

A b s t r a c t

Electronic commerce (EC) first appeared in Business-to-Business (B2B) markets, while Business-to-Consumer (B2C) markets developed later. It was due to the emergence of online auctions that even more recently Consumer-to-Consumer (C2C) electronic markets emerged and started to merit major attention in theory. One innovative area for C2C commerce is the concept of superdistribution which links the idea of file sharing with the exchange of money. The money paid for each item of downloaded media content is split among the artist, professional providers and the person from whom it is downloaded. This paper investigates the effect of such a splitting of revenues on users' music download behaviour by comparing five scenarios with different splitting ratios between professional providers and users. A prototype was developed and tested in an experimental setting. The results illustrate that the ratio of revenue splitting does affect the source the users download from, that most participants assume the business model to be fair and that nearly all users would be satisfied by a participation of half or less of the revenues. The results indicate that superdistribution in fact can help make file sharers pay for digital music content by creating a decentralized C2C electronic market.

Keywords: music business model, file sharing, C2C, revenue splitting, economic incentives

A u t h o r s

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Decentralized Electronic Markets: Exploring the Effects of Revenue Splitting Inside File Sharing Systems

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Digital information goods are increasingly sold and bought via electronic markets relying on internet business models. Timmers (1998) describes the internet business model as 'an architecture for the product, service and information flows, including a description of the various business actors and their roles; and a description of the potential benefits for the various business actors; and a description of

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the sources of revenues' (Timmers 1998, p. 4). Most internet business models follow the B2C logic known from physical markets where professional businesses generate revenues by supplying information goods to consumers (Picard 1989).

Digital technologies currently challenge these B2C business models. One evolution that has gathered more and more importance during the last decade is the concept of file sharing systems based on peer-to-peer (P2P) technology (Fattah 2002, Oram 2001). These systems allow for a decentralized and free exchange of digital media content (especially music, videos) via the Internet. A highly decentralized electronic market is generated by supply and demand of digital media files. Although a market is clearly established it remains to be discussed if file sharing can be described as electronic commerce as no money is exchanged. Instead, file sharing markets seem to rely on a non-monetary barter exchange combined with norms of reciprocity and altruism. The economic value generated on the demand side is merely the price not paid for digital information goods and – different from traditional barter exchange – the supplier does not lose value as he only gives

away a copy of the good but keeps his own version of the media file. This economic advantage compared to traditional B2C business models makes it efficient for recipients to switch to illegal file sharing systems (for investigations into illegal P2P-systems and their economic, psychological and social implications see: Gopal *et al.* 2004, Haug and Weber 2003a, 2003b, Liebowitz 2005, Oberholzer and Strumpf 2004, Peitz and Waelbroeck 2005, Schechter *et al.* 2003).

Efforts to regain ground in the distribution of digital information goods focus on complementing physical commerce by EC download services. Apple Computer, Inc. was the first company to succeed with its download service, iTunes Music Store. Since its launch in April 2003, more than three billion digital music songs have been sold over this digital platform (Apple Inc. 2007). Its success shows, among other things, that users are willing to pay for digital information goods if they are offered an easy-to-use distribution platform combined with a more liberal digital rights management which allows for exchanging media files and writing them to CD to a limited extent (von Walter and Hess 2004). Other commercial download services have followed since then by also integrating these typical features of distributed file sharing systems (Baumann *et al.* 2000). Nevertheless, all these download services mainly follow the traditional B2C business model known from non-digital markets. This paper tests the reverse approach which has not gained much attention in the EC literature yet: The concept of superdistribution integrates electronic commerce features into file sharing systems and turns them into C2C marketplaces. The innovative feature of these C2C marketplaces is the possibility of splitting revenues between traditional providers and users. However, there is no research on the effects of this splitting of revenues. As this issue cannot be comprehensively treated analytically, we present here an experimental test case of digital music distribution.

First, we will define superdistribution as a special case of recently emerging C2C electronic markets. Then, we describe the experimental setting of our study concerning sample, design and setting. After that, we present the results both on users' behaviour during the experiment and the initial attitudes towards the tested superdistribution model. From these findings, four propositions are derived. Finally, we point out limitations of our study and suggest fields for further research.

THEORETICAL BACKGROUND: ELECTRONIC COMMERCE AND SUPERDISTRIBUTION

There is no single official definition of electronic commerce (Kauffman and Walden 2001) but B2B and B2C markets have been the main topics under investigation for some time (for an overview on the

evolution of economic literature on electronic commerce, see Kauffman and Walden, 2001, while an outline specialized on electronic markets literature is drawn by Anandalingam *et al.* 2005). Before the diffusion of the Internet, B2B exchanges based on proprietary standards were the only application area for EC. As Kauffman and Walden's work shows, the Internet and its related technologies turned EC into a mainstream practice not only for B2B but for the first time also for B2C markets. One of the first definitions of EC including these two major fields was presented by Wigand in 1997. According to him, electronic commerce 'denotes the seamless application of information and communication technology from its point of origin to its endpoint along the entire value chain of business processes conducted electronically and designed to enable the accomplishment of a business goal. These processes may be partial or complete and may encompass business-to-business as well as business-to-consumer and consumer-to-business transactions' (Wigand *et al.* 1997). The concept of electronic commerce covers the spectrum between electronic hierarchies and electronic markets (Wigand 1997, p. 2), in which superdistribution can clearly be integrated as a type of electronic market.

But while the definition proposed by Wigand *et al.* includes B2B, B2C, and even C2B scenarios, C2C markets have only recently emerged due to the diffusion of internet technologies and have subsequently been included in definitions of EC. Falling back to Hayashi (1996) and extending his work, Urbaczewski *et al.* (2002) define electronic commerce as 'the use of computer networks to conduct business – basically the buying and selling of goods and services *and information* – electronically with one's suppliers, customers, or competitors, *or among consumers*' (Urbaczewski *et al.* 2002). Their emphasis on Hayashi's definition (as highlighted by the authors) show both that information cannot be easily integrated in traditional goods and services dichotomies and that EC increasingly also happens among consumers. Urbaczewski *et al.* note that consumer-to-consumer EC is one of the least investigated areas. In the area of digital distribution of information goods, the idea of superdistribution proposes such a C2C electronic market model.

The concept of superdistribution allows for a decentralized exchange of digital media content and a splitting of revenues. Originally designed for software distribution, the aim was to use the Internet's infrastructure to distribute software in a decentralized and secure way while still being able to monitor the use and modifications of the software (Mori and Kawahara 1990). This idea was adapted for decentralized distribution via any distribution channel (Cox 1994) and charging of media content (Buhse 2001).

Superdistribution is quite different to internet auctions like eBay (Anandalingam *et al.* 2005). In superdistribution the transaction includes two peers – in the

case of internet auctions we typically have a lot of prospects. Also in superdistribution we have no bargaining about the price or other aspects of the offer – in eBay to identify the price is the main point. Third superdistribution is focused on digital goods – on the other side internet auctions are offering all kinds of goods.

Economic fundamentals of superdistribution, including the problem of superdistribution as a ‘pyramid game’ (Gehrke 2004, Vander Nat and Keep 2002), have been discussed. Links to other fields of management research like viral marketing (Helm 2000) have been established. Prototypes have been developed (Nützel and Grimm 2003). A lot of questions regarding superdistribution remain open. One of these questions is about the compensation a person who is providing the content should get. With this paper we will focus on this fundamental question.

Gehrke and Anding (2002) developed a model assuming a download fee of 10 cents per file (see Figure 1). User accounts are managed by a central service provider. If peer Y downloads a music file from the hard disk of peer X the system charges an amount of 10 cents from user Y’s account. The amount of 10 cents is then shared between user X (5 cents) and the service provider (5 cents). The service provider forwards a share of the collected 5 cent fee to the original copyright owner. The remuneration of 5 cents paid to user X is credited to his account and can again be spent by user X’s on downloads (Gehrke and Anding 2002).

The success of such an idea of a decentralized electronic market basically depends on the willingness of both users and traditional rights holders like music labels to participate. Incentives to participate are not trivial and thus will be discussed with respect to both parties.

With respect to the users’ incentives to participate in such a system, it has to be discussed why and under which conditions a for-pay alternative should be chosen

by users instead of an offer at no charge. Gehrke (2004) formalizes the following condition for participation:

$$\alpha m - p + u \geq u \leftrightarrow \alpha m \geq 1$$

Using a system which charges no fee means a utility u for every downloaded song for a user. This utility is also given in the case of a for-pay system. Additionally, in this second case a price p has to be paid for each download (reduction of utility u). On the other hand, u is enhanced by the remuneration given to the supplier of music content. This remuneration equals the product of the number of downloads m and the provision per download α . In order to accomplish participation in the for-pay system, the overall utility of this for-pay system has to equal at least the overall utility of a free of charge system. The equation demonstrates that its success depends on the amount of downloads m and the level of the provision α . In our experiment we address both factors by varying provision α and comparing the resulting download behaviour. Due to this calculus, the user’s *economic* incentive to participate is covered by Gehrke’s theoretical assumptions. However, besides a purely economic perspective, the value of information flows has to be additionally measured from a psychological point of view by focussing on the individual context of information exchange (Kamel *et al.* 1997, pp. 93–4). The importance of environmental factors on uncertainty in marketing channels has been highlighted earlier in marketing literature (Achrol and Stern 1988). Thus, besides economic dimensions, socio-psychological aspects have to be considered when examining superdistribution models. (Impure) altruism and reciprocal norms complement economic factors to a significant extent (Andreoni 1990, Carman 1992). These socio-economic factors can be modelled by game theoretic models, e.g. offering music files in a file sharing system can be seen as a social norm and consequently can be modelled as an insurance game in which Player 1 cooperates only if Player 2 (re-)acts co-operatively (Kiyonari *et al.* 2000). The importance of co-operative behaviour and mutual trust on markets in general but especially inside distinct distribution channels has been emphasized (Alderson 1965, p. 239; McKean 1975, pp. 30–1; Young and Wilkinson 1989).

The different dimensions of users’ incentives to participate in a decentralized commercial marketplace for digital music seem to be clear now. However, to this point, it remains unclear why traditional providers of music like music labels should be in favour of such a music superdistribution model. At a first glance, these decentralized business models do not seem to provide any incentives for traditional commercial players. Instead, typical functions of those players, such as reproduction, distribution, storage, and marketing of music content are not fulfilled by themselves anymore but by the recipients themselves (Hess and von Walter

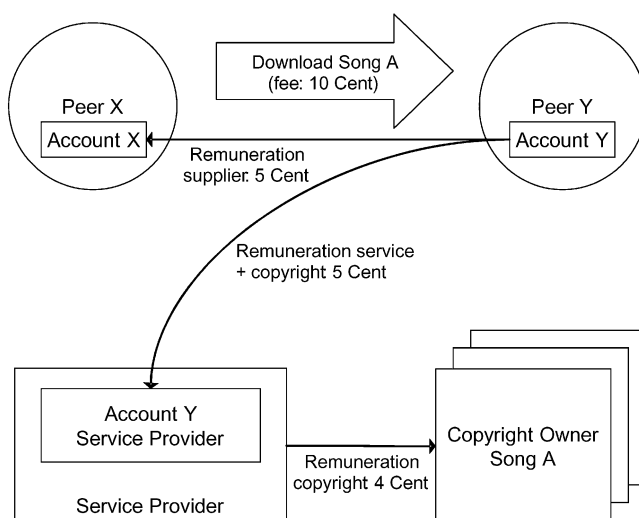


Figure 1. Distribution revenue model (Gehrke and Anding 2002)

2006). Furthermore, traditional commercial players have to share revenues which seem to result in lower margins from music sales. All in all, from a first, purely economic point of view, traditional commercial players in music markets would be heavily threatened by disintermediation if superdistribution were introduced.

Nevertheless, when taking a closer look, there are several points to make against these potential reservations. First, the most important issue for music labels is not so much to enter or not to enter digital distribution of music content but how to establish and maintain a dominant position in emerging digital music markets. Although iTunes has already succeeded in selling considerable numbers of digital downloads the absolute numbers only cover a marginal number of the total music distribution worldwide and there is still a long way to go to dominate the world of digital downloads. Music labels might simply regard superdistribution models as an additional digital distribution channel (for an introductory overview on the idea of distribution channels see Stern 1965) or at least as an ‘electronic marketing and information channel’ (Wigand 1997, p. 9). From a transaction cost perspective (Williamson 1999), superdistribution helps reducing transaction costs significantly, moving transaction cost levels at least towards a desirable ‘zero transaction cost model’ (North 1990, p. 107). Furthermore, remaining transaction costs are delegated from music labels and other commercial actors to recipients as, by superdistribution of music files, recipients fulfil important functions like reproduction, distribution and marketing of music files. In addition to that, although reduction of transaction costs is one important factor, even more important is the transaction value (Grewal *et al.* 1998) which includes both production and transaction costs (Zajac and Olsen 1993). Following this logic, sharing of revenues might reduce total sales volume for music labels but – considering the cuts in transaction costs mentioned above – not necessarily net transaction value from music sales. Already today, only about one third of the price of one music file sold via iTunes Music Store is kept by Apple Inc. In effect, choosing between sharing money with Apple or with users does not make a fundamental difference. Concluding, although superdistribution models seem to disintermediate and threaten music labels from a first economic point of view, this alternative distribution channel seems well worth considering when looking for additional, innovative entry strategies for music labels to digital markets as not only functions but also transaction costs can be delegated and net transaction value will not necessarily shrink but might also grow.

Concluding, superdistribution is consideration by both users and traditional commercial providers as – if implemented in an adequate way – both parties can benefit from it. At this point, it still remains unclear, if and under what explicit economic conditions, users would be willing to participate.

RESEARCH QUESTIONS: EFFECTS OF REVENUE SPLITTING

Different from traditional music markets, in the model at hand the users’ calculus of purchasing a music file does not only depend on his individual preferences but additionally on the estimated probability of reselling the file to other users. As mentioned above, social norms (altruism, reciprocity: Haug and Weber 2003b) and psychological circumstances of the information flow (cooperative atmosphere) play an additional powerful yet difficult to measure role. It remains to be tested empirically whether users are willing to cooperate in a relatively anonymous atmosphere as presented in our special case. This article addresses this issue by experimentally testing the effect of sharing revenues with supplying peers on the users’ download behaviour. From these theoretical considerations, two research questions are derived:

Research question 1: Do economic incentives inside peer-to-peer systems affect the users’ download behaviour and, thus facilitate the establishing of a decentralized electronic market?

In our special case one could assume that higher economic incentives will trigger users towards increasingly downloading from other users (who are refunded) instead of downloading from a professional provider (who would not share revenues) because – in the long run – users would profit from such a system in terms of money and social capital if they are willing to cooperate.

Even if our participants were to act according to our assumption it cannot be simply deduced that they would accept such a business model and integrate the technical system into their everyday lives. Although there are sophisticated models of user acceptance (Ajzen 1991, Brockhoff 1995, Davis 1989, Harms and Schweibenz 2000, Herrmann *et al.* 1999, Kollmann 2001, Schenk and Wolf 2000) acceptance itself cannot be validly measured after 30 minutes of experimental simulation with a prototype (for a description of the experimental setting see below). As research into user acceptance requires longer periods of investigation we at least tried to capture some very basic and initial attitudes towards the idea of revenue sharing inside file-sharing systems (e.g., the perceived fairness of the basic idea):

Research question 2: What are the initial attitudes of our participants towards this innovative business model (decentralized economic commerce)?

For this purpose, a relatively simple research design was developed. The ratio of revenue splitting served as the independent variable. The dependent variables observed concerned inter-group differences in download behaviour and initial attitudes towards the C2C download model (see Figure 2).

AN EXPERIMENT ON CHANGING DOWNLOAD BEHAVIOR

Recent economic literature offers first insights into social norms like altruism, reciprocity, and cooperation. However, as this direction of research in economics is new (Fehr and Schmidt 2006), it is not surprising that specialized economic literature for the case of decentralized C2C file sharing systems is not available. Also interdisciplinary research in this field is still in its infancy (Cropanzano and Mitchell 2005). This situation requires an exploratory research design from which first propositions on general principles of C2C electronic commerce can be derived. In order to acquire empirical data on the effect of different pricing models for the download of music, a prototype was developed and tested in a laboratory experiment. In the following sections the sample, the experimental design and setting are briefly described.

The sample – recruiting and matching

In order to test file-sharing under different economic incentives, five homogeneous groups of 20 people each were asked to form small-scale peer-to-peer networks. Potential participants were recruited via mailing lists and pre-selected with the help of a preliminary online questionnaire.

The 100 participants were assigned to the five different groups by a matching procedure (age, gender and download-affinity). According to ANOVAs not a single group differed significantly from another in terms of age (mean: 24; SD: 2.9; F-Value: 0.72; $p=0.56$) and download-affinity (measured by the question: ‘How often do you download music from the internet?’; answers on a five-point Likert scale from 1=every day to 5=never; mean: 3.64, SD: 1.1; F-Value: 1.06; $p=0.38$). All participants were university students and in each

group there were 6 female and 14 male participants. Students – and especially male students – had been employed earlier as a typical test group for P2P networks (Benlian *et al.* 2005). Nevertheless, it has to be stated clearly that the sample cannot be regarded as a representative selection of P2P users. However in experimental settings the main aim is not to create a representative sample (which would be impossible in the case of illegal file-sharing because the basic population is unknown) but to compare the behaviour and attitudes of as many relevant target people as possible. In our case the relevant target group consists of people who have experience of illegal file-sharing.

Design

The independent variable that varied across the five experimental groups (each of them $n=20$) was the ratio of a (fixed) price split between traditional providers (artists, music companies) and the users from whom the files were downloaded. Each of the five groups operated with a different provider/user ratio of shared revenues: 100/0, 75/25, 50/50, 25/75, and 0/0. This spectrum covers the range from the traditional legal music business model (100/0) to the situation inside illegal P2P systems (0/0). Three intermediate ratios simulate the idea of superdistribution in different phenotypes. While the ratio 50/50 mirrors the ratio proposed by Gehrke and Anding (2002), a ratio of 75/25 is more similar to the traditional commercial model and the 25/75 is more P2P-like. Unlike Gehrke and Anding’s concept, an additional remuneration of the copyright owner (see Figure 1) was not taken into account.

The dependent variables concerned download behaviour and initial attitudes towards the presented superdistribution model. Download behaviour was measured by the ratio between downloads from the central provider and downloads from other users. During the experiment, the change of download behaviour (provider/user-ratio) was tested for the different ratios of revenue splitting. After the experiment, users were asked about their initial attitudes towards each respective model. Initial attitudes were measured with the help of three different questions that were formulated to cover our special case: One question asked for the overall satisfaction with the system (measured by the question: ‘How satisfied are you with the technical aspects of the programme as a whole?’; answers on a five-point Likert scale from 1=completely satisfied to 5=not satisfied at all). Another two questions were formulated to check for the basic appreciation of the idea of revenue sharing systems (e.g. ‘How much do you agree with the following statements? The program ... facilitates proceeds, ... is based on a fair idea; answers on a five-point Likert scale from 1=strongly agree to 5=strongly disagree).

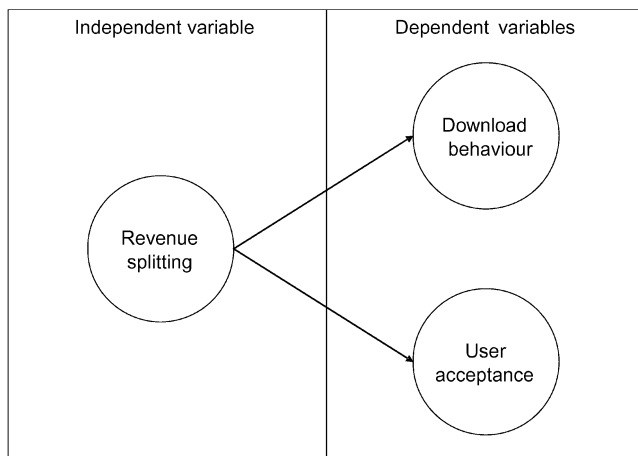


Figure 2. Research design

Experimental setting

The experiment comprised five 30-minute online file sharing sessions under different financial conditions and complementary pre- and post-experimental online questionnaires. All three instruments were integrated into one website design. The prototype developed for the experiment was based on a web server all users could connect to using standard web browsers. On the website, the users had access to the features necessary for participating in the simulated P2P network.

In a pre-experimental questionnaire we investigated basic socio-demographics (age, gender, income), general aspects of music usage (budget spent on music, changes in music budget) and special aspects of P2P usage (number of legal and respectively illegal files per week, assessment of prices) in order to generate some information on our participants' basic music-related behaviour and to check whether these characteristics are distributed evenly across the different experimental groups. The server allowed a user to proceed to the main P2P component once all questions in the questionnaire were answered. During five different file sharing sessions the users were able to download files from a central provider or other users. They were asked to use the prototype simultaneously for a period of 30 minutes and thereby formed a (small) P2P network. An amount of 75€ (approximately 85.50 US\$) of (virtual) money and no initial music files were given to each participant in order to achieve a state of similar financial restriction and propensity to download. A pool of 4,500 songs was offered to the users by an imaginary central provider at a price of 1€ (approximately 1.14 US\$) each. The song-list was generated by analyzing twelve different international record charts and extracting the 300 most successful artists. Of each of these 300 artists, the 15 most prominent songs were added to the song-list. Due to legal reasons and the server-based software design, the downloaded files did not contain real music data but random algorithms named with the title of the respective song. However, in order to create a realistic download scenario the participants were told that they could keep all the files they would be downloading during the experiment. For this purpose, all participants were given blank CDs in order to suggest that the stimulus material contained real music files. After the experiment the participants were asked whether they had entertained any suspicion. None of them stated to have suspected anything. All of them were subjected to a debriefing after the experiment and compensated. The sessions were limited to 30 minutes and the number of minutes remaining was displayed on each user's web browser, together with the amount of money still available. The server enforced the time restriction by automatically switching from the P2P application to the final questionnaire when the time was up. This second

questionnaire was administered in order to find out about the initial attitudes towards the system. Moreover we asked our participants to give us an idea about the optimum ratio of revenue splitting (question: 'Please imagine that you download one song at a price of 1€ from a legal website and you are allowed to resell this song. If other users download this song from you, you will receive a fraction of this Euro. The other fraction will be kept by the commercial provider you initially downloaded your song from. Which ratio of splitting the 1€ do you think to be adequate?').

The answers to the questionnaires were recorded. During the main P2P session, the actions of each user were tracked, such as login, searches, fulfilled and cancelled downloads. Each log entry included the user name and a time stamp. For the case of search operations the entry additionally listed the search string. For downloads, recorded details included the name of the song downloaded, the user from which the music was downloaded and the amount of money left to the respective user after the transaction. Limited live monitoring was possible during the experiment and allowed data collection, e.g., on how many users had already completed a questionnaire.

RESULTS AND PROPOSITIONS

In the following sections, results of both the experiment and questionnaires are presented. First the participants themselves are described, second their behaviour during the experiment and third their attitudes towards the concept are discussed. Together, the data generated allows a comparison of users' previous behaviour to their behaviour during the experiment and the resulting attitudes.

User profiles and demographic data

While it has been shown already that our five experimental groups ($n=100$) did not differ in terms of age, gender and download affinity (see above), the data from the pre-experimental questionnaire allowed control of several other relevant variables. According to a series of ANOVAs, our experimental groups did not differ significantly in terms of personal income (question: 'What is your monthly salary?'; answers: 1)=0–250€, 2)=251–500€, 3)=501–750€, 4)=751–1.000€, 5)=1.001–1.250€, 6)=1.251–1.500€, 7)=more than 1.500€; mean: 2.81; SD 1.52; F-Value: 1.30; $p=0.28$), budget spent on music (question: 'How much money do you spend on pieces of music per month?'; answers: 1)=0€, 2)=1–25€, 3)=26–50€, 4)=51–75€, 5)=76–100€, 6)=more than 100€; mean: 1.67; SD: 0.69; F-Value: 1.28; $p=0.28$) and recent changes in their music budget (question: 'Have your expenditures on music

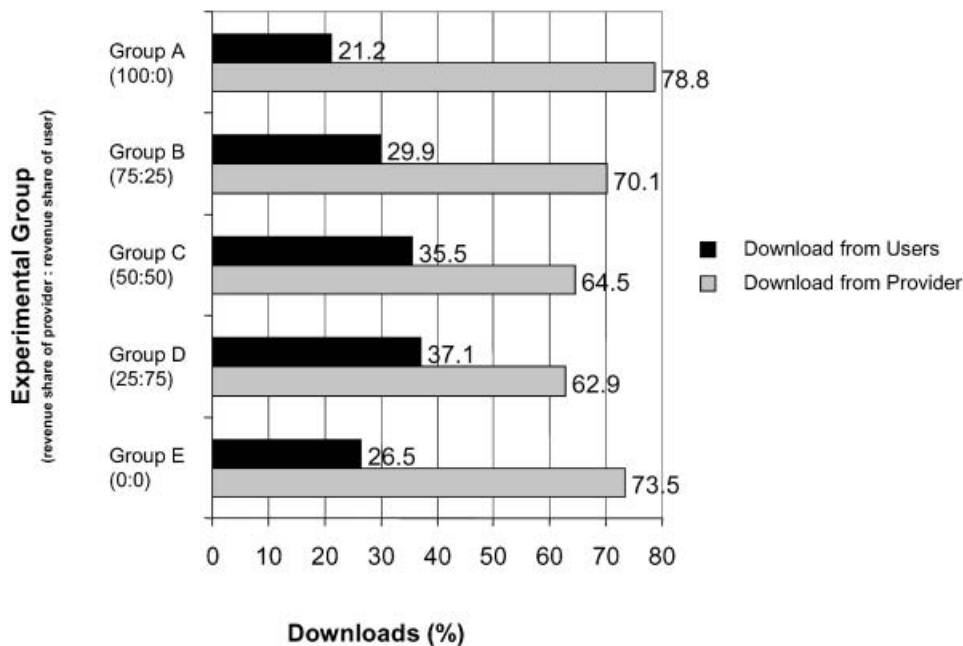


Figure 3. Downloads according to revenue splitting

Basis: 3,909 Downloads in group 0:0; 1,912 in group 25:75; 1,684 in group 50:50; 1,394 in group 75:25 and 1,412 in group 100:0

changed during the last few years?'; answers: 1=yes, they decreased, 0=no, stayed the same, +1=yes, they increased; mean: -0.43; SD: 0.66; F-Value: 1.33; $p=0.27$). Moreover there are no significant differences in the number of legal and illegal downloads per week (question: 'How many songs do you download per week? How many of them are downloaded legally ...'; mean: 3.28; SD: 12.42; F-Value: 1.26; $p=0.30$; 'how many of them are illegal?'; mean: 10.08; SD: 30.07; F-Value: 0.78; $p=0.54$) and the assessment of prices for legal downloads (question: 'How do you assess the price of legal downloads?'; answers on a seven-point Likert scale from 1=extremely expensive to 7=extremely cheap; mean: 3.06; SD: 1.19; F-Value: 0.31; $p=0.87$).

In short, the descriptive results are: On average our participants had a relatively low personal income, shared a relatively small budget for music, decreased their expenditures on music during the last few years, obtained about three-quarters of their music files illegally and believed that the prices for legal alternatives were rather high. On the one hand, the experimental groups do not differ significantly in terms of relevant music-related behaviour. On the other hand – and seemingly more important – the participating users belonged to the target group suitable for the purpose of the experiment: They are experienced (illegal) file-sharers (75 out of 100 participants admitted to be regular file-sharers). A superdistribution alternative to traditional file sharing might especially attract those users who would switch from traditional distribution channels to these systems due to economic and legal reasons.

User behaviour and attitudes

Figure 3 shows that the download decisions in the five groups differ according to the ratio of revenue splitting between traditional providers and users. First of all, the groups differ in the absolute number of downloads. While the participants in the 0:0 (revenue share of provider: revenue share of user) condition downloaded far more files than all other users, the number of downloads in all other groups increases with the share of revenues the participants are offered – with one exemption: The 100:0 group showed slightly more downloads than the 75:25 group. This result has probably been triggered by our test design. While users in the 100:0 group knew from the start that they could download only 75 songs within 30 minutes, users in the 75:25 group were looking for co-operating partners until the very last minute and thus missed the end of the simulation phase.

To answer research question 1, the ratio of downloads from a professional provider and other users is crucial. All of the groups first acquired files from the commercial provider. However, this was a necessity as all users had no files in the beginning and were forced to build up their own archives first by downloading from the professional provider. In the classic revenue model (100:0) in which uploading users are not remunerated, decentralized downloads – this is from other users and not from the professional provider – already accounted for one fifth of all downloads. Although there was no strict economic incentive for doing so, this can be attributed to the fact that users are indifferent in this case and/or that – the majority of the users being file-sharers

– they tend to prefer to download from other users rather than from the central provider. Accordingly, also in the peer-to-peer case (0:0) where no strict economic incentive was given, as many as every fourth download was from other users although, just as in the case of the classic revenue model, no comparative financial incentive is given.

Proposition 1: File-sharers tend to download from other users even if no financial incentive is offered which suggests that other than purely economic factors play an important role concerning exchange behaviour in decentralized file sharing systems

The remaining three groups, which included a remuneration for uploaders showed an even more decentralized download behaviour. When giving three-quarters of the price to the user (25:75) the file is downloaded four out of ten times from other users and not from a professional provider. The data makes clear that in comparison to the classic revenue model (100:0) the greatest relative change is to be observed with the introduction of decentralized superdistribution in general (21.2% → 29.9% downloads from other users). A constantly higher share of all revenues does not induce a constantly higher share of downloads from other users but a diminishing growth curve (relative growth: 8.7%, 5.6%, 1.6%). In order to check these differences with respect to significance we conducted another ANOVA. As the dependent variable we chose the share of downloads from other users (which adds up to 100% with the share of downloads from the provider). The results of this ANOVA show that four of our five groups differ significantly from each other (F-Value: 37.55; $p=0.001$): While the 100:0 group has significantly less downloads (21.2%) than all other groups, the 0:0 group again differs from all other groups and shows significantly less downloads (26.53%) than the 75:25 (29.98%), the 50:50 (35.4%) and the 25:75 group (37.13%). Finally the 72:25 group again differs from all other groups and comprises less downloads than the 50:50 and the 25:75 groups. Only the 50:50 and the 25:75 groups do not differ significantly.

Therefore our exploratory experiment indicates that there are good chances for professional providers to retain a large part of the revenues. From a certain point onwards (in our experiment 50%) further economic incentives do not significantly alter behaviour. As our experiment is not completely suitable for giving evidence on the shape of the function, future research may go into detail about the shape of the curve. Therefore, we derive the following proposition.

Proposition 2: Most important to users is the participation in revenues in general. A higher rate of revenues may lead to a diminishing growth rate of decentralized downloads from other users.

This result can partly be explained by the experimental design: because all participants had a maximum of 75€ to spend, the download was restricted in terms of money (except for group 0:0). It is important to bear in mind that all participants had to start with no songs in their archives and were therefore forced to build up a collection of songs first by downloading from the professional provider. Considering this, in a long-term real-life setting, a generally higher share of downloads from ‘other users’ may be expected. This estimation is strengthened by the fact that when asked about an optimum ratio of revenue splitting (for the question wording, see above), more than 80% of the users replied that they would be satisfied with a share of 41 to 50% (28% of all users) or even less (56% of all users; mean for all groups: 40.37%, SD: 21.78). But the results of an ANOVA (F-Value: 6.53; $p=0.001$) also show that users are influenced by their previous actions. While the participants in the groups 100:0 (mean: 33.60%; SD: 18.87), 0:0 (mean: 30.10%; SD: 17.89) and 75:25 (mean: 35%; SD: 20.78) would be satisfied with a relatively low share, the users who already received a higher share during the experiment ask for a significantly higher share afterwards (50:50: mean: 45.45% SD: 17.45; 25:75: mean: 57.7%; SD: 22.93). However, at least according to the data at hand, the possible hypothesis that users act as revenue-maximizing agents would have to be rejected. Moreover, as there are no standards for revenue sharing inside file-sharing systems so far and potential users react on the concrete offer, it seems to be possible to set the standards. Therefore we derive Proposition 3:

Proposition 3: Professional suppliers may well set the standards within a certain range because file-sharers do not seem to act as strict revenue-maximizing agents, are willing to share profits and have no absolute idea about adequate proportions.

The data on changing behaviour is supported by the post-experimental questionnaire on the initial attitude towards the system. As another series of ANOVAs demonstrates, the groups do not differ significantly in their overall satisfaction with the technical aspects of the prototype (Table 1). All of them are satisfied at a moderate level (mean: 2.30 on a five-point scale). Therefore differences in the appreciation of the system cannot be attributed to different perceptions of technical features but to perceptions of the basic idea of revenue splitting. When asked for the perceived option to make profit (facilitation of proceeds, Table 1) the groups that shared files on the basis of a revenue splitting model (25:75, 50:50 and 75:25) agreed significantly stronger to the statement that the programme allows for own proceeds than all other groups (this result can also be seen as a treatment check for the experimental setting). But only two groups in a revenue splitting condition (25:75 and 50:50) believe that the programme they worked with is significantly fairer than respondents in all

Table 1. Group differences – overall satisfaction with the prototype, facilitation of proceeds and perceived fairness

	Total (n=100) mean (SD)	group 0:0 (n=20) mean (SD)	group 25:75 (n=20) mean (SD)	group 50:50 (n=20) mean (SD)	group 75:25 (n=20) mean (SD)	group 100:0 (n=20) mean (SD)	F-value (p-value)
Overall satisfaction	2.30 (0.81)	2.30 (0.87)	2.35 (0.59)	2.10 (0.64)	2.40 (0.99)	2.35 (0.93)	0.41 (0.80)
Facilitation of proceeds	2.41 (1.10)	2.85 ^a (0.75)	1.90 ^b (1.02)	2.15 ^b (1.09)	2.15 ^b (1.18)	3.00 ^a (1.08)	4.39 (0.003)
Fairness	1.92 (0.93)	2.10 ^a (0.79)	1.80 ^b (0.95)	1.45 ^b (0.83)	2.25 ^a (1.12)	2.00 ^{ab} (0.80)	2.35 (0.050)

Basis: 100 participants.

Questions:

Overall satisfaction: 'How satisfied are you with the technical aspects of the program as a whole?' answers on a five-point Likert scale from 1=completely satisfied to 5=not satisfied at all).

Facilitation of proceeds: 'How much do you agree with the following statements?: The program ...facilitates proceeds.'

Fairness: 'How much do you agree with the following statements?: The program ...realizes a fair idea.'

Answers on a five-point Likert scale from 1=strongly agree to 5=strongly disagree).

Note: means with different superscripts differ significantly according to post-hoc-tests for group differences (Duncan; $p < 0,05$).

other groups. For respondents in the 75:25 revenue splitting condition the economic incentives are seemingly to low to differentiate the system from a full-payment or for-free system. A closer inspection of the means in each group offers an even more surprising result: Both revenue sharing conditions that trigger downloads from user-to-user to the greatest extent (25:75 and 50:50) are perceived to be much fairer than the simulation of an illegal system (0:0).

To sum it up: Our participants showed a relatively high-level of appreciation for revenue splitting inside file-sharing systems. Although our experiment offers first insights only and cannot completely determine the level of acceptance of superdistribution models for digital music, we postulate a rather daring but fruitful proposition for both researchers and practitioners.

Proposition 4: Superdistribution concepts for digital music deserve a higher level of appreciation than other concepts of digital music distribution.

In conclusion, the results indicate that users' download behaviour and appreciation for the download system can be triggered, but not wholly determined by financial incentives. First, we observed that including uploaders in revenue shares produced an effect of more decentralized download behaviour from other users. Second, we observe that the fact of participating is of primary influence whereas the rate of participation is not of such importance. Third, users show a rather high appreciation of this decentralized C2C business model.

IMPLICATIONS

At first sight, traditional content providers like music labels might argue against the model we have presented,

fearing reduced revenue shares resulting from user participation, assuming the total price per music file was kept constant. However, there are several points that weaken this argument. First, the percentage of expected revenue participation does not seem to be extraordinarily high but around 30 to 40% for the typical user in our experiment. This percentage is similar to the fraction of the revenues which download services like iTunes Music Store receive for offering media content for download. Second, it seems reasonable to apply different price models for different files (e.g. a higher ratio for the service provider when new files are sold, a lower one in the case of older files). Third, a digital provision of media content is substantially cheaper than physical reproduction and distribution (Buhse 2004) and therefore the effect of less revenue is at least partly outweighed by less marginal reproduction costs. Finally, unlike in classic music business models, traditional providers can participate in each decentralized download between peers. Thus, a continued revenue share is to be expected at least from some users. Despite a constant total price per file, the number of files paid for will significantly increase.

Independently from a strictly economic analysis based on financial concerns, there seem to be more qualitative or 'social' benefits in the tested C2C business model we have presented. As mentioned above, decentralized download behaviour does not strictly relate to an increasing revenue share but rather grows diminishingly. This indicates that users seem to appreciate foremost the chance to participate in this C2C business model and they do not seem to act as profit maximizing actors. Incentives as modelled in superdistribution models seem to be one way to reintegrate file-sharers into the legal market for music. From the music company's perspective this business model could contribute to a better image as it was considered to be fair by most of the participants.

Moreover, it can be assumed that many P2P users are uncertain about legal aspects of file sharing at the moment. Therefore the business model presented above might attract uncertain users as well as economic players who try to buy and resell files.

Taken together, if our proposed model succeeds, several players can benefit from it:

- First, music labels are able to regain ground against for-free file-sharing systems in the field of digital music distribution by reintegrating file-sharers into a legal service.
- Second, from the view of musicians and music labels, the model presents a cheap way of marketing music as the distribution is decentralized and is fulfilled at minimal cost.
- Third, apart from marketing the music, music labels can market themselves as the model appears to be highly appreciated by users
- Fourth, telecommunication companies profit from digital music distribution as they provide the digital infrastructure for each download.
- Last but not least, users profit from every download provided by them, allowing them to become music traders of their own.

LIMITATIONS AND FURTHER RESEARCH

The examination of decentralized electronic commerce between users (C2C) is a rather new theoretic field. There are no major empirical studies yet on the behaviour inside, as well as the acceptance of, these innovative business models nor is there a specific theoretical construct which can be employed to test C2C electronic commerce empirically. For this reason, we conducted an exploratory study by means of a laboratory experiment.

The results of such an exploratory experiment entail several limitations. We were able to show that economic incentives caused a considerable impact on user behaviour inside the simulated peer-to-peer system. Due to typical limitations of experiments, the participants can be seen as ‘typical’ file-sharers but not as representative for the whole population of file-sharers. Consequently, the experiment can only provide some initial insights. Furthermore, as only one variable was varied across the five groups there might be other variables which influence user behaviour to an even greater extent, e.g. in reality no time and money restrictions are to be observed and a typical file-sharing network is far bigger than in the experiment. Although users generally felt satisfied not only with the business model but also with the software prototype, a modified software application could influence the results and lead to different effects. Concerning an application of the model in a real

business model, legal issues – neglected totally in the experimental setting – would have to be considered.

Further research could focus on a modification of the independent variable. Considering the decreasing growth of downloads from other users when increasing the revenue share for supplying users, the experiment could be repeated with different ratios more close to the ratio of 40% participation for peers. This ratio was considered to be fair by the average user. Additionally, the effect of direct economic incentives for downloading users could be compared to the indirect compensation as was modelled here. Furthermore, an additional remuneration of the original copyright owner (artist) – as modeled by Gehrke and Anding (2002) – could lead users to download even more from other users as the artists reputation can be assumed to be generally high.

Further research could also focus on reasons for changes in the observed user behaviour. It would be interesting to know more about the objective of cooperative behaviour among users. Do users primarily act according to (random) utility maximization as they calculate money to stay longer inside the peer group and therefore the statistical probability of a return on investment is higher? Or are users more socially motivated as they simply prefer to download from other peers rather than of professional providers? What makes them believe that other users will support them in the future? (Social norms, social trust and social capital might be starting points for an explanation here, cf., Putnam 1995). And if there is an impact of economic incentives in general, do they also influence the decision of which file to purchase? Maybe users act as entrepreneurs trying to anticipate which files are more easily resold and include this calculus in their purchasing decision. If there is a gambling effect like this, is it another motivation for formerly illegal file-sharers to participate in a legal download system like the one presented here? Surely, also the contrary may be true as a ‘commercialization’ of file-sharing systems might have worked in our experimental setting but probably will not be accepted by the peer community as a whole because it might be perceived as an attack on peer-to-peer culture.

More generally speaking, all of these research questions address potential interdependences of technological (peer-to-peer systems), economic (incentives) and social aspects (cooperation, altruism). This research frontier opens up potential for further interdisciplinary research on electronic markets like in the case at hand.

References

- Achrol, R. S. and Stern, L. W. (1988) ‘Environmental Determinants of Decision-Making Uncertainty in Marketing Channels’, *Journal of Marketing Research* 25: 36–50.

- Ajzen, I. (1991) 'The Theory of Planned Behaviour', *Organizational Behaviour and Human Decision Processes* 50: 179–211.
- Alderson, E. (1965) *Dynamic Marketing Behaviour*, Homewood, IL: Richard D. Irwin, Inc.
- Anandalingam, G., Day, R. W. and Raghavan, S. (2005) 'The Landscape of Electronic Market Design', *Management Science* 51: 316–27.
- Andreoni, J. (1990) 'Impure Altruism and Donations to Public Goods: A Theory of Warm Glow Giving', *Economic Journal* 100: 464–77.
- Apple Inc. (2007) 'Usage of iTunes Music Store', available online at: <http://www.apple.com/pr/library/2007/07/3litunes.html>
- Baumann, S., Jobity, N., Airey, J. and Atak, H. (2000) 'Invites, Intros and Incentives: Lessons from a Web Survey', *American Association for Public Opinion Research Annual Conference*, Portland, OR.
- Benlian, A., Walter, B. von. and Hess, T. (2005) 'Semantically Enriched Information Seeking in Peer-to-Peer File Sharing Systems – Empirical Evidence from the User Perspective', *Proceedings of the 38th Annual Hawaii International Conference on System Sciences*, (HICSS-38), Hawaii.
- Brockhoff, K. (1995) *Management von Innovationen*, Wiesbaden: Gabler.
- Buhse, W. (2001) 'Digital Rights Management for Music File-sharing Communities', *Proceedings of the Seventh Americas Conference on Information Systems*, (AMCIS 2001), Boston, MA.
- Buhse, W. (2004) *Wettbewerbsstrategien im Umfeld von Darknet und Digital Rights Management - Szenarien und Erlösmodelle für Onlinemusik*, Wiesbaden: DUV.
- Carman, J. M. (1992) 'Theories of Altruism and Behaviour Modification Campaigns', *Journal of Macromarketing* 12: 5–18.
- Cropanzano, R. and Mitchell, M. (2005) 'Theories of Altruism and Behavior Modification Campaigns', *Journal of Management* 31: 874–900.
- Cox, B. (1994) Superdistribution, *Wired* 209: 89–92.
- Davis, F. D. (1989) 'Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology', *MIS Quarterly* 13: 319–39.
- Fattah, H. M. (2002) *P2P: How Peer-to-Peer Technology Is Revolutionizing the Way We Do Business*, Chicago: Dearborn Trade Publishing.
- Fehr, E. and Schmidt, K. (2006) 'The Economics of Fairness, Reciprocity and Altruism - Experimental Evidence and New Theories', in: S.-C. Kolm and J. Mercier Ythier (eds) *Handbook of the Economic of Giving, Altruism and Reciprocity*, Vol. 1, Amsterdam: Elsevier, pp. 25–32.
- Gehrke, N. (2004) *Peer-to-Peer-Applikationen für elektronische Märkte – Perspektiven für eine hochgradig dezentralisierte digitale Wirtschaft*, Wiesbaden: DUV.
- Gehrke, N. and Anding, M. (2002) 'A Peer-to-Peer Business Model for the Music Industry', in: J. L. Monteiro, P. M. C. Swatman and L. V. Tavares (eds) *Towards the Knowledge Society – eCommerce, eBusiness and eGovernment*, Boston: Kluwer Academic Publishers, pp. 243–58.
- Gopal, R. D., Sanders, G. L., Bhattacharjee, S., Agrawal, M. and Wagner, S. C. (2004) 'A Behavioural Model of Digital Music Piracy', *Journal of Organizational Computing and Electronic Commerce* 14: 89–105.
- Grewal, D., Monroe, K. B. and Krishnan, R. (1998) 'The Effects of Price-comparison Advertising on Buyer's Perceptions of Acquisition Value, Transaction Value, and Behavioural Intentions', *Journal of Marketing Research* 62: 6–59.
- Harms, I. and Schweibenz, W. (2000) 'Testing Web Usability', *Information Management & Consulting* 15: 61–6.
- Haug, S. and Weber, K. (2003a) 'Tauschnetzwerke im Internet und im Freundeskreis. Eine empirische Untersuchung der Wirksamkeit der Reziprozitätsnorm beim Tauschen. Teil I: Bestimmungsfaktoren der Reziprozität beim Tauschen', *kommunikation@gesellschaft* 4, available online at: http://www.soz.uni-frankfurt.de/K.G/B6_2003_Haug_Weber_I.pdf
- Haug, S. and Weber, K. (2003b) Tauschnetzwerke im Internet und im Freundeskreis. Eine empirische Untersuchung der Wirksamkeit der Reziprozitätsnorm beim Tauschen. Teil II: Ergebnisse der Online-Befragung', *kommunikation@gesellschaft* 4, available online at: http://www.soz.uni-frankfurt.de/K.G/B7_2003_Haug_Weber_II.pdf
- Hayashi, A. M. (1996) 'Is Corporate America Ready for e-Commerce?' *Datamation* 42: 54–6.
- Helm, S. (2000) 'Viral Marketing – Establishing Customer Relationships by "Word-of-mouse"', *Electronic Markets – The International Journal* 10: 158–61.
- Herrmann, T., Misch, A. and Moysisch, K. (1999) 'Methodische Aspekte bei Akzeptanzuntersuchungen', in: N. Szyperski (ed.) *Perspektiven der Medienwirtschaft. Kompetenz – Akzeptanz – Geschäftsfelder*, Lohmar, Köln: Josef Eul Verlag.
- Hess, T. and von Walter, B. (2006) 'Toward Content Intermediation: Shedding New Light on the Media Sector', *The International Journal on Media Management* 8: 2–8.
- Kamel, N., Narasipuram, M. M. and Toraskar, K. (1997) 'An Approach to Value-based Modeling of Information Flows', *The Information Society* 13: 93–105.
- Kauffman, R. J. and Walden, E. A. (2001) 'Economics and Electronic Commerce: Survey and Directions for Research', *International Journal of Electronic Commerce* 5: 5–116.
- Kiyonari, T., Tanida, S. and Yamagishi, T. (2000) 'Social Exchange and Reciprocity: Confusion or a Heuristic?', *Evolution and Human Behaviour* 21: 411–27.
- Kollmann, T. (2001) 'Measuring the Acceptance of Electronic Marketplaces: A Study Based on Used-car Trading Sites', *Journal of Computer Mediated Communication* 6(2), available online at: <http://jcmc.indiana.edu/vol6/issue2/kollmann.html>
- Liebowitz, S. (2005) 'Testing File-Sharing's Impact by Examining Record Scales in Cities', available online at: <http://ssrn.com/abstract=829245>

- McKean, R. N. (1975) 'Economics of Trust, Altruism and Corporate Responsibility', in: E. S. Phelps (ed.) *Altruism, Morality and Economic Theory*, New York: Sage, pp. 29–43.
- Mori, R. and Kawahara, M. (1990) 'Superdistribution – The Concept and the Architecture', *The Transactions of the IEICE*, E 73.
- North, D. C. (1990) *Institutions, Institutional Change and Economic Performance*, Cambridge, UK: Cambridge University Press.
- Nützel, J. and Grimm, R. (2003) 'Potato System and Signed Media Formats – An Alternative Approach to Online Music Business', *Wedelmusic 2003*, Conference, Leeds, United Kingdom.
- Oberholzer, F. and Strumpf, K. (2004) *The Effect of File Sharing on Record Sales: An Empirical Analysis*, Harvard Business School, mimeo.
- Oram, A. (2001) *Peer-to-Peer: Harnessing the Power of a Disruptive Technology*, Beijing: O'Reilly & Associates, Inc.
- Peitz, M. and Waelbroeck, P. (2005) 'An Economist's Guide to Digital Music', *CESifo Economic Studies* 51: 359–428.
- Picard, R. G. (1989) *Media Economics: Concepts and Issues*, Newbury Park, CA: Sage Publications.
- Putnam, R. D. (1995) 'Bowling Alone. America's Declining Social Capital', *Journal of Democracy* 6: 65–78.
- Schechter, S. E., Greenstadt, R. A. and Smith, M. D. (2003) 'Trusted Computing, Peer-to-Peer Distribution, and the Economics of Pirated Entertainment', *Paper presented at the Second Annual Workshop on Economics and Information Security*, College Park, Maryland, 29–30 May.
- Schenk, M. and Wolf, M. (2000) *Nutzung und Akzeptanz von E-Commerce*, Hohenheim, Universität Hohenheim. Forschungsstelle für Medienwirtschaft und Kommunikationsforschung.
- Stern, L. W. (ed.) (1965) *Distribution Channels: Behavioural Dimensions*, Boston, MA: Houghton Mifflin Company.
- Timmers, P. (1998) 'Business Models for Electronic Markets', *Electronic Markets – The International Journal* 8: 3–8.
- Urbaczewski, A., Jessup, L. M. and Wheeler, B. (2002) 'Electronic Commerce Research: A Taxonomy and Synthesis', *Journal of Organizational Computing and Electronic Commerce* 12: 263–305.
- Vander Nat, P. and Keep, W. (2002) 'Marketing Fraud: An Approach for Differentiating Multilevel Marketing from Pyramid Schemes', *Journal of Public Policy & Marketing* 21: 139–51.
- von Walter, B. and Hess, T. (2004) 'A Property Rights View on the Impact of File Sharing on Music Business Models – Why iTunes is a Remedy and MusicNet is Not', *proceedings of the Americas Conference on Information Systems*, New York.
- Wigand, R. T. (1997) 'Electronic Commerce: Definition, Theory, and Context', *The Information Society* 13: 1–16.
- Wigand, R. T., Picot, A. and Reichwald, R. (1997) *Information, Organization and Management - Expanding Markets and Corporate Boundaries*, Chichester, UK: Wiley.
- Williamson, O. E. (1999) *The Economics of Transaction Costs*, Cheltenham, UK: Elgar.
- Young, L. C. and Wilkinson, I. F. (1989) 'The Role of Trust and Co-operation in Marketing Channels: A Preliminary Study', *European Journal of Marketing* 23: 109–22.
- Zajac, E. J. and Olsen, C. P. (1993) 'From Transaction Cost to Transactional Value Analysis: Implications for the Study of interorganizational strategies', *Journal of Management Studies* 30: 131–45.