Adaptive Conjoint Analysis for Pricing Music Downloads

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Abstract. Finding the right pricing for music downloads is of ample importance to the recording industry and music download service providers. For the recently introduced music downloads, reference prices are still developing and to find a revenue maximizing pricing scheme is a challenging task. The most commonly used approach is to employ linear pricing (e.g., iTunes, musicload). Lately, subscription models have emerged, offering their customers unlimited access to streaming music for a monthly fee (e.g., Napster, RealNetworks). However, other pricing strategies could also be used, such as quantity rebates starting at certain download volumes.

Research has been done in this field and Buxmann et al. (2005) have shown that price cuts can improve revenue. In this paper we apply different approaches to estimate consumer's willingness to pay (WTP) for music downloads and compare our findings with the pricing strategies currently used in the market.

To make informed decisions about pricing, knowledge about the consumer's WTP is essential. Three approaches based on adaptive conjoint analysis to estimate the WTP for bundles of music downloads are compared. Two of the approaches are based on a status-quo product (at market price and alternatively at an individually self-stated price), the third approach uses a linear model assuming a fixed utility per title. All three methods seem to be robust and deliver reasonable estimations of the respondent's WTPs. However, all but the linear model need an externally set price for the status-quo product which can introduce a bias.

1 Introduction

Download services for digital music have gained popularity over the last years, most notably Apple's successful iTunes music download store. Single track downloads have doubled and grown to 353 million in 2005, and CD sales are gradually substituted by music downloads (IFPI, 2006). For music download services, pricing schemes for individual songs and especially for bundles of songs are still developing. Currently, most online services employ linear pricing

Table 1. Attributes and levels used in the conjoint analysis.

Package	Distribution channel	Sound quality	Booklet	Price
✓ 1 title	✓Record store	✓Radio	✓No booklet	✓ 1 €
✓ 3 titles	✓Mail	(64 kbs)	✓Booklet	✓ 5 €
✓ 6 titles	✓Download	✓CD		✓10 €
✓12 titles		(128+ kbs)		✓15 €
				✓20 €

and the prices in Europe vary between 0.99 € and 1.49 € per title. Finding optimal prices which maximize revenue is of great interest to practitioners and to researchers. A survey in the U.S. market by Jupiter Research (2003) concludes that at \$0.99 a market reach of 74% is achieved. However, the margins for music download service providers are very small (Jupiter Research, 2006). About 3% of \$0.99 go to the service providers. The rest goes to the recording industry (47%), the credit card companies (25,3%), the collecting societies (12,1%), the artists (8,3%), and network carriers (4%).

Researchers have tried to estimate consumer's WTP to improve the pricing schemes for music downloads. For example Buxmann et al. (2005) use self-stated WTP to estimate demand curves for online music in Germany with the conclusion that special prices and rebates could improve sales. Bamert et al. (2005) conducted a conjoint study for pricing online music in the Swiss market with the result that price is the most important attribute and usage restrictions (digital rights management), offered range of titles, and method of payment are less important. Using a direct survey, the authors also found out that at a price of 0.99 Swiss Francs (0.32 €) 16 songs can be sold to the average user.

In this paper we discuss three approaches based on adaptive conjoint analysis for pricing music downloads. After we present the design of the study, we compare the results of the three approaches with the current pricing practices in the market.

2 Setup of the Conjoint Interview

The interview was performed as a supervised adaptive conjoint analysis (ACA, cf. Green et al., 1991, and Johnson, 1991) using non-price attributes that discriminate between buying music in conventional record stores and downloading music bought online to estimate respondents' utility structures and responsiveness to price changes. The interview was carried out among students of the Vienna University of Business Administration and Economics in spring 2005. In this paper the results for a sample of 99 respondents are reported.

The design of the conjoint study is shown in Table 1. The levels of the attributes "Sound quality," "Price" and "Package" have a natural ordering

Table 2. Time since the participants bought their last CD.

Months	1	3	6	12	13+
Participants	10	23	11	15	40

(e.g., more songs are better) and thus do not need to be ranked by the re-spondents. The order of the levels of the attributes "Distribution channel" and "Booklet" do not have such a clear ordering and thus were elicited in a ranking task. After completion of the ranking scene the respondents rated the attributes in an importance scene. Finally, the respondents were presented a series of paired comparison scenes following the ACA procedure.

All interview scenes were explained to the respondents before the start of the interview, and a supervisor was present during the interview, in case of comprehension problems.

3 Results of the Interviews

After the conjoint interview some socio-demographic information about the participants was elicited. 60 of the 99 participants were female. The average age was 23.72 years with a standard deviation of 2.65 years. As their preferred audio system 47 students mentioned their CD player and 52 already preferred to use their personal computer. Most of the participants (69) had access to a broad band internet connection while 25 used a modem to dial-in. 5 did not have access to the internet at home.

The participants were also asked about their music shopping behavior. Table 2 summarizes when the participants last bought a CD in a store. The data shows that the majority (55 participants) did not buy a CD within the last 6 months. However, 24 participants stated that they use file-sharing services often to obtain music and another 47 stated that they use such services oc-casionally. This illustrates the importance that music distributed via internet already has reached.

We checked whether significant relationships between the variables exist and found out that female participants prefer using a CD player while the male participants prefer to play their music with a personal computer. There is also a significant relationship between using personal computers for playback and using file-sharing tools. However, the use of file-sharing tools in the sample is not gender specific.

Table 3 compares the importance of the attributes calculated from the results of the conjoint analysis. The attribute booklet has by far the lowest importance across all respondents. In the decision making process the at-tributes price and package (number of songs) have the highest contribution to the valuation of product offerings. Measured in terms of conjoint utilities, price and package are around four times more important than the booklet.

Table 3. Importance of Attributes.

	Minimum	Median	Maximum
Price	1.727	4.670	7.772
Package	1.378	4.592	7.235
Sound quality	0.054	2.036	5.020
Distribution	0.083	1.986	5.144
Booklet	0.070	1.163	4.760

The attributes sound quality and distribution channel have a higher importance than booklet, but compared to price and package they are still relatively low.

Measuring quantitative attribute levels with conjoint analysis can sometimes result in reversals (cf. Orme, 2002). If all attributes stay the same and only the attribute package is changed, the utility should increase monotonically with the number of titles contained in the package. The same holds for the attribute price. However, in real survey data this is not always the case. Even though the attributes package and price were pre-ordered when the conjoint analysis was initialized, reversals for package were observed for 36 respondents and for 51 respondents for price. The part-worth utilities with and without reversals are shown in Figure 1. In the plots to the right it can be seen that most reversals represent minor fluctuations which can be attributed to measurement and estimation errors. Major reversals seem to be the result of non-cooperative respondents (e.g., random choices to finish the interview faster). Such respondents need to be removed from the dataset.

For the price attribute practitioners suggest to only use few price points and to apply linear interpolation heuristics in order to avoid reversals in the data (Orme, 2002). We estimated an exchange rate between utility and price by fitting a linear model to the estimated utility scores and the price levels (cf. Kohli and Mahajan, 1991, and Jedidi and Zhang, 2003). For eight respondents the reversals are so strong that the estimated exchange rate is negative, which means that the respondents would be willing to pay more money for less utility. Since this is not plausible, these eight respondents were removed from the dataset. In the remaining dataset the linear models fit the data well (mean R-squared value of 0.87 across the respondents).

4 Estimation of Willingness-to-Pay

Three different approaches were used to estimate the respondents WTPs. The first approach is the classical approach with a fixed status-quo product (cf. Kohli and Mahajan, 1991). As fixed status-quo product usually a typical product is used for which the market price is known. The price of the other product configurations in the conjoint study is calculated by translating the utility differences to the status-quo product into a price difference using the

(a) Title (no reversals)   (b) Title (reversals)

(c) Price (no reversals)   (d) Price (reversals)

Fig. 1. Part-worth utilities for title and price without and with reversals.

utility-price exchange rate. If the respondents are willing to pay the price for the status-quo product, they are also willing to pay the estimated prices for the other products. For our calculations a price of 0.99 € for the download of one song was used, because this is the price that is currently charged by most download services in Europe. Based on this price the WTPs for the different packages 3, 6, and 12 titles were estimated.

As a second approach an individual, self-stated WTP for the status-quo product was used for each respondent to calculate the WTPs for the other package sizes. The self-stated WTPs were elicited from the respondents at the end of the conjoint interview by directly asking them to state a price they were willing to pay for the download of one song. Three users were removed from the dataset because they stated an unreasonably high WTP of over 5 € for a single title.

For the third approach a linear model was applied to the estimated part-worth utilities to calculate the marginal utility for an additional title. In our

(a) Status-quo product (fixed price) (b) Status quo product (self-stated price)

(c) Linear model

(d) Comparison of average WTPs

Fig. 2. Estimations of WTPs based on different estimation approaches.

dataset (see Figure 1) a linear model for the range between 1 and 12 titles seems to be a reasonable simplification. The models' mean R-squared value is 0.80 across the respondents. Using the marginal utility and the exchange rate between utility and price the corresponding monetary equivalent which represents an estimate of the respondent's WTP per title can be calculated.

$$WTP \ per \ title = exchange \ rate \ \frac{price}{utility} \cdot marginal \ utility \ \frac{utility}{title} \qquad (1)$$

With this procedure a status-quo product is not needed. A similar approach was used for quantitative attributes by Jedidi and Zhang (2003).

The results of the different approaches are plotted in Figure 2. To give a reference, we indicate the price range of 0.99 € to 1.49 € which is currently used by the market leaders in each plot by two solid lines. Figures 2(a) and (b) show boxplots of the WTPs based on a status-quo product ((a) priced at 0.99 € and (b) using the individually self-stated WTP). Since both models are

Table 4. Average estimated WTPs in € by method (*values not estimated).

	1 title	3 titles	6 titles	12 titles
Status-quo product (fixed price)	0.99*	6.96	13.20	19.69
Status quo product (self-stated price)	2.39*	8.36	14.60	21.09
Linear model	1.84	5.53	11.06	22.12

based on the same utility structure, both plots look similar. Only the off-set price for one song is different with an on average higher self-stated price. In the two plots the decreasing marginal price for additional songs is clearly visible. At 12 titles already a part of the interquartile range (represented by the box) is below the upper market price line indicating that many respondents are not willing to pay 1.49 € per song for 12 or more songs.

Figure 2(c) shows the estimates based on the linear model. In the linear model the marginal price for one song is fixed which would mean that a person willing to pay the market price for the first song, would buy all available songs. This is obviously not possible. However, for a small number of songs (≤ 12) the linear model provides a useful approximation. The big advantage of the linear model is that it allows us to estimate the price for one song without using a status-quo product.

In Figure 2(d) the average WTPs of the different approaches are compared. The average estimated WTPs are given in Table 4. The prices for one song for the methods using status-quo products are not estimated but are the market price or self-stated. Only with the linear model the WTPs for one song can be calculated for each respondent. The average of 1.84 € seems a reasonable result with a value between the market price and the self-stated prices.

The results of the three approaches can be used together with the linear pricing scheme of 0.99 € per title currently used in the market. Based on the estimations with a fixed status quo product 72 respondents would be willing to pay the market price for the download of three songs (2.97 €), 58 would be willing to buy 6 songs (5.94 €), and 18 would be willing to buy 12 songs (11.88 €). When the self-stated status quo product is used for each respondent, more songs could be sold given the linear pricing scheme used in the market. 73 respondents would accept the price for 3 songs, 66 the price for 6 songs, and 18 the price for 12 songs. With the linear model a single WTP is estimated for the download of one song. Using this estimation 75 respondents would be willing to pay 0.99 € for the download of a title.

5 Conclusion

We investigated the valuation of music downloads and purchasing a music CD at a record store with adaptive conjoint analysis for a group of students. Practitioners believe that consumers generally value a CD notably higher than the download of music (IFPI, 2006). However, this seems not to be true for

the participants of our interview. Our investigation showed that the main differentiators booklet and distribution are only of little importance to the interviewed students. Our data also shows that the marginal WTPs per title decreases with larger package sizes. Therefore linear pricing strategies as found in the market seem not to be optimal to maximize profits.

We compared three approaches to estimate the willingness-to-pay from conjoint data. Two approaches use externally obtained prices for a status-quo product. Obtaining these prices can introduce a bias (e.g., not all customers buy the status-quo product at the market price). The third approach uses a linear approximation to compute a fixed utility per title which eliminates the need for an external price. However, the linear model cannot represent the fact that for a given customer the marginal utility of additional songs decreases (e.g., after the most favorite songs have been purchased).

An idea for future research is to use the linear model with the data for package sizes 1 to 6 where the linear approximation yields a good estimate for the WTPs of one song. These WTPs could then be used as the price for the status-quo product to offset the WTPs for larger package sizes. This combination would eliminate the need of an external price and at the same time reflect the decreasing marginal utility of buying additional songs.

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