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On file sharing with indirect Network effects between concert ticket sales and music recordings

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DISCUSSION PAPER

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On File Sharing with Indirect Network Effects Between Concert Ticket Sales and Music Recordings*

Ralf Dewenter† Justus Haucap‡ Tobias Wenzel§

Abstract

This paper analyses the interdependency between the market for music recordings and concert tickets, assuming that there are positive indirect network effects both from the record market to ticket sales for live performances and vice versa. In a model with two interrelated Hotelling lines prices in both markets are corrected downwards when compared to the standard Hotelling model. Also, file sharing has ambiguous effects on firms' profitability. As file sharing can indirectly increase demand for live performances overall profits can either increase or decrease, depending on the strength of indirect network effects. Finally, file sharing may induce firms to switch from the traditional business model with two separate firms to an integrated business model where one agency markets both records and concerts (so-called 360 degree deals).

JEL-Classification: L13, L82, Z10.

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Keywords: Music Industry, Indirect Network Effects, File Sharing, Piracy, Record Sales, Concert Tickets.

1 Introduction

The music industry is going, once again, through a phase of rapid technological change. The digitalisation of music has made copyright enforcement much more difficult and costly, and there is a heated and very controversial debate about the effects of file sharing possibilities (see, e.g., Oberholzer-Gee and Strumpf (2007); Liebowitz (2007)). Most of the debate focuses on the question how file-sharing affects record sales, firms' profits and music distribution systems (see, e.g., Alexander (2002); Peitz and Waelbroeck (2006)) as well as vertical product differentiation (quality) (e.g, Bayaan (2004)). While there is also a limited literature that addresses the effects on concert ticket sales (in particular Curien and Moreau (2009); Gayer and Shy (2003, 2006)), this literature only analyses how record sales affect the demand for live performances, ignoring the fact that live performances may also also affect the demand for music recordings. While our paper builds on this research, we explore how file-sharing, record sales, and the demand for concert tickets are interrelated in (imperfectly) competitive markets with differentiated goods where record and ticket sales are interrelated. Hence, the key differences between Curien and Moreau (2009), Gayer and Shy (2003, 2006) and our paper are (a) that we analyse an (imperfectly) competitive market instead of a monopoly and (b) our model does not only analyse effects from record to ticket sales but also feedback effects from ticket to record sales.

For this purpose our paper analyses a model with two Hotelling lines (Hotelling, 1929) where demand for a given product in the one market (e.g.,

the record market) affects product demand in the other market (e.g., concert tickets) and vice versa. Put differently, we assume that - as music consumption is also a *social* phenomenon, as many individuals tend to partially define themselves through their music consumption - the demand for concerts is increasing in record sales while the demand for records itself is also increasing in concert ticket sales.

While our paper aims at helping to explain and understand some recent trends in the the music industry, another example which fits our framework may be the relationship between books and movies (based on these books). For example, Harry Potter books and movies may be complements and exhibit indirect network effects. The reading of a Harry Potter book may provide a higher utility if more people also watch the movie, while at the same time the movie is the more attractive the more books are sold. In principle, any complementary products that exhibit these social network effects may serve as examples.

As there are indirect network effects present between the two products, our model may be interpreted as a particular example of a two-sided market model in the sense of Armstrong (2006), Rochet and Tirole (2006) or Belleflamme and Peitz (2010). In two-sided markets there is typically one intermediary who promotes transactions between different types of consumers in the presence of indirect network effects. In contrast, in our model there is only one group of consumers who demands several types of products between which indirect network effects exist. Thus, we contribute to the two-sided market literature by considering the impact of piracy in such markets.[1] We also analyse (in section 4) the case of separated firms selling records and concert tickets independent from each other, something that is difficult to

[1]See also Rasch and Wenzel (2011) for a complementary study of piracy in a two-sided market, albeit in the context of the software industry.

conceive if we deal with typical platforms in two-sided markets.[2]

The remainder of the paper is now organised as follows: The next section introduces and analyses the model before section 3 extends the model to illegal file sharing (i.e., piracy). Section 4 then analyses the case of non-integrated business models where one firm sells the music record while another organises tours and sells concert tickets, as it has been traditionally the case in the music industry before so-called 360 degree deals became fashionable. Our main results and conclusions are finally summarised in section 5.

2 The Model

Let us consider the market for records (or other forms of music recording) on the one hand and the market for music shows and performances on the other hand. For both markets we assume that consumers are located uniformly along a Hotelling line with two different bands or brands - located at the endpoints of these lines - managed by two independent firms. In this section, we assume that one integrated firm markets both records and show tickets or, put differently, we assume that artists sign so-called 360 degree deals. Under a 360 degree deal, one company is responsible for handling both an artist's record sales as well as touring and ticket sales. While traditionally an artist's record sales and concerts were managed by different agents (a case which will be analysed in section 4 of our paper), 360 degree deals have become more and more standard in the music industry in recent years (see, e.g., Kasubian

[2]Our model is also somewhat related to the so called multi channel sales literature which analyses how sales in one channel (for, e.g., online markets) affect sales in other markets (e.g., traditional "offline" markets) from a management and marketing perspective. See e.g. Danaher et al. (2010) for an empirical analysis on piracy and multi channel sales.

(2009)).

We assume that there are two types of consumers. While there are N consumers (called music lovers) that receive utility from both musical recordings and live music shows (concerts), there are also M consumers which do not like to attend shows, but only receive utility from recordings. The latter group will be called listeners. A given music lover k is assumed to receive the following utility from buying a music recording of band i:

$$U_R^k = V_R - tl_k + \theta s_i - p_i,$$

where l_k denotes k's distance from band i, while t measures the associated "transportation" costs. The number of live concerts of band i is denoted by s_i, i.e. we assume that a music lover's utility from a given music recording i is increased by θs_i if there are also s_i live concerts associated with the band's album.[3] In our model, s_i corresponds to the share of music lovers that attend a concert of band i.[4] In contrast, θ is assumed to be zero for simple music listeners, i.e., they do not receive any additional utility from live concerts. Hence, the number of live performances is utility enhancing for music lovers and a tool of vertical product differentiation for them while it is not relevant for the M music listeners (i.e, $\theta = 0$ for music listeners, while $\theta > 0$ for music lovers). The record price, p_i, is deducted from consumers' utility. The gross utility from consuming recorded music, V_R, is assumed to be sufficiently high to ensure that all music lovers and listeners buy records.

[3]To focus on network effects across markets we neglect possible network effects within markets. See e.g. Gayer and Shy (2006) for a model that considers network effects within a market.

[4]Note that the indirect network effect depends only on the share of music lovers that attend the concert by band i. Thus, the strength of the indirect network effect is independent of the market size and the presence of music listeners. The same applies to the indirect network effect from music recordings on the concert market.

Now let the music lovers' utility from attending a live concert be given by

$$U_C^k = V_C - dl_k + \delta q_i - w_i,$$

where V_C is the gross utility of attending a concert, l_k denotes, as before, k's distance from band i, while d measures the associated transportation costs in the live concert market. There is again a complementarity between records and live concerts so that the utility from live concerts is enhanced by a factor of δ the more records are sold. The variable q_i denotes the share of music lovers that buy records of band i. Hence, there are indirect network effects from both the record market to the live concert market (the strength of which is measured by δ) while the strength of the indirect network effects from the live concert market to the record market is measured by θ. The ticket price per live concert of band i is denoted by w_i.

To ensure equilibrium existence, we assume that the degree of product differentiation in the markets for records and concerts is sufficiently large compared to the network effects between the two markets:[5]

Assumption 1 $4td(N+M) > N(\theta+\delta)^2 + 4M\theta\delta$.

The indifferent music lover (q_m) and music listener (x_m) in the music record market and the marginal consumer in the live concert market (s_m) are given by

$$V_R - tq_m + \theta s_1 - p_1 = V_R - t\,(1 - q_m) + \theta s_2 - p_2,$$

$$V_R - tx_m - p_1 = V_R - t\,(1 - x_m) - p_2,$$

$$V_C - ds_m + \delta q_1 - w_1 = V_C - d\,(1 - s_m) + \delta q_2 - w_2.$$

[5]The details are provided in the Appendix.

Hence, the respective demands for band i are given by:

$$q_i = \frac{1}{2} + \frac{(p_j - p_i) + \theta(s_i - s_j)}{2t}, \tag{1}$$

$$x_i = \frac{1}{2} + \frac{(p_j - p_i)}{2t}, \tag{2}$$

$$s_i = \frac{1}{2} + \frac{(w_j - w_i) + \delta(q_i - q_j)}{2t}. \tag{3}$$

Taking into account the interdependencies between q_i and s_i, we can reformulate the two respective demand functions as

$$q_i = \frac{1}{2} + \frac{\theta(w_j - w_i) + d(p_j - p_i)}{2(dt - \theta\delta)}, \tag{4}$$

and

$$s_i = \frac{1}{2} + \frac{\delta(p_j - p_i) + t(w_j - w_i)}{2(dt - \theta\delta)}. \tag{5}$$

As we assume, in this section, that bands sign 360 degree deals so that one integrated firm manages all aspects of the band (record sales and touring), the profit of band i can now be written as follows:[6]

$$\pi_i(p_i, w_i) = Np_iq_i + Mp_ix_i + Nw_is_i. \tag{6}$$

Solving the first-order conditions yields the following equilibrium prices leading to an equilibrium where each band attracts half of the market:

[6]Notice that we have normalized all possible costs (e.g., producing and marketing records, organising concerts,...) to zero. Due to our assumption of inelastic demand introducing linear variable costs would not affect our results. Introducing fixed costs would also not affect our results as long these costs are not too high so that both firms can earn positive profits in equilibrium.

$$p^* = t - \delta \left(\frac{N}{M+N} \right), \tag{7}$$

$$w^* = d - \theta \left(1 + \frac{\delta}{t} \frac{M}{N+M} \right). \tag{8}$$

Note that the resulting prices are lower than in the simple Hotelling model. If we ignore the music listeners and set $M = 0$, so that we only focus on the two interdependent demand functions q_i and s_i we can rewrite the two prices as

$$p = t - \delta, \tag{9}$$

and

$$w = d - \theta. \tag{10}$$

That means that both prices are corrected downwards. This result contrasts with other models of two-sided markets or complementary products where usually the price for one good or service is lower while the prices for the other product or service increases when compared to a reference model without complementarities or indirect network effects (Wright, 2004; Parker and van Alstyne, 2005). In our model of two interdependent Hotelling lines, this changes because, in contrast to other models, there is no market expansion, but only a business stealing effect. Hence, labels compete aggressively in order to win customers. The more consumers' utility of live concerts and, therefore, their demand for them is affected by record sales (as measured by δ) the lower is the price for records and vice versa. If the indirect network effects from one market to the other are very strong, one price may even turn negative, in principle.

Obviously, the downward correction of the record price is the lower the fewer customers are interested in concerts. If the fraction of music lovers in

the population, as measured by $N/(M+N)$, becomes smaller, the downward bias of the record price, p, is also reduced. Similarly, the downward correction of the concert ticket price, w, is the more severe the more music listeners there are (i.e., the higher $M/(M+N)$). The intuition is as follows: The more music listeners (who are not interested in concerts) there are, the higher is the opportunity cost (in terms of foregone revenues) of lowering the record price (as it only stimulates demand for music concerts for a fraction of the population). Hence, with many music listeners firms rather keep record prices up and stimulate record sales to music lovers by "cross-subsidising" ticket prices.

Inserting equilibrium prices into the profit function, we obtain equilibrium profits of each label:

$$\pi^* = \frac{(N+M)}{2}\left[t - \delta\left(\frac{N}{M+N}\right)\right] + \frac{N}{2}\left[d - \theta\left(1 + \frac{\delta}{t}\frac{M}{N+M}\right)\right].$$

The network effects have a negative impact on profitability. The higher δ and θ, the lower is the label's profit. The reason is the aforementioned downward pressure on prices for records and concerts due to the interrelated demands for the two products. Concerning the degree of product differentiation, measured by d and t, the model delivers the standard predictions. The higher the transportation costs, the higher are the music labels' profits.

3 File Sharing

Let us now analyse how (illegal) file sharing or piracy affects the equilibrium. For this purpose we assume that only a fraction α of the customer masses of N and M is actually paying for recorded music while the fraction $(1-$

α) is engaging in piracy or (illegal) unpaid file sharing. Label i's profit maximisation problem now becomes

$$\pi_i = \alpha N p_i q_i + \alpha M p_i x_i + N w_i s_i.$$

Our restriction on parameter values to guarantee equilibrium existence modifies as follows:

Assumption 2 $4td(N+M)\alpha > N(\alpha\theta+\delta)^2 + 4\alpha M\theta\delta.$

Deriving the first-order conditions and solving yields the following equilibrium values

$$\hat{p} = t - \frac{\delta}{\alpha}\left(\frac{N}{M+N}\right),$$

and

$$\hat{w} = d - \theta\left(\alpha + \frac{\delta}{t}\frac{M}{N+M}\right).$$

File sharing has opposite effects on the prices for records and concerts. It decreases the price for records, but increases the price for live concerts. Note that this effect of file sharing relies on the presence of complementarities between the two markets.

To understand our results, suppose first that there are no complementarities, that is, $\delta = \theta = 0$. Then, equilibrium prices would not be affected by file sharing, but file sharing would only affect labels by reduced profitability in the market for records, as only a proportion α of consumers would actually pay for records. The market for live concerts would not be affected at all. Next suppose that $\delta > 0$, but still $\theta = 0$, i.e., there is only a positive complementarity from record sales on the utility from concerts. Then, increased file sharing reduces the equilibrium price p for records, but leaves

the ticket price w for concerts unchanged. The intuition is as follows: As shown above, a positive δ induces firms to lower their price in the market for records to attract additional customers in the market for live music. An increase in file sharing decreases the opportunity costs of lowering the price for records, as only a fraction α actually pays for recorded music. Thus, in equilibrium the price for records is reduced. Now suppose that there is additionally a positive complementarity from concert visits onto record sales. Due to the complementarity prices for concerts are lower than in a standard Hotelling model. However, this downward correction depends on the degree of file-sharing. The more file-sharing the lower the incentives to reduce the price for concerts to attract sales in the record market, as the benefit in the record market is reduced with more file-sharing.

Inserting equilibrium prices into profits gives

$$\hat{\pi} = \frac{(N+M)}{2}\left[\alpha t - \delta\left(\frac{N}{M+N}\right)\right] + \frac{N}{2}\left[d - \theta\left(\alpha + \frac{\delta}{t}\frac{M}{N+M}\right)\right].$$

Comparative statics concerning the degree of product differentiation and the size of the network effects yield the same results as without file sharing. More interestingly, how does file sharing affect the labels' profitability? Differentiating profits with respect to α yields

$$\frac{\partial \hat{\pi}}{\partial \alpha} = \frac{(M+N)t - N\theta}{2}. \tag{11}$$

This expression can either be positive or negative. Profits increase with file sharing, that is $\frac{\partial \Pi^*}{\partial \alpha} < 0$, if $\theta > t\frac{N+M}{M}$. Hence, file sharing can have a positive impact on profits if the stimulating effect from concerts on record sales is sufficiently strong. As seen above, increased file sharing has a positive

effect on concert prices but a negative effect on record prices. Thus, the overall effect depends on the size of these two effects. If t is high, record sales make up for a large proportion of profits. Then, file sharing (i.e., a lower value of α) has a detrimental effect on labels' profits. However, if t is relatively low, income from record sales is relatively unimportant and file sharing has a positive impact on profits.

Note that the economic literature has shown several avenues by which file-sharing may increase profits: Peitz and Waelbroeck (2006) show that due to sampling effects record companies may gain from downloading. Free samples inform consumers about available products and can increase their willingness to pay. In Gayer and Shy (2006) different players in the music industry are affected differently by file sharing. While record companies lose from file sharing, artists may gain due to cross-effects onto the market for concerts and other merchandising. Network externalities within the market for records may also make record companies benefit from piracy (Conner and Rummelt, 1991; Shy and Thisse, 1999). If demand for legal copies rises with the amount of illegal copies profits may increase. We add to these results by highlighting a further avenue. If network effects from concert attendance on record sales are significant, then file sharing can be positive for a label's profit as labels compete and price less aggressively in the concert ticket market because stimulating record sales is less rewarding. Note that this result is obtained even though there is no market expansion effect present in our model.[7] The driving force in our model is the reduced business stealing effect due to file sharing.

[7]Due to the Hotelling setup, each consumer demands a single unit of a product and, hence, total demand is constant.

4 The non-integrated business model

So far we have studied a business model of the industry where firms are integrated and offer both records and concerts of a band i. This section studies an alternative business model that has traditionally been applied in the music industry, namely that firms are not integrated, and records and concerts of band i are sold by separate entities. The purpose of this section is to study whether the extent of file sharing may affect a band's choice of the business model.

For simplicity and without loss of generality, we focus on the case with only music-lovers ($M = 0$). The profit of a record company and a concert promoter, respectively, is then

$$\pi_r = \alpha N p_i q_i, \tag{12}$$

and

$$\pi_c = N w_i s_i. \tag{13}$$

Prices for concert tickets and records are chosen independently leading to the following equilibrium values:

$$\overline{p} = t - \frac{\delta\theta}{d}, \tag{14}$$

and

$$\overline{w} = d - \frac{\delta\theta}{t}. \tag{15}$$

Note that piracy does not affect equilibrium prices, as the level of file sharing is exogenous and is not affected by record prices in our model. To analyze labels' preference for or against this business model, we report the

joint profits of the record company and the corresponding concert organiser:

$$\overline{\pi} = \frac{1}{2}\alpha N \left[t - \frac{\delta\theta}{d}\right] + \frac{1}{2}N \left[d - \frac{\delta\theta}{t}\right]. \tag{16}$$

It follows that file sharing has a negative impact on the profitability of record companies due to a lower number of legal sales, but has no effect on the concert industry. Joint industry profits decrease with file-sharing. This is in contrast to the market structure with integrated firms where file-sharing can - under certain circumstances - actually increase profits. We can conclude that increased file sharing may induce the music industry to alter its business model towards an integration of record and concert management, as has happened indeed with the growing introduction of 360 degree deals in recent times. Formally, the integrated business models leads to higher profits if the problem of file sharing is sufficiently severe, that is, if legal sales are sufficiently unimportant:

$$\alpha < \frac{\delta d(\theta - t)}{t\theta(d - \delta)}. \tag{17}$$

5 Summary and Conclusions

This paper has analysed the interdependency between the market for music recordings and concert tickets, assuming that there are positive indirect network effects both from the record market to ticket sales for live performances and vice versa. Using a model with two interrelated Hotelling lines we have shown that prices in both markets are corrected downwards when compared to the standard Hotelling model. Furthermore, we have shown that the effects of file sharing on labels' profitability are ambiguous. File sharing can actually lead to higher profits through increased concert ticket demand if

indirect network effects are sufficiently strong.

In addition, we have shown that an integrated business model can be more profitable than the traditional model of separated record and tour management if file sharing is sufficiently strong or, put differently, once the level of legal record sales becomes sufficiently unimportant.

Given that profits may even increase through file sharing one may speculate that variety may increase in a more general model with market entry. While we have to leave this question open at this point, we consider it an interesting topic for future research to analyse how market entry and product variety are affected through file sharing if demands for show tickets and music recordings are interrelated. Similarly, we have not endogenised the amount of file sharing in our model but rather taken it as an exogenously given fact. A richer model may also endogenise the file sharing decision, which we leave for future research.

Appendix

For the equilibrium to exist the second order conditions must hold. We consider the more general case with file-sharing.The Hessian of the optimisation problem of firm i with file-sharing is

$$H = \begin{pmatrix} -\frac{Nd\alpha}{td-\theta\delta} - \frac{M\alpha}{t} & -\frac{N(\alpha\theta+\delta)}{2(td-\theta\delta)} \\ -\frac{N(\alpha\theta+\delta)}{2(td-\theta\delta)} & -\frac{Nt}{td-\theta\delta} \end{pmatrix}. \tag{18}$$

For the second-order conditions to be fulfilled the Hessian needs to be

negative semi-definite which is ensured if two conditions are met:

$$td > \theta\delta, \tag{19}$$

and

$$4td(N+M)\alpha > N(\alpha\theta+\delta)^2 + 4\alpha M\theta\delta. \tag{20}$$

It can then be shown that the second condition is more restrictive. Reformulating, the first condition can be expressed as $4td(N+M)\alpha > 4(N+M)\theta\delta\alpha$. Then, $N(\alpha\theta+\delta)^2 + 4\alpha M\theta\delta > 4(N+M)\theta\delta\alpha$, and hence the second condition is more restrictive. Thus, we assume $4td(N+M)\alpha > N(\alpha\theta+\delta)^2 + 4\alpha M\theta$. In case there is no file-sharing ($\alpha = 1$) the condition simplifies to $4td(N+M) > N(\theta+\delta)^2 + 4M\delta\theta$.

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