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W-467



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Department of Business Technology

March
2009

HELSINGIN KAUPPAKORKEAKOULU
HELSINKI SCHOOL OF ECONOMICS
WORKING PAPERS
W-467

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ISSN 1235-5674
(Electronic working paper)
ISBN 978-952-488-317-7

Helsinki School of Economics -
HSE Print 2009

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Abstract

The purpose of this study is to estimate the impact of price increases and decreases for three, at least partly, compensatory services. The existence of a reference effect in pricing has been commonly accepted. However, the observations of consumer choices with prices below and above the reference price have produced mixed results with regard to whether the changes in demand are symmetric or not. According to prospect theory price increases represent losses and losses are weighed more heavily than gains. The current study differs from the mainstream in that the object is a service and instead of scanner panel data, stated preferences measured by conjoint analysis are used. The services were different reproduction and delivery types of copyrighted digital material in education. The respondents were a representative sample of teachers. The main outcome of the study was that respondents showed different behavior towards different services. Relatively strong evidence was found to support loss aversion in the traditional service. However, the reactions to the two modern services were mixed: both symmetric and asymmetric behavior was detected.

Key words: pricing, reference price, loss aversion, prospect theory, services

Acknowledgements: We wish to thank The Finnish Copyright Society for letting us use their data. We would also like to thank professors Markku Kallio and Jyrki Wallenius for valuable comments.

1. Introduction

In marketing theory the reference price concept is well accepted; consumers evaluate their choice alternatives' prices not only in absolute values but against a reference price. This information is important especially for pricing strategies. With reference prices the presence of loss aversion is often found. Loss aversion means that a consumer observing a price above his/her reference point (a loss) reacts more strongly to that than a price below the reference point (a gain). The opposite behavior is called gain seeking. Loss aversive and gain seeking behavior represent asymmetric responses to price changes, whereas a symmetric reaction is equal in size for both price increase and decrease from the reference level. Kahneman and Tversky's (1979, 1991) prospect theory included both reference effects and loss aversion as its key constructs and its deterministic analogy has been used in pricing.

Reactions to changes in prices have been extensively studied by statistical models of scanner panel data of frequently purchased grocery products. Numerous studies support loss aversion (e.g., Kalwani, Yim, Rinne & Sugita, 1990; Putler, 1992), though contradictory evidence has also been found (Bell & Lattin, 1993). For example, Mazumdar & Papatla (1995), found some product categories where consumers were more responsive to gains than to losses. Klapper, Ebling & Temme (2005) proposed that consumer characteristics may be used to analyze the extent of loss aversion. Overall, only a limited understanding has been achieved with regard to reactions to price increases and decreases.

We study the effect of price changes from a reference level. The study differs from the mainstream of earlier work in several aspects. The object is a service, not a commonly used everyday low-involvement product. We study three different, at least partly, compensatory services at the same time. Two of the three services are new and do not have a market price. In addition, instead of scanner panel data we are using stated preferences to study the effects of price changes, which allows us to measure the preferences of the same individuals for both price increases and decreases. We use Choice-Based Conjoint Analysis which allows us to estimate value functions on the respondent level and consider the behavior of individuals around the reference price. So far only a few studies with individual choice models have been published and we are not aware of any other research studying reference prices and loss aversion using individual utilities estimated via conjoint analysis.

The service in the focus of this study is a license permitting to reproduce and deliver copyrighted material from Internet by teachers on all educational levels from comprehensive schools to universities. A representative quota sample of Finnish teachers (n= 1146) responded to a choice based conjoint questionnaire, where price was one attribute. The study was carried out in 2005.

Our main focus is to consider how a price increase and decrease, similar in size, affect the relative demand for a service. Are the effects symmetric or not? It is also of interest to know how the different services, of which one is traditional, familiar to all, and the other two more modern, differ from each other. Our main result was that price behavior for the traditional service obeys loss aversion surprisingly well. Loss aversion could, however, be considered as the dominant type of behavior only in that service. With the other two more modern services,

symmetric and mixed results were found, in particular a remarkable extent of gain seeking behavior was detected.

The rest of this paper is organized as follows. In section two the previous literature is discussed. In section three, the methodology, the empirical study and the data are explained. The results are described in section four and the implications of the results in section five.

2. Reference prices and loss aversion in consumer choice

Prospect theory (Tversky & Kahneman, 1979) considers a value function over gains and losses from a reference point (see also Korhonen, Moskowitz & Wallenius, 1990). According to it there is a kink at a reference point in the individual value functions which is at that point asymmetric, steeper for losses than for gains. The study of loss aversion in the pricing context was first suggested by Thaler (1985).

Several studies have examined issues related to reference prices. Most of the research in this area models alternative reference price formulations and tests different effects with calibrated consumer panel data (e.g. Putler, 1992; Hardie, Johnson & Fader, 1993; Bell & Lattin, 2000; Krishnamurthi, Mazumdar & Raj, 1992; Mazumdar & Papatla, 1995). All the studies used frequently purchased grocery products. We are not aware of any other study, besides ours, that would use a service to study choice behavior with reference prices. In addition, our study is rather in the category of b-to-b than traditional consumer behavior.

In general, three kinds of models have been used to study reference prices. The first stream of models aggregating homogeneous data has discovered effects of loss aversion (Kalyanaran & Winer, 1995; Kalwani et al., 1990; Mayhew & Winer, 1992; Putler, 1992; Hardie et al., 1993). The second stream included price response heterogeneity in the model (Bell & Lattin, 1993). Bell and Lattin claimed that “loss aversion may not in fact be a universal phenomenon...”. Other studies that also found heterogeneous price responses include (Krishnamurthi et al., 1992; Mazumdar & Papatla, 1995; Erdem, Mayhew & Sun, 2001; Klapper et al., 2005).

A third modelling stream incorporates price thresholds, i.e. models in which price has no effect within a price interval in reference price formulations (Han, Gupta & Lehmann, 2001; Terui & Dahana, 2006). Terui & Dahana (2006) introduced a model with heterogeneous price thresholds. They also applied the homogeneous and heterogeneous models without price thresholds as well as heterogeneous models with thresholds in their data. They concluded that the model that used homogeneous data showed loss aversion most clearly, the model that incorporated heterogeneity without price thresholds may make the reference price effects disappear. The third model yielded results between the first and second model.

Pauwels, Srinivasan & Franses (2007) concluded that price thresholds do matter in many brands and product categories. In addition, the thresholds may be asymmetric for losses and gains, and brand characteristics influence the threshold location.

Few studies have used other approaches than modelling of scanner panel data to study consumer choice around reference prices. Hankuk & Aggarwal (2003) measured directly the “perceptions of gains and losses”. Some studies have attempted to identify characteristics of consumers or products that could be linked with loss averse or gain seeking behavior (e.g., Mazumdar & Papatla, 1995; Erdem et al., 2001; Klapper et al., 2005). We briefly discuss some observations.

Consumer loyalty and price sensitivity

Krishnamurthi et al. (1992) concluded that loyal customers exhibit symmetric behavior towards losses and gains, whereas non-loyal customers show strong asymmetry. Non-loyal customers are more responsive to gains than to losses. A possible explanation is that the non-loyals are bargain-hunters and more price sensitive than loyal customers.

Product quality and quality consciousness

Klapper et al. (2005) found that non-quality conscious consumers exhibit loss aversion and quality conscious exhibit less loss aversion. Hankuk & Aggarwal’s (2003) experiment on high and low quality-tier products identified that loss aversion occurred only with low quality-tier products. Consumers showed gain seeking behavior towards products that have high quality-tiers.

Promotional level

In the margarine and liquid detergent category, consumers behaved differently in their choices around the reference price. Margarine shoppers were more responsive to gains, whereas liquid detergent shoppers were more responsive to losses. Mazumdar & Papatla (1995) suspect that the reason lies in the differences in promotional levels - the level of promotion is much higher in liquid detergents than in margarine, and consumers may exhibit greater aversion to paying regular prices.

3. The empirical study and the research methods

3.1 The study and the sample

The service under study is a license to reproduce and deliver copyrighted Internet material in education. The three alternative ways/ types of delivery are: 1. printing the material to students, 2. showing the material as part of own presentation in class or 3. loading the material to the school intranet/ sending via e-mail. In the sequel we will call these alternative delivery types service1, service2 and service3. There has been a license available for service1 (called the traditional service) for several years, but not for the other two more modern types of delivery. Teachers are, however, familiar with the modern service types, as they may distribute e.g. their own digital material through these channels. It should be noted that intranets were relatively well developed at the time of the survey only on the highest educational levels.

Teachers currently use rather extensively material from the Internet. In 2005, of material used by a teacher, the share of Internet-based material was 22 percent on average in the primary and secondary schools and 30 percent in the universities (Ministry of Education, 2006). Primary and secondary school teachers copy and save digital material to be delivered to students on an average 0,7 times per year (2003) and university teachers 2,5 times a year (2004) (Finnish copyright organization, personal communication).

A representative quota sample of teachers was prepared (the sample is characterized in Appendix 1). The teachers were from primary/ secondary schools, colleges, higher vocational schools and universities. Altogether 1146 teachers participated in the study with the response rate being 33 percent. Each teacher was presented with 15 choice tasks. Each choice task included three profiles. The respondent indicated each time the most preferred one among the profiles shown (see an example of a question in Appendix 2). The profiles included three attributes (their alternative values are presented in Appendix 3). The attribute values, the preference of which was measured in the study, were selected on the basis of teacher interviews. In the web based questionnaire it was pointed out that no attention should be paid to the fact that some of the services were not yet available.

The teachers do not pay themselves for the reproduction. In the study, they were asked to consider the prices presented from the point of view what they considered fair. Teachers are conscious of scarce funds which can also be seen in the estimated preferences.

A different reference price was set to each service and for each service two alternative price levels were defined, which were 50 % above and below the reference price. The prices were set in “euros per student per year” for historical reasons. For printing the reference price was 4 euros per student (approximately the current price) per year. The reference prices for the remaining service types were chosen to reflect the “harm” the use of the material causes to its right holder. Excluding the delivery by service1, the reproduction of digital material maintains the high quality of the original and the distribution on a large scale is easy. The reference price of service1 was multiplied by 1.5 and 2.5 to produce the reference prices for service2 and service3. Similar multipliers are used in pricing, e.g., in Denmark.

The price increments ± 50 per cent were chosen to assure a large enough change to affect the demand and to be beyond the price thresholds. An additional level for price would have made the questionnaire too exhausting.

3.2 Choice based conjoint analysis

Conjoint analysis (CA) is based on multi-attribute utility theory, according to which products/services are composed of multiple attributes that contribute to consumers' satisfaction. The total utility of a product/service profile is a function of its attribute values. Utility functions measure perceived value and consist of the deterministic part called the value function (total value V) and the random error term ε .

$$U = V + \varepsilon \quad (1)$$

Choice based conjoint analysis (CBC) can use the simple additive value function, which, with P attributes a_1, a_2, \dots, a_P is

$$\text{total value } V = v_1(a_1) + v_2(a_2) + \dots + v_P(a_P) \quad (2)$$

where v_1, v_2, \dots, v_P are value functions for the attributes.

A more general value function takes into account attribute interactions. Assume that one 2-way interaction term of attributes i and j $i \neq j$, is included. Then the total value V becomes

$$V = v_1(a_1) + v_2(a_2) + \dots + v_P(a_P) + v_{P+1}(a_i, a_j), \quad (3)$$

where v_{P+1} is a value function of two attributes.

The choice model that CBC uses is multinomial logit. The error terms are assumed to be independent and identically Gumbel distributed (Bierlaire, 1997). When K profiles with the corresponding total values V^1, V^2, \dots, V^K are offered for evaluation, then using suitable scaling of V , the probability that the k^{th} profile ($k = 1, \dots, K$) is chosen is

$$\exp(V^k)/[\exp(V^1)+\exp(V^2)+\dots+\exp(V^K)] \quad (4)$$

The relative demand can be simulated using, e.g., (4) as the choice rule. (Orme, 2006, p. 139). Kallio and Halme (2009) have developed general conditions for a respondent to be loss averse/gain seeking, when the additive utility function and multinomial logit choice model are employed. In their formulation the market share of a product/brand under consideration plays a central role. The general results are independent of prospect theory.

The individual value functions were estimated using Hierarchical Bayes estimation (Lenk, Desarbo, Green & Young, 1996). This is a standard estimation method when individual utilities are required. Its measure of fit, root likelihood (rlh), is the geometric mean of the probabilities that the estimated utilities predict the correct concept choices. It can be compared with the uniform choice probability which is, in the case of K alternatives in each choice task, $1/K$.

The value of the Hierarchical Bayes model “lies in its ability to characterize heterogeneity in preferences while retaining its ability to study specific individuals” (Rossi & Allenby, 2005). They also point out that there exists substantial uncertainty in the part worths of a specific respondent, since they are not precisely estimated.

4. Results

How the changed prices affect demand in the different services is described next. We assume that in each choice situation the three services are in the set of alternatives, with two services on the reference price level and the price for one service is changed at a time. The results are based on the calibrated value functions of individual respondents.

The estimation was carried out with HB/CBC 3.2 (Sawtooth Software). The rlh was 0.65 with unconstrained estimation of the utilities and slightly lower, 0.63 when the price levels of each respondent were constrained to have the natural signs with price increases and decreases. The interaction effect between delivery type and price was significant in the aggregate model (chi-square test, $p < 0.001$).

The relative demand for each service was next calculated with the reference price as well as the increased and decreased price. As stated, in each calculation the market consists of the three services. When the price of one service is changed, the rest of the services remain on the reference price level. The logit rule (4) is used to calculate for each respondent the probability to choose each service profile among the profiles offered. This probability also represents the expected value of the profile's relative demand in a repeated simulation, when the market alternatives are the profiles offered. In the base case the market consists of the three services all on their reference price level. In Table 1 the relative demand for each service is presented with three different prices.

Table 1. Average relative demand (%) represented by average choice probabilities (standard deviation) across respondents. The demand for each service is calculated with the reference, increased and decreased price while the remaining services have the reference price. (n = 1146).

<i>Service</i>	<i>Reference price (base case)</i>	<i>Price + 50 %</i>	<i>Price – 50 %</i>
Service1	49.5 (1.3)	38.2 (1.3)	52.9 (1.3)
Service2	34.6 (1.4)	24.8 (1.2)	46.2 (1.4)
Service3	15.9 (1.0)	11.8 (0.9)	23.7 (1.2)

When service1 takes the increased price, while the remaining alternatives are on the reference level, its relative demand is 38.2 %. Compared with the base case the demand has fallen by 22,8 % . With its decreased price the relative demand is 52.9 % with a increase from the base case by 6.9 %. In this case, the fall of the demand in absolute terms is greater than the corresponding rise. The results for service1 support prospect theory but the other two do not. Especially in service3, on average, a decrease in price causes a considerably greater effect on the demand than the increase in price. Note that Table 1 could be used to calculate price elasticities of demand – the most and least traditional services represent the extremes in behavior in such a way that service1 is the most rigid and service3 the most flexible.

Next consider the individual value functions in order to study whether or not a relative increase in price has an effect, similar in size, on the demand as a similar sized relative decrease in price. Denote the set of alternative services on the market by $A = \{\text{service1, service2, service3}\}$.

Denote the set of respondents by N . For respondent $i \in N$, $N = \{1, \dots, n\}$, the probability of choosing $j \in A$ is

$$P_{ji}^U \text{ when } j \text{ has the raised price and the prices of alternatives } j' \neq j \text{ are unchanged}$$

P_{ji}^D when j has the decreased price and the prices of alternatives $j' \neq j$ are unchanged

P_{ji}^R when j has the reference price and the prices of alternatives in $j' \neq j$ are unchanged.

Consider for $i \in N, j \in A$ the following variables

$$\Delta P_{ji} = (P_{ji}^D - P_{ji}^R) - (P_{ji}^R - P_{ji}^U) \quad (5)$$

If $\Delta P_{ji} > 0$ then the price decrease effect is greater than the price increase effect (in absolute terms).

Next test for all $j \in A$ if the average of ΔP_{ji} , where

$$\Delta P_j = 1/n \sum_{i \in N} \Delta P_{ji}, \quad (6)$$

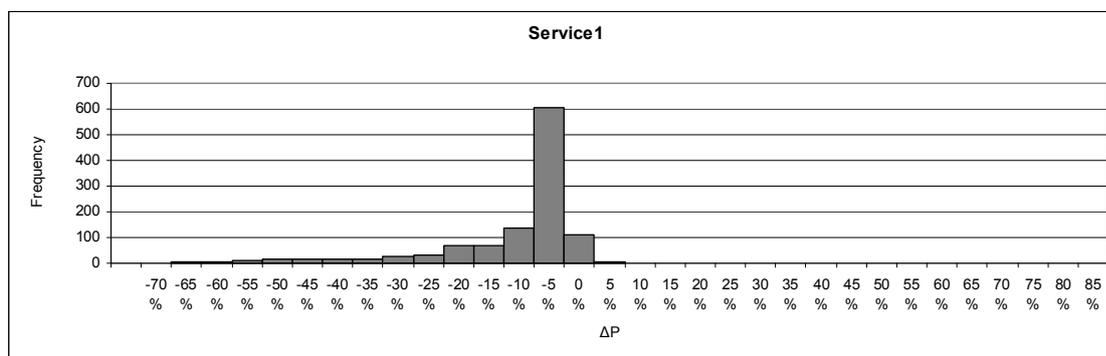
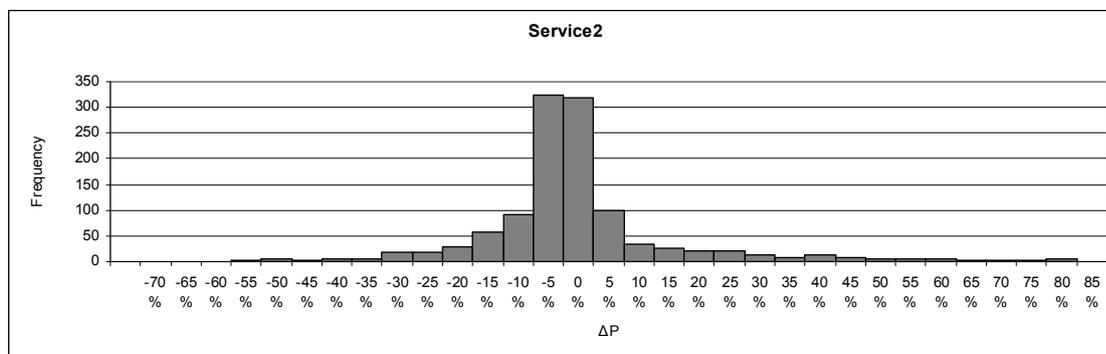
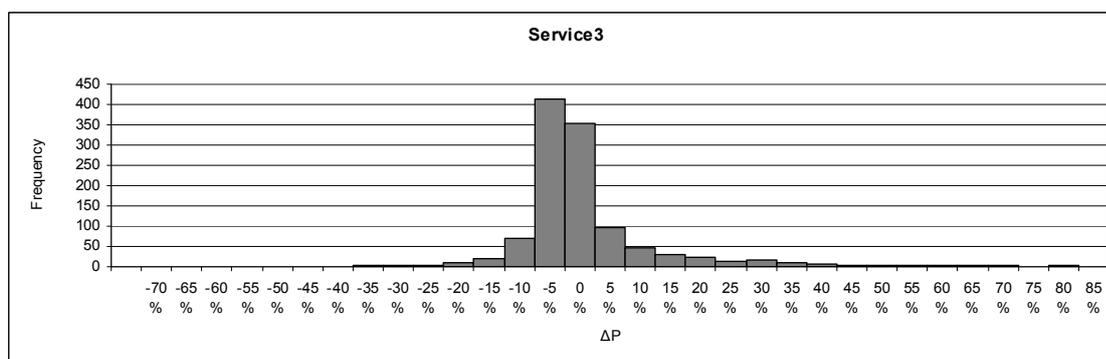
are zero. The sample averages (standard deviations) and medians are presented in Table 2.

Table 2. Sample averages (standard deviations) $\Delta P_{j, j \in A}$ and medians of $\Delta P_{ji}, i \in N$ (n=1146).

<i>Service</i>	$\Delta P_{service} \%$	<i>Median %</i>
Service1	-7.9 (1.1)	-2.6
Service2	1.8 (1.3)	0.2
Service3	3.7 (1.0)	0.1

According to t-test, the average in Service1 is zero, whereas the averages of Service2 and Service3 are non-zero with $p < 0.0001$. The most prominent feature of the results is that only the traditional service has strong indication of loss aversive behavior. Loss aversion can in fact be detected with few exceptions in the data: 10 per cent of the individual ΔP values for service1 are greater than zero and 4 per cent exceed 1 %. The behavior towards price changes in the two other services not yet on the market calls for more detailed considerations.

In Figure 1 a)-c) the distributions of $\Delta P_{ji}, i \in N, j \in A$ are presented.

Figure 1a. Distribution of ΔP_{ji} , $i \in N$, $j = \text{service1}$.Figure 1b. Distribution of ΔP_{ji} , $i \in N$, $j = \text{service2}$.Figure 1c. Distribution of ΔP_{ji} , $i \in N$, $j = \text{service3}$.

The distributions b)-c) suggest that all versions of price behavior can be found; symmetric as well as gain seeking and loss averse.

For each $j \in A$, ΔP_{ji} were regressed on the available descriptors: age, relative shares of material used and educational level. The coefficients of determination of the models were low, between 0.6 % and 2.5 %. With service2 and service3 we, however, identified significantly differing coefficients for most of the education levels.

In an attempt to identify groups with lower heterogeneity than in the entire data we have produced Table 3 with the data decomposed into four education levels, as suggested by the regression results. As noted, the volume of their current use of digital material as well as familiarity with the more modern services were not equal at the time of the study. In particular the lowest and highest education levels were extreme also in their level of adoption of the new technologies.

Table 3. Sample means of ΔP_{ji} , $j \in A$, $i \in N$ (standard deviations) and medians across four education levels (per cent).

	<i>Level 1 (n=451)</i>		<i>Level 2 (n=248)</i>		<i>Level 3 (n=221)</i>		<i>Level 4 (n=221)</i>	
	$\Delta P_{service}$	median						
Service1	-7.9 (1.6)	-2.8	-7.2(2.2)	-2.4	-8.8(2.2)	-2.1	-7.5(2.1)	-3.0
Service2	-0.4 (1.9)	-1.0	3.8 (2.5)	0.4	1.8 (2.6)	0.8	4.3 (2.5)	1.2
Service3	4.4 (1.4)	1.0	0.5 (2.1)	1.1	6.0 (2.2)	-0.7	3.0 (2.0)	-1.2

Loss aversive behavior is dominant in the traditional service1 on all education levels. Its averages in Table 3 differ from zero with $p = 0.0001$ on all education levels (t-test). On each education level the other two services show symmetric, loss aversive as well as gain seeking behavior. They differ mostly with respect to the extent of gain seeking behavior. It is interesting to note that more gain seeking than loss avers behavior can be detected.

Several versions of the probability calculations were carried out to test the sensitivity of the results, such as modifications in the value function estimation and the choice rule. The results were robust to changes.

The two modern services have no valid price as no such license was available so far. Their reference prices were set 1.5 and 2.5 times greater than the reference price for the traditional service1. It may well be that the reference prices were considered high and compared with the reference price of service1. It is difficult to say how much the respondents realized the opportunities opened by the new technologies, especially intranet and e-mail distribution (service3), as it was not as easily available for them to use as the old technology.

The modern services may also be considered as new technology and of high quality compared with the traditional techniques. Hankuk and Aggraval (2005) stated that the quality may affect the attitude towards price increases and decreases. However, in this study most of the respondents preferred the traditional technique to the more modern and higher-quality ones.

At least two important factors can be seen in the background when assessing the observed reactions to the different prices of modern service2 and service3: that they are not as easily available as the old technology and their considerably higher reference price. The only existing price was the reference price of service1 (4 €/ student per year) which could be considered as a benchmark. The lowest prices of service2 and service3 considered (3 € for service 2 and 5 € for service3) approach that benchmark price. This could explain the gain seeking behavior observed

among a subset of respondents; the fact that for both service2 and service3, on average, a decrease in price seemed to matter more than an increase.

Above we considered some reasons for different changes in perceived value, when prices change from the reference level. It is not, however, adequate to solely discuss the utility changes. As stated earlier, general conditions for loss averse or gain seeking behavior have been developed (Kallio & Halme, 2009). Even if for some $j \in A$, $i \in N$ an increase ($x\%$) in price from the reference level causes a smaller change in perceived utility than a corresponding decrease ($-x\%$) it may turn out that $\Delta P_{ji} = (P_{ji}^D - P_{ji}^R) - (P_{ji}^R - P_{ji}^U) < 0$ meaning that respondent i is loss averse. This may occur, if the probability of the respondent to choose j with the prevailing price is high, exceeds 0.5. Symmetrically, even if the value gain originating from a price decrease is smaller than the loss, it may happen that the respondent is gain seeking if the probability to choose j is below 0.5. We see that among products that have high probabilities to be chosen more loss aversion is expected than among products with low choice probabilities. This was validated in our study, where with the traditional product with the highest average choice probability almost entirely loss aversive behavior was detected. It should, however, be noted that market shares below 0.5 are obviously much more frequent than market shares exceeding 0.5. This is why more attention should perhaps be devoted to study gain seeking behavior.

5. Conclusions

Choice behavior around the reference price for a b-to-b service was studied. The data was stated preferences, originating from a choice based conjoint study where individual value functions were estimated. We could find clear differences in the price behavior of a traditional service compared with the more modern services. The main outcome of the study was that strong evidence of loss aversion in the traditional service was found, whereas versatile reactions to the changing prices in the modern services were detected. Specifically, with the more modern services a remarkable number of respondents could be diagnosed as gain seeking.

The reference price studies so far have concerned low-involvement consumer products. We expect that they expand to other product categories and also to b-to-b choices. The progress in estimation techniques has made it possible to reliably estimate also the individual (with scanner data the household specific) models (e.g., Klapper et al., 2005, and Terui & Dahana, 2006), as was done in the current study, and try and relate special kind of price behavior e.g. to some socio-demographic descriptors.

The new technology evaluated in the study is today more familiar to the respondents and their user skills more developed than in 2005. That would suggest a re-measurement of the price reactions of service2 and service3. Would their ΔP distributions show more loss aversive behavior compared with the situation in 2005?

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Appendix 1

Sample description.

<i>Educational Level</i>	<i>n</i>	<i>Age (mean)</i>	<i>Use of AV material (%)</i>	<i>Use of printed material (%)</i>	<i>Use of commercial Internet (%)</i>	<i>Use of free Internet (%)</i>
Primary and secondary schools	451	43.7	20.8	57.9	1.9	19.4
Colleges	248	46.0	14.8	56.8	2.3	26.1
Higher vocational schools	221	46.5	10.9	57.7	4.3	27.1
Universities	221	41.3	7.7	62.2	7.4	22.7
All	1146	44.3	15.0	58.5	3.5	23.0

Appendix 2

An example of a choice task.

You have at your disposal free Internet services. You wish to distribute the content to your students to supplement your teaching. .

Choose the alternative best suited for you by clicking the ball in the lower part of the card.

<p>Website: Communication material of companies and public administration</p> <p>Usage: Scanning into Power Point</p> <p>Price: 9 euros per year/student (above normal)</p> <input type="radio"/>	<p>Website: Scientific material</p> <p>Usage: Copying and delivery in Intranet</p> <p>Price: 5 euros per year/student (below normal)</p> <input type="radio"/>	<p>Website: Educational material of educational institutions</p> <p>Usage: Printing for students</p> <p>Price: 4 euros per year/student (normal)</p> <input type="radio"/>
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Appendix 3

The alternative values of the attributes employed.

Type of Internet material	
<ol style="list-style-type: none"> 1. publishers' open educational material websites 2. educational material by educational institutions 3. news; e.g. articles and websites 4. scientific material from universities and research institutes 5. pictures; photographs, drawings, maps 6. communications of companies and public administration; instructions, product and service information 	
Type of reproduction	
<ol style="list-style-type: none"> 1. printing/copying to students 2. copying into own presentation, e.g. Power Point 3. delivery to students in school Intranet or email 	
Price, price was dependent on type of usage	
printing/copying to students	<ol style="list-style-type: none"> 1. normal 2. normal increased by 50 % 3. normal decreased by 50 %.
copying into own presentation, e.g. Power Point	<ol style="list-style-type: none"> 1. normal 2. normal increased by 50 % 3. normal decreased by 50 %.
delivery to students in school Intranet or email	<ol style="list-style-type: none"> 1. normal 2. normal increased by 50 % 3. normal decreased by 50 %.