COOPERATIVE PRICING IN DIGITAL VALUE CHAINS – THE CASE OF ONLINE MUSIC

Peter Buxmann
Information Systems Department, Darmstadt University of Technology
buxmann@is.tu-darmstadt.de

Jochen Strube
Information Systems Department, Darmstadt University of Technology
strube@is.tu-darmstadt.de

Gerrit Pohl
Information Systems Department, Darmstadt University of Technology
pohl@is.tu-darmstadt.de

ABSTRACT

In this paper we examine alternative pricing models for digital music from the perspective of the entire music value chain. By analyzing empirical data on the willingness to pay, we show that the turnover from music downloads could be increased by lower prices. However, such a low price strategy can only be realized if the actors of the value chain, i.e. artists, labels, collecting societies, service providers, and online shops act as cooperation partners. We develop a model to find profit-maximizing prices and show how to split up the resulting increasing revenues between the partners of the value chain to assure Pareto-efficient solutions.

Keywords: Digital goods, digital value chain, cooperation, online music, empirical study.

1. Introduction

Even though the growth rates of online music services are remarkable we can observe an ongoing debate whether current prices are appropriate [CNN 2005; Menta 2005]. The record labels agreed to Apple iTunes' 99 Cent model three years ago. When negotiating the renewing of the contracts, some labels were pushing for higher prices. However, analysts expect that consumers would not accept such an increase of prices [Veiga 2006]. Apple's CEO Steve Jobs even characterized the respective labels as greedy [LeClaire 2006].

Against this background we explore whether low-price strategies might be a promising approach for digital music vendors. The main focus of our paper, however, is to show that an isolated analysis of pricing strategies from the perspective of a digital music retailer such as iTunes is not sufficient. In contrast, our approach suggests the need for cooperation among the actors involved in the music value chain, i.e. musicians, labels, distributors, collecting societies as well as network and financial service providers. We show that a cooperative pricing strategy can be profit-maximizing for the entire music value chain. Our approach is model-based, required data is obtained from an empirical survey.

In section 2 we give an overview about related work, i.e. pricing of digital goods on the one hand and basic principles of digital value chain management on the other hand.

In section 3 we use empirical data on the willingness to pay for online music to estimate a sales function using a non-linear regression analysis. This sales function serves as a basis to determine which price optimizes the turnover of digital music retailers. The results suggest a clear price cut.

Section 4 shows that cooperation is prerequisite for such a price cut because the decisions of the players involved in the music value chain are interdependent. For example, it is obviously not reasonable for a distributor to set prices below the licence fee the distributor has to pay to the labels. Therefore, we develop a model which supports the determination of profit-maximizing prices from the perspective of the entire value chain. Moreover, we examine alternatives to split up the profit between the value chain partners. The empirical data serves as input parameters for the model.

The paper closes with a summary and an outlook on further research.

2. Related Work

Digital Goods are characterized by a specific cost structure. The production of the first copy, e. g. the writing and recording of a song or the development of software, usually leads to high costs. However, once the first copy is produced, the replication costs can be neglected [Shy 2002, p. 182].

This cost structure has an impact on pricing. While cost-oriented pricing is not reasonable in this context, the low marginal costs of digital goods enable a great variety of demand-oriented pricing strategies [Varian 2004, p.12]. In particular, research has revealed a lot of insight into the opportunities of price discrimination [Ulph and Vulkan 2000; Aron et al. 2005; Choudhary et al. 2005], versioning [Bhargava and Choudhary 2001; Jing 2002, Sundarajan 2003 and 2004; Alvisi et al. 2003], price bundling [Bakos and Brynjolfsson 1999 and 2000; Altinkemer and Bandyopadhyay 2000; Vekantesh and Chatterjee 2006; Olderog and Skiera 2000] as well as fixed-fee pricing [Fishburn, Odlyzko and Siders 2000; Sundarajan 2003].

The meaning of an appropriate pricing strategy for online music vendors is emphasized by a survey of Bamert et al. [2005]. Based upon a conjoint study in the Swiss market they showed that price is the most important attribute for consumers while usage restrictions (Digital Rights Management), offered range of titles, and methods of payment are less important. Gallaway and Kinnear [2001] surveyed 996 students to examine the options of “intertemporal price discrimination”. In a survey with 99 students Breidert and Hahsler [2006] applied an adaptive conjoint analysis to measure the willingness to pay for different versions of music downloads and different bundle sizes of music titles.

However, these works have in common that they examine pricing strategies only from the perspective of a single vendor. In contrast, we can often observe that more than one institution is involved in producing and delivering goods to the customer. In the context of pricing this phenomenon has been examined by Voeth and Herbst [2006]. They argue that pricing could be used as a joint tool for outcome optimization of overall supply chain processes. While Voeth and Herbst apply this concept to industrial markets, we pursue a similar approach and apply pricing as a measure to optimize the profits in the digital music industry.

Thereby, we follow the idea that analogous to traditional supply chain management in the music industry different players are involved in producing and distributing digital music. The artists and/or producers create intellectual property, the intellectual property rights are monitored among others by collecting societies. The labels define products such as single or album downloads which are distributed via digital music retailers. Infrastructure and Service Providers support the delivery to the customer and the payment process.

The central idea of supply chain management is that the participants of a supply chain consider themselves as partners working together to achieve common goals [Martín Díaz 2006]. In this context the Bullwhip effect is a well-known example to show that cooperation among partners in a supply chain is useful and profitable [Chen et al. 2000; Thonemann 2002].

In the following we transfer the basic idea of cooperation from traditional supply chain management to the digital music value chain [Clemons and Lang 2003]. In particular, we show that cooperation among the involved partners is an essential prerequisite for applying a profit-maximizing price strategy.

3. Estimating optimal Prices on the basis of an empirical survey

In this section we estimate the profit-maximizing price for online music using the results from an empirical survey. First, we give an overview about our survey and the sample. Second, we derive the profit-maximizing prices from the perspective of online music vendors. Third, it is shown that it is not sufficient to analyze the willingness to pay from the isolated perspective of a music online store. Rather, it is essential to consider the entire digital music value chain.

3.1. Description of Survey and Sample

The major goal of our explorative survey was to gather information about the willingness to pay of consumers on the one hand and about their general perceptions of the online music market on the other hand. In this paper we focus on the willingness to pay and possible consequences for the pricing strategies of the vendors. We decided to use a straightforward approach of self-stated willingness to pay, since the questionnaire should be kept simple to ensure response quality and to avoid a high drop-out rate [Bogen 1996; Deutskens et al. 2004; Galesic 2005]. However, when interpreting our results, it has to be taken into account that a direct query of the willingness to pay might lead to a hypothetical bias, i.e. consumers usually tend to assess their willingness to pay higher as if financial obligations were imposed [Nape et al. 2003].

Additionally, the questionnaire included questions about demographical data, general attitude towards music, music taste and purchase behavior. Prior to implementation, the survey questionnaire was pre-tested and refined accordingly. The target audience of our survey consists of German Internet users. The survey was conducted from October 16th until November 13th 2006 in cooperation with the leading German news portal “Spiegel Online” (4 million unique visitors per month). Passive recruitment was used to obtain the sample: The survey was accompanied by a series of articles on the music industry and interviews with industry experts on "Spiegel Online". In each of these articles the link to our web survey was featured in an info box. In order to avoid a bias in the survey's outcome no incentives were given for participation in the study [Deci 1971; Singer 2002].

In total 2,437 respondents participated in the survey. However, we eliminated those participants who did not complete the questionnaire. Therefore, the sample consists of 1,534 participants.

In the following we describe essential characteristics of the participants of the survey. 9.68% of the participants were female and 90.32% male. The age distribution of the participants is shown in table 1.

Table 1: Age distribution within the sample

14 years and below	15 to 19 years	20 to 29 years	30 to 39 years	40 to 49 years	50 to 59 years	60 years and older
0.5%	4.89%	37.87%	33.88%	16.77%	4.84%	1.25%

Even though our sample is not representative for the total population, we abstained from weighting the records for the following reasons. First, in literature the effect of weighting is disputed [Vehovar et al. 1999]. Second, an analysis of our data revealed that the willingness to pay does not vary heavily between the weighted and the non-weighted sample. The resulting differences can be neglected for our further analysis, since they have no impact on the conclusions and the application of our model in section four.

However, another characteristic of our sample is worth to mention. Figure 1 shows that a considerable number of the participants have purchased either album or single downloads during the last year. Furthermore, 96.36% of the respondents own a collection of digital music files and 79.83% have a MP3-Player.

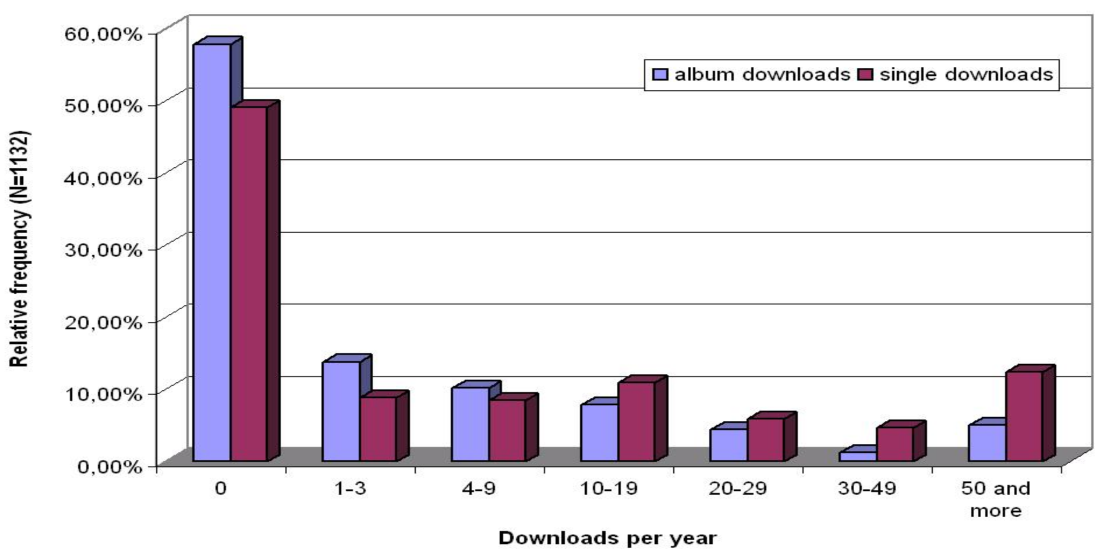

Figure 1: "During the last year, how many of the following products have you purchased?"

In addition, 52.1% of the participants regularly read articles about music in magazines or over the Internet. Even 80.4% stated that they are interested in learning about new artist and music genres.

In the following, we use data from our survey to estimate profit-maximizing prices for online music vendors and the entire music value chain. However, the model approach in the remainder of this paper is a general one using empirical data only as input parameters.

3.2. Estimating Optimal Prices

In our study we asked the participants about their willingness to pay for current hits. Thereby, we defined six classes with price ranges representing the willingness to pay. The results show that 29.7% have a willingness to pay below 10 Cents, 28% would pay a price between 10 and 50 Cents, 35.8% between 50 and 99 Cents and 6.5% have a willingness to pay of more than 99 Cents. Hence, these results suggest that the willingness to pay is clearly below the current prices for online music.

To further examine pricing strategies for online music, we analyze which price maximizes the provider's revenue. By applying a regression analysis, we derive a demand function *DF(p)* where p represents the price.

The assumption of an exponential function

(3.1) $$DF(p) = b_0\, b_1^{\,p}$$

leads to b_0=1.546 and b_1=0.973. Our results were calculated based on the respective mid-points of the classes (e. g. 74.5 Cents in the class from 50 to 99 Cents). The resulting demand function indicates the demand in percent of the maximum demand. For example, at a price of 99 Cents 10.29% of the potential buyers would buy a current hit ($DF(99) = 1.546 \cdot 0.973^{99} = 0.1029$).

We chose an exponential function (Adjusted R-Square=0.960; s=0.513)[1] because it shows a better fit compared to a linear function (Adjusted R-Square=0.782; s=19.463). We rejected polynomial functions of higher degree, because they are not strictly monotonic decreasing and thus are not suitable for a demand function [Landsburg 2001].

From the demand function (3.1) we now derive a sales function *S(p)* for an arbitrary number of consumers *N*:

(3.2) $$S(p) = p\, b_0\, b_1^{\,p}\, N$$

The sales function is represented in figure 2. We exemplarily assume that *N=10,000* consumers are interested in buying a download; other values for *N* lead to similar graphs with varying ordinate values.

Figure 2: Sales function for music downloads (N=10,000)

We determine which price $p_{opt\_turnover}$ maximizes the turnover by differentiating (3.2) with respect to *p* and satisfying *S'(p)=0*:

(3.3) $$p_{opt\_turnover} = -\frac{1}{\ln(b_1)}$$

By applying (3.3) we find that the optimal price is 37 Cents. The result indicates that current prices charged by online music stores exceed most consumers' willingness to pay.

3.3. Interdependencies and Costs in Digital Music Value Chains

So far our analysis was based on the assumption that an online store can act and decide as an isolated entity without considering fees and other restrictions resulting from the decisions of other actors involved in the digital music value chain. However, in the real world such a setting in most of the cases is unrealistic. In order to clarify this, let us take a look at an online store for digital music. This store has to bear costs for both infrastructure and service providers. Moreover, a download store has to pay royalties to collecting societies or fees to the labels. The costs can either be costs per download c, or turnover-depending costs $\beta \in [0,1]$.

Including these costs into the sales function (3.2) we derive the contribution margin *D(p)* as follows:

(3.4) $$D(p) = p\, b_0\, b_1^{\,p}\, N(1-\beta) - b_0\, b_1^{\,p}\, N c$$

We are now able to determine the profit-optimal price p_{opt_profit} by differentiating (3.4) with respect to *p* and satisfying *D'(p)=0*:

[1] The high Adjusted R^2 can in particular be explained by the fact that the regression analysis is based upon six cases (each case representing one class of willingness to pay).

$$(3.5) \qquad p_{opt\_profit} = \frac{\ln(b_1)c - (1-\beta)}{\ln(b_1)(1-\beta)}$$

As (3.5) shows, the profit-optimal price increases with the costs per download c and the turnover-dependent costs β.

If we assume that an online music store like iTunes has to pay 70 Cents for royalties and 27 Cents per transaction to credit card companies [Bockstedt et al. 2005] the profit-maximizing price is 1.34 €. This leads to the question whether a low-price strategy as discussed before is obsolete. In the following section we show how a low price strategy can be implemented in the value chain for digital music in order to increase revenues for all of the participants.

4. Cooperation as Prerequisite for Implementing a Low Price Strategy: A Model-based Approach

A prerequisite for the implementation of a low price strategy is cooperation between the partners involved in the digital music value chain, i.e. artists/composers, labels, collecting societies, distributors as well as infrastructure and service providers. In this context cooperation means that the price for music is conjointly set and the profit is shared between the value chain partners.

In the following, we examine, whether such a cooperation scenario is applicable and to what extent additional profits are gained for the entire digital value chain.

4.1. Basic Model

We examine a digital music value chain with n actors and assume that the value chain tries to maximize its contribution margin d. Each actor has to bear costs c_i per download. Therefore, (4.1) represents the contribution margin per unit for the entire value chain.

$$(4.1) \qquad d = p - \sum_{i=1}^{n} c_i$$

By multiplying the contribution margin per unit with the sales we obtain the total contribution margin for the entire value chain. The number of copies sold is determined by a demand function $DF(p)$ similar to the function we derived in the third section. We obtain the objective function (4.2):

$$(4.2) \qquad \max d \cdot DF(p)$$

In the following, γ_i represents the share actor i receives of the price. (4.3) represents the individual contribution margin per unit d_i for each value chain participant.

$$(4.3) \qquad d_i = p\gamma_i - c_i \qquad i=1,2,\ldots,n$$

Furthermore, we assume that the turnover is completely split up between the participants:

$$(4.4) \qquad \sum_{i=1}^{n} \gamma_i = 1$$

In the following, we consider if and under which conditions the actors of the value chain have an incentive to switch from an existing price and sharing model to a low price strategy.

Therefore, we extend our basic model to find a solution which strongly dominates the established price models, meaning that none of the value chain actors should be worse-off and at least one better-off than before [Jackson and Bloch 2004].

The total contribution margin D_i for an actor i can be calculated by multiplying the contribution margin per unit at a price p with the demand at that price ($DF(p)$):

$$(4.5) \qquad D_i = (p\gamma_i - c_i) \cdot DF(p) \qquad i=1,2,\ldots,n$$

Now let D_i^* represent the total contribution margin of actor i in the existing pricing and sharing model. D_i^* is determined by the number of sold copies at the current price p^* and the contribution margin per unit at that price. It is obvious that the new price strategy for i is only superior if (4.6) is true.

$$(4.6) \qquad (p\gamma_i - c_i) \cdot DF(p) \geq (p^*\gamma_i^* - c_i) \cdot DF(p^*) \qquad i=1,2,\ldots,n$$

On this basis we determine the minimum share for each actor $\gamma_i^{\min}$ by solving (4.6):

$$(4.7) \qquad \gamma_i^{\min} = \left(\frac{(p^*\gamma_i^* - c_i) \cdot DF(p^*)}{DF(p)} + c_i \right) \cdot p^{-1}$$

$\gamma_i^{\min}$ indicates which share of the price an actor i has to receive at least in order to guarantee Pareto-efficiency [Lockwood 1987]. Additionally, using (4.8) we can use $\gamma_i^{\min}$ to determine whether a feasible solution exists at a price p.

(4.8) $$\sum_{i=1}^{n} \gamma_i^{\min} \leq 1$$

Moreover, we can use $\gamma_i^{\min}$ to calculate the value of cooperation *v*.

(4.9) $$v = p(1 - \sum_{i=1}^{I} \gamma_i^{\min})$$

4.2. Application of the Model

For an application of the model we assume a simple digital music value chain consisting of three actors: a distributor (online music shop), a collecting society (a body that collects royalty payments for copyright holders), and a label. The example is based on a real-life scenario of a German online music distributor and the empirical data presented in section 3.

Table 2 shows the starting position of our example. In the existing pricing model a price of 99 Cents is charged per download. The shares of the price which the actors currently receive are represented in the left column; the estimates of the costs per download are shown in the middle column. For the data from our empirical survey we derive that at a price of 99 Cents 157 downloads are sold resulting in a turnover of 155.43 €. The resulting contribution margins for the respective actors are shown in the right column of the table.

Table 2: Starting positions

	γ_i^*	c_i	D_i*
Distributor	$0.\overline{34}$	15	29.83€
Collecting society	$0.\overline{12}$	0	18.84 €
Label	$0.\overline{53}$	1	81.64 €
Σ	1	16	130.31 €

To apply our model we have to determine the optimal price according to the given cost structure. The sum of the costs per download for all actors in our example is 16 Cents. Given our empirical data we apply (4.2). This leads to an optimal price of *p*=53 Cents at which 555 copies would be sold. The resulting turnover is 294.15 €. After subtracting the costs per download from the turnover, the total contribution margin for the entire music value chain is 205.35 €, i.e. obviously higher compared to the existing pricing model.

The minimal shares $\gamma_i^{\min}$ each actor expects to receive in order to be not worse-off than in the current situation is depicted in the first column of table 3. The second column shows the shares in Cent. In total, 39.5 Cents have to be shared between the three actors in order to obtain a Pareto-efficient solution. The remaining 13.5 Cents are the value of cooperation *v*.

Table 3: Minimum shares for each actor

	$\gamma_i^{\min}$	$\gamma_i^{\min} * p$ in Cent
Distributor	0.3844	20.4
Collecting society	0.0640	3.4
Label	0.2964	15.7
Σ	0.7448	39.5

Looking at the resulting figures in table 3 the question arises, how this value of cooperation is to be shared between the value chain actors. To reach a Pareto-efficient solution we consider the resulting values for $\gamma_i^{\min}$ as restrictions. One obvious method for sharing the value of cooperation is to determine the added value each actor contributes to the product. While this approach is already difficult to apply in a supply chain for physical goods [Beamon 1999], it is even harder in a digital value chain because measures like cost or customer responsiveness can hardly be taken into account.

Therefore, we examine two simple alternative methods for profit sharing. However, they fulfil the requirement that after applying the method none of the actors will be worse-off than in the current pricing and sharing model.

The first method suggests an equal distribution where each actor of the value chain receives an equal share of the value of cooperation.

Table 4: Allocation of the value of cooperation with equal distribution

	$\gamma_i^{min} * p$ in Cent	Share of value of cooperation	Share of turnover	Contribution margin per unit	Total Contribution margin
Distributor	20.4	4.5	24.9	9.9	54.94 € (+84.2%)
Collecting Society	3.4	4.5	7.9	7.9	43.84 € (+132.7 %)
Label	15.7	4.5	20.2	19.2	106.56€ (+30.5%)

In order to find a possibly more balanced solution, the shares in the current price model could be used as an indicator how to split up the cooperation value. Thus, this second method uses a distribution according to the shares at the price of 99 Cents. Table 5 shows the resulting contribution margins for each actor.

Table 5: Allocation of the value of cooperation according to shares at 99 Cents

	γ_i^{min} in Cent	γ_i^*	Share of value of cooperation	Share of turnover	Contribution margin per unit	Total Contribution margin
Distributor	20.4	$0.\overline{34}$	4.64	25.04	10.04	55.70 € (+86.7%)
Collecting Society	3.4	$0.\overline{12}$	1.62	5.04	5.04	27.95 € (+48.4%)
Label	15.7	$0.\overline{53}$	7.23	22.93	21.93	121.65 € (+49.1%)

In contrast to the model with equal distribution, the second model favours the labels. One could argue that this is a fairer solution, since the label has to bear the risk of the investment into an artist and thus has higher fixed costs, which have to be covered by the contribution margin. For that reason the second model might be easier to apply in practice. Furthermore, this allocation could also be desirable from the customer's perspective since increased earnings could provide more incentives for the labels to invest in new artists.

Of course, other methods than the two proposed are possible to divide up the value of cooperation between the actors [Jackson and Bloch 2004]. Finally, one crucial question is what kind of sharing models the actors of the value chain consider to be fair. Moreover the bargaining positions of the actors will obviously have a strong impact. These are important issues since we suspect that even if all actors in a new pricing and sharing model are better-off than before, it is ensured by no means that all of the actors will accept the model. In particular, single actors will not accept a new Pareto-optimal solution if they suspect that the other partners profit more from a new pricing and sharing model than they do.

5. Conclusion and Further Research

In this paper we examined alternative pricing models for digital music from the perspective of the entire music value chain. In particular, we developed a model to show that the turnover from music downloads could be increased by lower prices. The required data for the application of the model was obtained from an empirical survey. Prerequisite for such a low price strategy is that the actors of the value chain, i.e. artists, labels, collecting societies, service providers and online shops, act as cooperation partners. We show that it is even possible to create solutions which are Pareto-superior compared to current business models. Furthermore, we discussed opportunities to split up the additional revenues between the actors of the music value chain.

One important aspect of future research will be the integration of multi-channel management [Dewan, et al. 2000; Webb 2001] in order to examine the effects of online-pricing on the sales of physical sound storage media.

Furthermore, the model proposed in this article follows a centralized approach to value chain coordination. Therefore, such a central model has the potential to find Pareto-efficient solutions for the entire value chain. In practice, however, a decentralized model might be more suitable to represent the behavior of the actors, even though it is rather unlikely to find the optimal solution [Whang 1995]. A promising approach for decentralized control and decision making, however, is the use of value chain contracts as a coordination mechanism. For example, Cachon and Lariviere [2005] show how revenue sharing contracts can be applied to the so called "newsvendor problem". Tsay et al. [1999] give an overview of contractual schemes for physical supply chains.

Our further research will focus on the design of contracts between partners in the digital value chain in order to assure a price, from which both the value chain partners and its customers will benefit.

REFERENCES

Altinkemer, K. and S. Bandyopadhyay, "Bundling and Distribution of Digitized Music Over the Internet," *Journal of Organizational Computing and Electronic Commerce*, Vol. 10, No. 3:209-224, 2000.

Alvisi, M., E. Argentesi, and E. Carbonara, "Piracy and Quality Choice in Monopolistic Markets", Working Paper, http://www.bepress.com/cgi/viewcontent.cgi?article=1061&context=gwp, 2003.

Anderson, C., "The Long Tail," *Wired Magazine*, Vol. 12, No. 10, October 2004.

Aron, R., A. Sundararajan, and S. Viswanathan, "Intelligent agents in electronic markets for information goods: customization, preference revelation and pricing," *Decision Support Systems*, Vol. 41, No. 4:764-786, May 2006.

Bakos, Y. and E. Brynjolfsson, "Bundling information goods: pricing, profits and efficiency," *Management Science*, Vol. 45, No. 12:1613-1630, December 1999.

Bakos, Y. and E. Brynjolfsson, "Bundling and competition on the internet: aggregation strategies for information goods," *Marketing Science*, Vol. 19, No. 1:63-82, January 2000.

Bamert, T., T.S. Meier-Bickel and C. Rüdt, "Pricing Music Downloads: A Conjoint Study," Proceedings of the 2005 European Academy of Management Annual Conference, 2005.

Bhargava, H. and V. Choudhary, "Second Degree Price Discrimination for Information Goods," Proceedings of the 34th Hawaii International Conference on System Sciences (HICSS), Maui, Hawaii, January 2001.

Beamon, B., "Measuring supply chain performance," *International Journal of Operations and Production Management*, Vol. 19, No. 3:275-292, 1999.

Bockstedt, J., R.J. Kauffman, and F.J. Riggins, "The Move to Artist-Led Online Music Distribution: Explaining Structural Changes in the Digital Music Market," Proceedings of the 38th Annual Hawaii International Conference on System Sciences (HICSS'05) - Track 7, pp. 180a, 2005.

Bogen, K., "The Effect of Questionnaire Length on Response Rates - A Review of the Literature", Proceedings of the Survey Research Methods Section, Alexandria: American Statistical Association, pp.1020-1025, 1996.

Breidert, C. and M. Hahsler, "Adaptive conjoint analysis for pricing music downloads.", Proceedings of the 30th Annual Conference of the Gesellschaft für Klassifikation e.V., Freie Universität Berlin, March 8-10, 2006.

Cachon, G. and M. Lariviere, "Supply chain coordination with revenue sharing contracts," *Management Science*, Vol. 51, No. 1:30-44, January 2005.

Chen F., Z. Drezner, J.K. Ryan and D. Simchi-Levi, "Quantifying the Bullwhip Effect in a Simple Supply Chain: The Impact of Forecasting, Lead Times, and Information," *Management Science*, Vol. 46, No.3:436-443, March 2000.

Choudhary, V., A. Ghose, T. Mukhopadhyay, and U. Rajan, "Personalized Pricing and Quality Differentiation," *Management Science,* Vol. 51, No. 7:1120-1130, July 2005.

Clemons, E. and K. R. Lang, "The Decoupling of Value Creation from Revenue: A Strategic Analysis of the Markets for Pure Information Goods," *Information Technology and Management*, Vol. 4 , No. 2-3:259-287, April-July 2003

CNNMoney.com, "iTunes may pay more to play", http://money.cnn.com/2005/08/29/technology/apple_itunes/, 2005.

Deci, E. L., "The effects of externally mediated rewards on intrinsic motivation.", *Journal of Personality and Social Psychology*, Vol.18, pp. 105-115, 1971.

Dewan, R., M. Freimer, and A. Seidmann, "Organizing distribution channels for information goods on the internet," *Management Science*, Vol. 46, No. 4:483-495, April 2000.

Deutskens, E., K. de Ruyter, M. Wetzels and P. Oosterveld, "Response Rate and Response Quality of Internet-Based Surveys: An Experimental Study", *Marketing Letters*, Vol. 15, No. 1:21-36, 2004.

Fishburn, C., A.M. Odlyzko, and R.C. Siders, "Fixed fee versus unit pricing for information goods: competition, equilibria, and price wars," B. Kahin and H. R. Varian (eds.), Internet Publishing and Beyond: The Economics of Digital Information and Intellectual Property, MIT Press, Cambridge, 2000.

Galesic, M., "Effects of questionnaire length on quality of responses in web surveys", ESF Workshop on Internet survey methodology, Dubrovnik, 26-28 September 2005.

Gallaway, T. and D. Kinnear, “Unchained melody: a price discrimination–based policy proposal for addressing the MP3 revolution,” *Journal of Economic Issues*, Vol. 35, No. 2:279-287, June 2001.
Jackson, M. O. and F. Bloch, "The Formation of Networks with Transfers among Players," Grand Coalition 78, Grand Coalition Web Site, 2004.
Jing, B., “Versioning information goods with network externalities”, Working Paper, Stern School. of Business, New York University, 2002.
Landsburg, S.E., “Price Theory and Applications,” 5th edition, South Western College Publishing, 2001.
LeClaire, J., “Record Industry Pushes Apple to Raise iTunes Prices”, http://www.technewsworld.com/story/49727.html, March 2006.
Lockwood, B., “Pareto Efficiency,“ The New Palgrave: A Dictionary of Economics, Eatwell, J., Milgate, M., and Newman, P. (eds..), London etc., Vol. 3, pp. 811- 813, 1987.
Martín Díaz, L., “Evaluation of Cooperative Planning in Supply Chains,” Gabler, Wiesbaden, 2006.
Menta, R., “iTunes Prices Too High”, MP3newswire.net, 2005. http://www.mp3newswire.net/stories/5002/itunesprices.html.
Nape, S., P. Frykblom, G.W. Harrison, and J.C. Lesley, “Hypothetical Bias and Willingness to Accept,” *Economics Letters,* Vol. 78, No. 3:423-430, 2003.
Olderog, T. and B. Skiera, “The benefits of bundling strategies,” *Schmalenbach Business Review*, Vol. 52, No. 2:137-159, 2000.
Papaefstathiou, I., C. Manifavas, “Evaluation of Micropayment Transaction Costs”, *Journal of Electronic Commerce Research*, Vol. 5, No. 2:99-113, 2004.
Shy, O., “The economics of network industries,” Cambridge University Press, Cambridge, 2002.
Singer, E., “The use of incentives to reduce nonresponse in household surveys”. In R. M. Groves, D. A. Dillman, J. L. Eltinge, R. J. A. Little (eds.), “Survey Nonresponse”, pp. 163-177, Wiley, Chichester 2002.
Smith, T., “Are Representative Internet Surveys Possible?”, Proceedings of Statistics Canada Symposium, 2001.
Statistisches Bundesamt, “Statistisches Jahrbuch 2006 – Kapitel 2 Bevölkerung”, http://www.destatis.de/download/jahrbuch/2_bevoelkerung.pdf, 2006.
Sundararajan, A., “Nonlinear Pricing of Information Goods,” *Management Science,* Vol. 50, No. 12:1660-1673, 2003.
Sundararajan, A., “Managing digital piracy: pricing and protection,” *Information Systems Research*, Vol. 15, No. 3:287-308, March 2004.
Thonemann, U.W., ”Improving supply-chain performance by sharing advance demand information”, *European Journal of Operational Research*, Vol. 42, No. 1:81-107, 2002.
TNS Infratest, “Monitoring Informationswirtschaft, 9. Faktenbericht”, http://www.tns-infratest.com/06_bi/bmwa/infrasearchreg/reg9.asp?dfile=TB6_Chartversion_de.pdf, June 2006.
Tsay, A., S. Nahmias, and N. Agrawal, “Modeling supply chain contracts: A review,” Quantitative Models for Supply Chain Management, Tayur, S., Ganeshan, R., and Magazine, M. (eds.), Kluwer, Boston, pp. 299-336, 1999.
Ulph, D. and N. Vulkan, “Electronic Commerce and Competitive First-Degree Price Discrimination”, mimeo, UCL and University of Bristol, 2000.
Varian, H., J. Farell, and C. Shapiro, “The Economics of Information Technology: An Introduction,” Cambridge University Press, Cambridge, 2004.
Vehovar, V., K.L. Manfreda and Z. Batagelj, “Web Surveys: can the weighting solve the problem?”, Proceedings of the Section on Survey Research Methods, American Statistical Association, pp. 962-967, 1999.
Veiga, A., “Recording labels, Apple split over pricing,” USA Today online, http://www.usatoday.com/tech/products/services/2006-04-02-itunes-variable-pricing_x.htm, April 2006.
Venkatesh, R. and R. Chatterjee, “Bundling, unbundling, and pricing of multiform products: The case of magazine content,” *Journal of Interactive Marketing*, Vol. 20, No.2:21-40, April 2006.
Voeth, M. and U. Herbst, “Supply-chain pricing – A new perspective on pricing in industrial markets”, *Industrial Marketing Management*, Vol. 35, No.1:83-90, January 2006.
Webb, K. L., “Managing channels of distribution in the age of electronic commerce”, *Industrial Marketing Management*, Vol. 31, No. 2:95-102, 2001.
Whang, C., L.R. Ye, Y. Zhang and D. Nguyen, “Subscription of Fee-Based Online Services: What Makes Consumers Pay for Online Content”, *Journal of Electronic Commerce Research*, Vol. 6, No. 4:304-311, 2005.
Whang, S., “Coordination in operations: A taxonomy,” *Journal of Operations Management*, Vol. 12, pp. 413-422, 1995.