, 0.4500, 0.4000, 0.3500, 0.3000, 0.2500, 0.2000, 0.1500, 0.1000, 0.0800, 0.0600, 0.0400, 0.0200, 0.0100, 0.0050, 0.0010, 0.0005, 0.0001. When the participants switched from web shop A (with customer reviews) to choose web shop B, titration up was started using the proportions in reverse. When the participants switched again, from web shop B to web shop A, the experiment moved on to the next condition.

### **Results**

After the experiment, the median of the points of indifference for each review score level was calculated. This median value corresponds to the group level point of indifference. This is a price where one-half of the group prefers web shop A, while the other half prefers web shop B. Since web shop B was not allowed to increase the price above NOK 4250, we ran into problems when the median value was measured to NOK 4250, i.e. at the review score levels  $r = 0.05$ ,  $r = 0.1$  and  $r = 0.3$ . In these cases the only thing we know about the median value is that it exceeded NOK 4250. Accordingly, we only investigated the data measured at review levels  $r = 0.5$ ,  $0.7$ ,  $0.9$ ,  $0.95$ . These data were compared with Equation 4, and the unknown parameters were estimated to

$$V = 1620 \text{ NOK}, \quad t = 0.51, \quad (5)$$

with  $R^2 = 0.985$ . See Figure 2 for a plot of the measurements together with the fitted model.



*Figure 2:* Group points of indifference plotted against the review score.

In Figure 2, we see that the group demands lower prices in web shop B as the review score in web shop A increases. When the review score  $r$  in web shop A equals 0.5 we see that the estimated group point of indifference is close to NOK 4250. This means that when the review score  $r=0.5$  and both of the web shops sell the product for NOK 4250, about 50% of the participants prefer web shop A, while the other half prefers web shop B. On the other hand, when the review score  $r$  in web shop A equals 0.9, the estimated group point of indifference is close to NOK 3400. Hence, with this review score, 50 % of the group prefers to spend NOK 4250 in web shop A rather than spending NOK 3400 in web shop B.

### Discussion

We wanted to investigate how probability discounting can contribute to the understanding of the impact of online reviews on consumer choice. To the best of our knowledge this is the first study that adopts a behavioral economics perspective to examine how consumer choice is impacted by online customer reviews. Our results conform to the standard discounted utility model (see Loewenstein & Prelec, 1992) and revealed that variations in reviews with respect to the delivery reliability and customer service had a strong impact on customers' online purchase decision. Furthermore, it confirms results from previous research dealing with effects of online customer reviews (see Chatterjee, 2001; Dellarocas et al., 2007; Liu, 2006; Wei & Lu, 2013). The practical implication of our study was that, in order to buy a product, customers expect lower prices from an online shop without customer reviews, when a competitor online shop's review ratings increased; this again is in line with Ögüta and Taşb's (2012) study, dealing with hotel bookings which highlighted that positive customer reviews can enable a hotel to charge comparatively higher prices than competitor hotels.

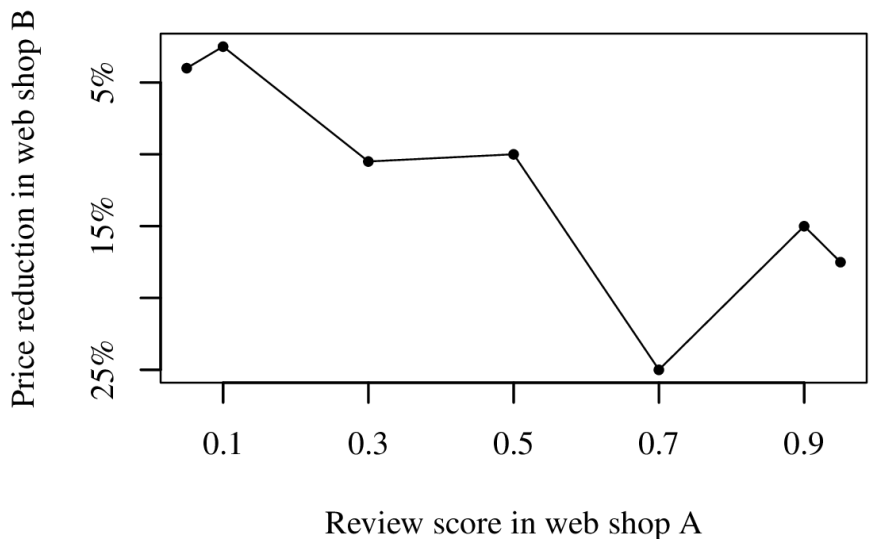
The study that we undertook has an important limitation. Participants were responding to a simulated shopping scenario; this is subject to criticism notwithstanding the fact that reviews of studies on differences in discount rate between real rewards and hypothetical rewards conclude that methods involving hypothetical choices and those involving real consequences usually show qualitatively similar results (Camerer & Hogarth, 1999).

Nonetheless, we have empirically demonstrated the viability of applying behavioral economics to understanding online reviews. Accordingly, findings highlight that a participant's subjective value of the product is discounted from its original amount when the uncertainties of reception (delivery reliability) and customer service of the reward (the tablet) rise. When a

consumer purchases a product the behavior itself can be understood as a resultant of conflicting behaviors (Alhadeff, 1982), with behavior being determined by the possibly different consequences in the specific choice situation. Adopting this rationale, customer reviews become antecedents in a choice situation which modifies the subject value of consequences, thereby influencing consumer choice. The answer to the research question of our study is, therefore, that probability discounting can certainly be used to understand the influence of online reviews on consumer choices; to this end, adopting a behavioral economics standpoint is perfectly feasible.

**Managerial Implications**

What happens when the competitor webshop A receives very positive customer reviews? Our study not only demonstrates that prices in webshop B have to drop to counter this, but also suggests the magnitude of this drop, as depicted in Figure 3. Thus, our results show that for online review scores of 0.7, 0.9 and 0.95, the optimal price reduction is about 15% to 25 %.



*Figure 3:* Price reduction in web shop B for optimization of income at different levels of review score in web shop A.

Our study has therefore shown quantitatively how customer reviews impact pricing in an online setting. However, we note that the results depicted in Figure 3 include some important assumptions: Firstly, Figure 3 ignores the cost structure of the web shop and consequently only targets maximum income; however, this is not equivalent to maximum profit, for which the cost structure has to be factored in. The participant group from which the results of Figure 3 were obtained is also special, in that members were aware of the existence of both shops; in a real world setting, being aware of competitor web sites with better reviews is not always the case. Indeed, if only a handful of web shop B's customer are aware of the better customer reviews of web shop A, the need for web shop B to reduce its prices in order to be profitable might be obviated. Even if web shop B does decrease its prices, in so doing, subsequent sales volume might lead to overall income levels exceeding that of web shop A. From Figure 3 we can see that this is indeed the case even when web shop A has very low review score. We therefore conclude that the most important message that Figure 3 shows is that higher review scores in competitor web shop A entail lower prices in web shop B.

### **Conclusion**

In an online world, it is important that companies fully understand the impact that existing customer reviews have on future customers' intention to buy their products. Towards this end, this paper adopts a behavioral economics perspective, and assumes that positive customer reviews are an indication of successful online transactions. Moreover, in so doing, they function as markers to customer choices. Thus, an online review indicates the probability of a

successful transaction, and, from the definition of probability discounting, alters the subjective value of its consequence.

An empirical study was therefore conducted, whereby participants were presented with two alternatives: to buy from a web shop with customer reviews on product delivery reliability and customer service, and one with no reviews but lower product prices. A titration procedure over sales price for the web shop without customer reviews on reliability was run over seven probability conditions. Mean switching points and probability discounting factors were calculated.

Results highlight how customers tradeoff between certain and uncertain outcomes; thus, a customer's subjective value of a product factors in a proportionally higher discount when any uncertainty associated with the product (in our case, its delivery and customer service) rises. Moreover, the results display a good fit with the standard discounted utility model. The most important practical and managerial implication is that one can compete with a competitor's better online customer reviews by reducing prices; the present study indicates, in the presence of certain important assumptions, that for positive competitor reviews, a price reduction in the region of 25% is called for. The most important assumption in this scenario is that pricing is the only mechanism available to respond to the competitor's better online reviews - the impact that other mediating factors, such as brand or endorsement, might have on customer choices is ignored; all represent valuable avenues for future endeavors.

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