

# The Music Industry in the Digital Era: Towards New Business Frontiers?

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## Abstract

We propose a model of the Music industry under piracy. We take into account quality, variety as well as price adjustments and show that our results fit quite well with empirical evidence. We then show that Peer-to-Peer networks, and their corollaries that are free files-sharing, could have a positive impact on the Music Industry as a whole (recorded music, live music, and ancillary goods such as ringtones, etc.). However, given the present contractual arrangements that prevail in the music industry, record companies bear almost all of the negative impact of piracy whereas artists (as a whole) rather benefit from it. Royalties often amount for the smallest part of their income whereas piracy tends to boost live performances audience. Hence, rather to focus on deterring piracy by suing pirates, record companies should seek to extend their business frontiers, either by renegotiate music contracts with artists or, if it proves to be impossible, by a downstream vertical integration, especially towards the concert industry.

**Keywords:** Music Industry; Piracy; Peer-to-Peer; Product differentiation; Vertical Integration

**JEL Code:** L1; L22; L82; L86; Z1

## 1 Introduction

"*Piracy threatens the survival of the music industry and thus artists' survival as well*" is the message hammered out by the four "majors" of the music industry<sup>1</sup> and by their business organizations (Recording Industry Association of America - RIAA, International Federation of Phonographic Industry - IFPI, etc.). According to them, music file-sharing on various Peer-to-Peer (P2P) networks (Kazaa, eDonkey, eMule, Gnutella, BitTorrent, Morpheus, etc.) explains most of

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<sup>1</sup>Since the merger between Sony Music and Bertelsmann Music Group (BMG) announced in november 2003, four firms, Sony/BMG, Universal Music, Warner Music and EMI, share about 80% of worldwide music revenues.

the 21% drop in US CDs sales over the 2000-2003 period<sup>2</sup>. They claim that P2P generates a *replacement effect* (free music downloads and CDs are substitute) and put forward the concomitance of the drop in CDs sales and the growing number of broadband Internet subscribers and music file-sharers. Hence, the intensification of legal actions against "digital thieves". Between September 2003 and June 2004, and solely in the US, the leading record companies have brought copyright infringement lawsuits against 2,947 alleged illegal file sharers.

Yet, according to data provided by the OECD (2004), those lawsuits did not significantly reduce files sharing. If Kazaa experiences a rather flat evolution since November 2003, it seems to be a migration of P2P users to networks that attract less attention from the music industry and connected lawsuits. Furthermore, no empirical evidence shows that music file-sharing is significantly responsible for the music industry downturn<sup>3</sup>. Some studies admittedly find a rather negative impact of P2P on music sales (Fine, 2000; Zentner, 2003; Liebowitz, 2003; Peitz and Waelbroeck, 2003b), but all of them agree to consider that this impact is rather low. Moreover, some studies conversely conclude to the absence of any negative impact or even to a positive one (Oberholzer and Strumpf, 2004; Molteni and Ordanini, 2003; Boorstin, 2004). Such a positive impact could arise from a *sampling effect* generated by P2P. Free music downloads allow to discover new artists or new CDs of established artists, and thus possibly increase future sales. It then appears hasty to claim that file-sharing is solely responsible for the worldwide drop in CDs sales. The completion of the substitution between vinyls and CDs, the growth of competing cultural products (especially DVDs), an excessive price charged for CDs<sup>4</sup>, or the poor creativity of new CDs released stand as probably better alternative explanations (see, among others, Liebowitz, 2003).

Anyway, in this paper dealing with strategies that could allow the music industry to accommodate piracy, we will adopt a conservative assumption: each individual who freely downloads a song is supposed to be unwilling to buy it in the future. Up to now, most of the papers that study how the music industry can accommodate or conversely deter piracy focus on the increase of vertical differentiation between the original product and the copy (see for instance Duchêne and Walbroek, 2002; Zhang, 2002; Peitz and Walbroek, 2003b; Gayer and Shy, 2004a, 2004b). Though Peitz and Walbroek (2003b), Bakker (2004) and Bayaan (2004) mentioned an increase in ancillary revenues as a possible compensation for the loss in CDs revenues for record companies, they did not formalize that intuition nor did they even try to go deeper into it. If Gayer and Shy (2004a, 2004b) do formalize an idea close from our own, their model exhibits some weaknesses that this paper tries to avoid.

Our point may be summed up as follows: revenues yield from live performances and from ancillary products (ringtones on mobile phones, T-shirts, caps, etc.) increase with the diffusion of an artist's music, this diffusion being legal (CDs, radio, pay-downloads) or illegal (piracy). Incorporating these sales in

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<sup>2</sup>Data available on [www.riaa.com](http://www.riaa.com).

<sup>3</sup>A survey of the various studies on the impact of P2P on music sales is provided in Gensollen et al. (2004).

<sup>4</sup>In the US, in 2002, Universal Music, Warner Music, BMG, Sony Music and EMI and three large music retailers agreed to pay \$143 million to settle charges of price collusion over the period 1995-2000.

their business model, conversely to what music industry presently done, could allow record companies to compensate for the loss in CDs revenues or even to benefit from piracy. They could indeed be able to price discriminate between consumers willing to buy a CD as well as concert tickets and ancillary goods and consumers who are only willing to buy the latter, for instance because they consider as excessive the average price charged for a CD. Without piracy, the latter are unable to discover new artists (sampling opportunities are low) and thus are less likely to buy concert tickets and ancillary products. Since piracy increases the audience of an artist, revenues drawn from ancillary products sold to individuals who would not have bought the CD may compensate for the loss generated by free downloads of individuals who would have bought the CD. This paper indeed shows that P2P networks, and their corollaries that are free files-sharing, could have under reasonable hypotheses a positive impact on the music industry as a whole (recorded music, live music, and ancillary goods such as ringtones, etc.). However, given the present contractual arrangements that prevail in the music industry, record companies bear almost all of the negative impact of piracy whereas artists rather benefit from it. Royalties often amount for the smallest part of their income whereas piracy tends to boost live performances audience. Hence, rather to focus on deterring piracy by suing pirates, record companies should seek to extend their business frontiers, either by renegotiate music contracts with artists or, if it proves to be impossible, by a downstream vertical integration, especially towards the concert industry.

The remainder of this paper proceeds as follows. Section 2 provides a survey of the literature on the impact on profits and welfare of piracy of digital products, especially music. In section 3, we propose a model that accounts for leading record companies' decisions in quality, price and variety. In section 4, we discuss the empirical relevancy of our results and derive conjectures on alternative strategies record companies could adopt to deal with piracy, besides suing pirates. A short conclusion is provided in section 5.

## 2 Literature review

Peitz and Walbroek (2003a) provide the most comprehensive survey on the impact of piracy of digital products on firms' profits and on social welfare. They emphasize that, in general, it is assumed that the original and the copies exhibit different qualities and that consumers are heterogeneous as regards their willingness to pay for the original compared to the copy. A general result is that piracy either leaves the firm's profits unchanged or reduces them. This result holds whatever the firm's reaction, should it try to deter piracy (by reducing price or suing pirates) or should it try to accommodate it, accepting that some consumers obtain only the pirated good. However, it is generally accepted that in a short term analysis piracy may increase the total welfare, either because the raise in consumers' surplus exceeds the loss in firms' profit, or because social costs arise if firms spend resources on detection (Chen and Png, 2003) or if a copyright enforcement policy is implemented by the copyright owner (Yoon, 2002). However, under some assumptions, it is possible to show that lower profits reduce firms' incentives to provide high quality products (Novos and Waldman, 1984; Bae and Choi, 2003) and/or reduce incentives to provide variety (Johnson, 1985). According to those works, although piracy may be

welfare improving in a short-term perspective, the long-term effects are more likely to be negative.

More precisely, Peitz and Walbroek (2003a) identify three main streams of works. In the first set, consumers are perfectly informed about the characteristics of the digital product and there is no network effect between consumers' decisions. In the second set, there exists a network effect affecting consumers' decisions. In the third, consumers are imperfectly informed about the characteristics of the product and copying provides information facilitating the purchasing decision. Since only the third stream really allows to deal with music piracy, because capturing the experience good nature of CDs, we will focus on it<sup>5</sup>.

Duchêne and Walbroek (2002) propose a model of P2P technologies in which an original provides additional value compared to the copy, but the latter yields information on the content of new products. Consumers differ according to their opportunity cost of spending time online and are differentiated with respect to their ideal product. The authors show that although P2P technologies reduce the profit of already well-known artists who use a traditional distribution system (with high fixed costs), and thus lowers their incentives to create, those technologies offer to small (previously unknown) artists the opportunity of uploading digital versions of their product online with almost no fixed costs, whereas they would be unable to distribute their product and reach consumers in the traditional way. Consumers interested in the music of these new artists will buy the original CD after having downloaded a copy in a P2P network. Of course, this positive effect on creation (profit of unknown artists is increasing with P2P development) is balanced by a negative one, since profit of already well-known artists is decreasing with the growing up of P2P technologies.

Duchêne and Waelbroek conclude that the profit loss of established artists is generally offset by the positive welfare effect of introducing new products. They state that with a low distribution cost (that reduces the profitability threshold of well-known artists) and a high quality differential between originals and copies (that gives an incentive to consumer to buy the original after downloading the copy), a flexible copyright law is socially optimal. Piracy may be welfare improving.

The argumentation developed by Zhang (2002) is quite similar. According to him, sticking to the traditional distribution technology is wasteful from a social point of view when P2P technologies are available, because the current distribution technology, which relies on persuasive advertising, favors artists with a large audience (or stars) preventing marginal artists to be distributed in the market. P2P, by offering a cheaper way (digital copies) to provide information to consumers, makes it possible for a marginal artist to enter the market. Zhang makes the assumption that there exists a fraction of "honest" downloaders that purchase the songs they like to argue that marginal artists can gain from the exposure effect, while stars unambiguously loose. This idea that P2P technologies favor the entry of new artists at the detrimental of more established artists has been empirically confirmed by Gopal et al. (2002). Analyzing Billboard's music sales Top 200 between 1991 and 2000, they show that the leadership of superstars is overall declining, since 1998. A study of students CDs purchasing

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<sup>5</sup>Models that encompass network effect are more fitted to deal with software piracy.

habits show that the availability of P2P tends to have a negative impact on sales for superstars but a positive one for new artists.

Peitz and Walbroek (2003b) also analyze the informational role of copies in a multi-product environment with horizontally differentiated products. As in Duchêne and Walbroek (2002), consumers derive a higher utility from the original than from a downloaded copy but, by using P2P, obtain detailed information on the horizontal characteristics of products (otherwise they have to choose at random among the products sold by the monopoly). Peitz and Waelbroeck show that provides the number of products is large enough, the firm can benefit from the informational role of digital copies that leads to a higher willingness to pay for the original, and thus to higher profits. Moreover, in the presence of P2P, that can be seen as a substitute for marketing and promotion, firms can reduce the associated costs, which also yields a profit increase. Hence, even if P2P has a negative effect by reducing revenues through cannibalization of CD sales by digital copies, it also has a positive one, through a higher willingness to pay for the original and a reduction in the distribution cost. Profits may actually increase under the condition that the original and the copy are differentiated enough.

Bayaan (2004) attempts to model both investments in quality and legal remedies as means to deal with the threat of music piracy and examines the effects of those instruments on variety and industry profits. He assumes that the demand addressed to CDs of a particular artist depends on both the price of the CD and a popularity parameter, and that CD production only generates a fixed cost for the monopoly. He shows that, without P2P, the monopoly only signs artists the popularity parameter of which lies above a threshold that allows to cover fixed costs. All the artists standing below this threshold don't sell anything. The model concludes that, whatever the firms attempts to fight against free downloading of CDs (investments in quality or legal remedies), they always end up with less profit than they previously enjoyed before technological improvements. The model also shows that the number of artists signed by firms decreases in any scenario involving file-sharing. However, Bayaan (2004) relevantly points out that piracy is not as serious for artists as it is for the industry because all revenues derived from the production of music do not come from the sale of CDs. If signed artists are worse off with piracy, P2P technologies allow unsigned artists to distribute their music through the Internet and yield profit from non-CDs revenues (touring, merchandising). However Bayaan's model raises several criticisms. Pricing strategy is not seen as a means to deter piracy, hence charging lower price while reducing quality is not considered. Furthermore, notoriety is exogenous in this paper, whereas it is clearly endogenous since majors use promotion and marketing expenses to "build" some artists notoriety (see for instance bands that come from Real TV). Finally, the consequences of the empirical evidence that all of the revenue from the production of music does not come from the sale of CDs is not formalized.

The work closest from the present one is Gayer and Shy (2004a, 2004b) twin papers. In Gayer and Shy (2004b), they propose a very simple model that show that legal actions against file-sharers generate a possible conflict of interest between artists, record companies (publishers) and lawyers. They assume that at least some consumers are "support-oriented users" which means that

they derive an extra-value from the original product compared to the copy (the original and the copy are vertically differentiated). This extra value could be toll-free service help lines, extra manuals, discounts on upgrades, Internet access to retrieve more information, etc. They also assume that there is a network effect: the utility an individual derives from a product increases with the number of users (hence when more people copy the product, more people will then buy it). Providing that both effects (vertical differentiation and network effect) are high enough, they show that the publisher earns a higher profit under the digital technology, and that there are more users under the digital technology compared with the non-digital technology. Gayer and Shy assume that artists earn profit not only from royalties on CDs sales, but also from other market activities such as selling tickets for live performances, getting hired to perform in television and radio advertising, and even selling ringtones for cellular phone. The demand on all of these markets is supposed to be directly related to the number of all users (buyers and copying users). As for lawyers, the more illegal users are sued, the higher their profit. Gayer and Shy then study two scenarios. If every sued copying user becomes a buyer, they show that all the three agents (artists, publishers, and attorney) benefit from an increase in the number of law suits. Conversely, should copying users not becoming buyers after being sued, then artists always lose from litigation (because their total audience decreases), publishers are not affected (since the number of buyers remain the same), and only the attorneys continue benefiting from suing copying users. Gayer and Shy (2004b) conclude "that law suits against users who infringe on artists' copyrights may in practice hurt the artists who are in fact the original creators of this information product. In fact, the publishers who act as the artists' agents as well as the lawyers who work for the publishers do not protect the artists' interests under network effects in digitally-distributed information."

However, Gayer and Shy's twin papers raise several problems. Beyond the fact that the music industry is very poorly modelised, two crucial hypotheses are questionable. On the one hand, if network effect does exist in the software industry, such an hypothesis is much more arguable in the music industry (see for instance Peitz and Waelbroek, 2003a). On the other hand, assuming the existence of support-oriented consumers who consider that original and copy are not substitute is also arguable. Alike most of the above mentioned models, to show that a limited piracy may be welfare improving, Gayer and Shy (2004a, 2004b) have to assume that there is enough difference between the original and the copy, otherwise downloaded digital copies will only cannibalize offline sales. Hence, according to Peitz and Walbroek (2003a), the expected quality of the copy is lower from a technical point of view, because of the compression algorithm and because of the probability of downloading a wrong or incomplete file. They also argue that for consumers who greatly value pictures, lyrics and music information, a digital copy is a product with lower quality characteristics. Yet, this latter assumption is questionable: consumers may also download lyrics, pictures and so on and, with a color laser printer, they may build themselves a nearly perfect copy of the original.

Above all, denying any role to price to deter piracy in such a model seems especially odd. The authors' two scenarios (in which sued illegal users become or not buyers) would be much more convincing if such a decision derive from the price charge by publishers for the original. Reducing price decreases piracy

but decrease revenues yield from CDs sales as well. Hence, Gayer and Shy's result that publishers may gain by suing illegal users whereas artists loose is probably not robust to a more realistic modelisation of the fight against piracy (that consists in legal actions as well as quality increases or price-cuts). Last but not least, the authors do not study what seems to become the most favoured solution for publishers: the capture of some of the rent artists' yield from other market activities.

The model we propose below answers to most of these criticisms. It accurately models the music industry and its reaction to the diffusion of piracy. We take into account quality, variety as well as price adjustments and show that our results fit quite well with empirical evidence. Finally, rather to assume a vertical differentiation between originals and digital copies, assumption that could be challenged, we explore the idea that should piracy has a negative impact on recorded music sales, it probably has a positive impact on the music industry considered in its broadest frontiers.

## 3 The model

### 3.1 Costs and preferences

We shall consider the music industry as a monopoly, a sketchy representation of the majors' oligopoly. Consumers are uniformly distributed along a circumference of length unity and the monopoly supplies  $n$  musical varieties (or  $n$  artists) localized at regular intervals of length  $1/n$  on that circumference. Differentiation is horizontal, each variety being marketed at a same price  $p$ .

The industry incurs three types of cost: *(i)* the cost of producing the scope of supplied varieties; *(ii)* the cost of promoting each variety; *(iii)* finally, the cost of distributing CDs. If  $x$  denotes the level of promotional efforts made to develop the notoriety of a variety (or an artist), then the industry's global cost function writes:

$$C(q, n) = n \cdot (b \cdot x^\beta + c \cdot n^\gamma) + F \quad b > 0, c > 0, F > 0, \beta > 1, \gamma > 0.$$

The above expression reflects decreasing returns to scale with respect to the promoting of each of the  $n$  varieties (term proportional to  $n \cdot x^\beta$  with  $\beta > 1$ ) and with respect to the number of supplied varieties (term proportional to  $n^{1+\gamma}$  with  $\gamma > 0$ ). As for the physical distribution of CDs, it mainly generates a fixed cost  $F$  and the marginal cost is set equal to zero, for the sake of simplicity.

The "subjective quality" of a given variety, *i.e.* the quality as it is perceived by consumers, writes:

$$q = x^\alpha \quad 0 < \alpha < 1,$$

exhibiting decreasing returns to scale in the reactivity of demand to commercial promotion. Willingness to pay  $w(q, \xi)$  of a consumer localized on the circumference at distance  $\xi$  ( $\xi \leq 1/2n$ ) of the closest available variety then writes:

$$w(q, \xi) = a \cdot q - t \cdot \xi \quad a > 0, t > 0,$$

hence incorporating two effects : firstly, the positive influence of perceived quality  $q$  on demand; secondly, the demand sensitivity to the "relevance" of supply,

as willingness to pay is a decreasing function of distance  $\xi$  separating the consumer's ideal variety from the location of the best fitted supplied variety.

Willingness to pay  $w(q, \xi)$  is the maximal expenditure the consumer is ready to make for her music-related purchases, either directly through buying her preferred variety, or indirectly through purchasing concert tickets or ancillary goods. We shall not develop here an explicit modelization of the live music market and simply assume that, once she has purchased or downloaded a piece of recorded music, the consumer devotes a share  $\rho$  ( $0 < \rho \leq 1$ ) of her resulting surplus (*i.e.*  $\rho \cdot [w(q, \xi) - p]$  or  $\rho \cdot w(q, \xi)$ , in case of a download) to the consumption of live music. We thus assume, firstly, that the decision to purchase concert tickets or ancillary goods is rather a consequence and not a cause of CDs consumption. And secondly, that an increase in consumers surplus from CDs purchase transforms into an increase in other music expenses. Our first assumption, although challenged by the historic view on the causality between concert and album sales<sup>6</sup>, has been adopted in theoretical works by Gayer and Shy (2004a, 2004b) and seems to much better fit with recent empirical evidence<sup>7</sup>. As far as the second assumption is concerned, empirical data do show that concomitantly with the drop in CDs sales encountered for several years, sales of ringtones for cellular phone and above all of concert tickets have experienced a strong growth<sup>8</sup>.

Thus, the distribution of recorded music (legal or illegal) leaves the consumer with a surplus partially dedicated to the consumption of live music. This gives rise to an externality effect, the supply conditions in the recorded music market (in terms of perceived quality and price) influencing revenues in the live music market. Moreover, "tasting" the quality of pieces of music by purchasing CDs, or downloading them on a P2P network, creates incentives to attend live shows, through a "sampling" effect. Parameter  $\rho$  interprets as a factor of scale, measuring both the intensity of the sampling effect and the intrinsic vitality of the live music market, *i.e.* the ability of actors in that market to convert consumers' willingness to pay into actual revenues.

<sup>6</sup>Usually, touring was seen as the best way for an artist to promote a new release, and thus to increase sales. This historic position is still defended by Vogel (2001), though data he refers to have been collected in 1970, and by Krueger (2004).

<sup>7</sup>A poll that asks US consumers which type of media influenced them to purchase their last CD shows that live performances was quoted by less than 30% of consumers, far away behind radio (75%) and four other sources of advice (friends/relative, music video channel, music store, movie soundtrack) (Peitz and Waelbroek, 2004). Moreover, surveying discussion forums devoted to music piracy shows that most of the internet users claim that buying or downloading a CD from a given artist help them to decide whether to buy a concert ticket.

<sup>8</sup>In 2003, the market ringtones for cellular phone amounted to € 3.5 billion (10% of the music market). Accordingly, the research firm A.T. Kearney expects that, by 2006, from 20% to 30% of all music revenues will come from mobile phones (Dufft, 2004). Data provided by the *Pollstar Magazine* on music expenses in the US (see table 1 in appendix) show that between 2000 and 2003, the 47% increase in revenues generated by live shows revenues has been much more important than the drop in CDs sales. Since the average price of a concert increased by 24% over the same period, it turns out that, between 2000 and 2003, both the volume of sold units and revenues do increase. Since, over the period 1991–2000 during which the extent of piracy was much smaller, we did not observe a significant correlation between concert revenues and record sales, these data do indeed suggest that concert revenues are much more driven by music consumption as a whole than by records sales. Those data are confirmed by French ones that show that between 2000 and 2003, while CDs sales slightly drop (- 1.1%) and free downloads increase, concert revenues experience a 70% growth (data on concert revenues are calculated from the annually collected amount of a 3.5% tax on tickets sales for "tournées professionnelles de variétés").

### 3.2 The recorded music market

All varieties of recorded music sold by the industry at price  $p$  are also available for free on P2P networks. However, when downloading a piece of music, an individual incurs an "immaterial" cost associated with the risk of being sued for copyright violation. The monetary equivalent  $\tilde{p}_\theta$  of that cost will be set proportional to market price  $p$ , *i.e.*  $\tilde{p}_\theta = \theta \cdot p$ , considering that downloaders anticipate a fine correlated with the value of the "theft". Coefficient  $\theta$ , which varies across individuals, is assumed uniformly distributed among the population, with density  $\tau$  over the interval  $[0, 1/\tau]$ .

Parameter  $\theta$  interprets as an individual characteristic, revealing propensity to piracy: for individual  $\theta = 0$ , downloading simply amounts to a free purchase, whereas individuals such that  $\theta > 0$  show some degree of reluctance towards the usage of P2P, not viewing piracy as a purely neutral operation. Fighting against piracy then aims at increasing the share of individuals with a high  $\theta$  characteristic, through adopting technical (DRM), legal (suing pirates) or regulatory (upload taxation) settlements.

During the reference period of the model, an individual  $(\xi, \theta)$  may, either legally purchase, either pirate, one single unit of the variety which stands the closest to her taste, or not consume at all. Her decision rule writes :

$$\inf[p, \theta \cdot p, w(q, \xi)] = \begin{cases} p & \implies \text{Purchase} \\ \theta \cdot p & \implies \text{Piracy} \\ w(q, \xi) & \implies \text{No consumption} \end{cases} .$$

It will be assumed that  $\tau < 1$ , in order that at least some individuals (those with a  $\theta$  such that  $1 < \theta \leq 1/\tau$ ) do prefer purchasing rather than downloading, whereas the others (those with a  $\theta$  such that  $0 \leq \theta < 1$ ) decide to pirate. The ratio of the latter sub-population to the whole population is  $1/(1/\tau) = \tau$ . Parameter  $\tau$  then simply interprets as the rate of piracy, *i.e.* the fraction of potential pirates within the population.

Given the expression of  $w(q, \xi)$ , the decision rule rewrites :

$$\begin{cases} 1 < \theta \leq 1/\tau \text{ and } t \cdot \xi < a \cdot q - p & \implies \text{Purchase} \\ 0 \leq \theta < 1 \text{ and } t \cdot \xi < a \cdot q - \theta \cdot p & \implies \text{Piracy} \\ a \cdot q - \inf(1, \theta) \cdot p < t \cdot \xi \leq 1/2n & \implies \text{No consumption} \end{cases} .$$

This formulation holds, provided that quality  $q$  and diversity  $n$  satisfy inequality  $q < 1/2n$ , which amounts to considering that the market would remain imperfectly covered, even in the polar situation where CDs would be legally distributed for free: in other words, we suppose that the supply conditions, in terms of quality and differentiation, are never attractive enough to draw the whole population into the market, even at zero-price and with no threat of penalty for piracy.

### 3.3 Industry's profits and artists' revenues

In order to assess industry's profits and artists' revenues, the two markets of recorded and live music must be consolidated. As a simplification device, we

shall assume that the revenues derived in the recorded music market go exclusively to the industry. Do notive however that this assumption does not misrepresent reality since, as Boorstin (2004) underlines, most of recording artists rarely get royalties for records released through major labels<sup>9</sup>. Revenues derived in the live music market are supposed to be shared between industry and artists, surplus share  $\sigma$  accruing to the industry and the complementary share  $\rho - \sigma$  to the artists ( $0 \leq \sigma \leq \rho$ ), where  $\rho$  is the fraction of consumer surplus which is actually converted into consumption of live music. Note that the capture by the industry of part of the consumer surplus amounts to a price discrimination, since an individual's global payment to the industry increases with her willingness to pay.

Ratio  $\sigma/\rho$  is subject to negotiation and features as a key item in the contract, when industry signs an artist. The case  $\sigma = 0$  correctly reflects the present situation, where the industry mainly draws profits from CD sales, while artists do not earn significantly from that market but benefit from almost all live-show revenues. As a matter of fact, if current contracts in the music industry do assign to labels the management of CD sales and almost all associated profits, they leave the artists with the management and the profits of live shows and ancillary products sold on that occasion. Since an artist can expect up to 35% of tickets revenues for a top concert and up to 50% from revenues yielded from merchandise sold at the show (Kafka, 2003), even an artist who does get royalty from its label, yields a lower income from CDs than from ancillary products. For instance, one of the world's foremost divas earned in one year roughly \$20m from sponsorship, \$15m from touring, \$15m from films, \$3m from merchandise and \$9m from CD sales<sup>10</sup>.

Taking the consumers' decision scheme into account (see above), the industry's profit writes:

$$\begin{aligned}
P = & 2n \cdot \int_1^{1/\tau} \left[ \int_0^{(a \cdot q - p)/t} [p + \sigma \cdot (a \cdot q - p - t \cdot \xi)] \cdot d\xi \right] \cdot \tau d\theta \\
& + 2n \cdot \int_0^1 \left[ \int_0^{(a \cdot q - \theta \cdot p)/t} \sigma \cdot (a \cdot q - t \cdot \xi) \cdot d\xi \right] \cdot \tau d\theta \\
& - n \cdot \left[ b \cdot q^{\beta/\alpha} + c \cdot n^\gamma \right] - F.
\end{aligned}$$

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<sup>9</sup>In a standard recording contract, the costs of recording and promoting an album, making a music video, etc. are usually "recoupable expenses" that are deducted from an artist's royalties. Thus, although the initial rate of artist's royalties ranges between 7% and 15% (depending on the reputation of the artist) of sales revenue, all those deductions make the final royalty percentage the artist receives (for instance 12%) go down to about 3% of sales revenue (Regner, 2002; Krasolovsky and Schemel, 2003). Since the costs of recording an album can easily reach several hundred thousand dollars, an artist can only expect to earn royalties from an album if it sells over 500,000 copies. Only 5% of recordings attain this level of success, so most artists do not receive royalties based on the actual number of records sold. Usually a record company pays an artist an advance against royalties so he has money to live while recording the album, but since the artist has to pay back this advance, this is most often the only money a band ever sees for a recording. Therefore 95% of artists earn their living by live shows. Performer/songwriter Janis Ian witnesses that though she has created more than 25 albums for major labels, she has never once received a royalty check that didn't show she owed them money and makes the bulk of her living from live touring (Boorstin, 2004).

<sup>10</sup>Music's brighter future. *The Economist*, Oct. 28th 2004.

Similarly, the revenue of an artist is:

$$A = 2(\rho - \sigma) \cdot \int_1^{1/\tau} \left[ \int_0^{(a \cdot q - p)/t} (a \cdot q - p - t \cdot \xi) \cdot d\xi \right] \cdot \tau d\theta \\ + 2(\rho - \sigma) \cdot \int_0^1 \left[ \int_0^{(a \cdot q - \theta \cdot p)/t} (a \cdot q - t \cdot \xi) \cdot d\xi \right] \cdot \tau d\theta .$$

Introducing the hedonic price-index, *i.e.* the ratio of price to valuation of quality, *i.e.*:

$$h = \frac{p}{a \cdot q} ,$$

and setting:

$$\delta = \frac{2\alpha}{\beta} ,$$

which measures the cost of providing quality to consumers (the higher  $\delta$ , the lower this cost), after computation of the above integrals, the following expressions obtain:

$$P(h, q, n) = f_{\sigma, \tau}(h) \cdot \frac{a^2}{t} \cdot n \cdot q^2 - n \cdot \left[ b \cdot q^{\frac{2}{\delta}} + c \cdot n^\gamma \right] - F , \\ f_{\sigma, \tau}(h) = \sigma + 2(1 - \sigma) \cdot (1 - \tau) \cdot h - [(2 - \sigma) \cdot (1 - \tau) + \sigma \cdot \tau/3] \cdot h^2 , \\ A(h, q) = (\rho - \sigma) \cdot g_\tau(h) \cdot \frac{a^2}{t} \cdot q^2 , \\ g_\tau(h) = 1 - 2(1 - \tau) \cdot h + (1 - 4\tau/3) \cdot h^2 .$$

We shall now consider that the industry and the artists enter a two players' strategic game, in which the industry maximizes its profits with respect to quality  $q$ , price  $p$  (or equivalently  $h$ ), and diversity  $n$ , at a given internalization rate  $\sigma$ , while artists select  $\sigma/\rho$  (or equivalently  $\sigma$ ), so as to maximize their revenues.

### 3.4 Maximization of industry's profits

Function  $P(h, q, n)$  is concave with respect to  $h$  (as coefficient of  $h^2$  is negative in the expression of  $f_{\sigma, \tau}(h)$ ) and with respect to  $n$  (as  $\gamma > 0$ ). We shall further assume:

$$0 < \delta < 1 ,$$

so that  $P(h, q, n)$  is concave as well with respect to  $q$ .

The first order condition for the maximization of  $P(h, q, n)$ , *i.e.*  $f'_{\sigma, \tau}(h) = 0$ , then yields:

$$h_{\sigma, \tau} = \frac{(1 - \sigma) \cdot (1 - \tau)}{(2 - \sigma) \cdot (1 - \tau) + \sigma \cdot \tau/3} \\ = \left[ 1 + \frac{1}{1 - \sigma} + \frac{1}{3} \cdot \frac{\sigma}{1 - \sigma} \cdot \frac{\tau}{1 - \tau} \right]^{-1} .$$

Thus, the optimal hedonic price  $h_{\sigma, \tau}$  is such that  $0 < h_{\sigma, \tau} < 1$ , ensuring that a market area of strictly positive amplitude, namely  $2(a \cdot q - p)/t = 2a \cdot q \cdot (1 -$

$h_{\sigma,\tau}/t$ , lies around each variety. Moreover  $h_{\sigma,\tau}$  is a decreasing function of both the internalization rate  $\sigma$  and the piracy rate  $\tau$  (since  $1/(1-\sigma)$ ,  $\sigma/(1-\sigma)$  and  $\tau/(1-\tau)$  are increasing functions of  $\sigma$  or  $\tau$ ).

Injecting the optimized hedonic price  $h_{\sigma,\tau}$  into the expression of profit and then maximizing  $P(h_{\sigma,\tau}, q, n)$  with respect to  $q$ , yields the optimal perceived quality and the optimal nominal price:

$$\begin{aligned} q_{\sigma,\tau} &= f_{\sigma,\tau}^{\frac{\delta}{2(1-\delta)}}(h_{\sigma,\tau}) \cdot \delta^{\frac{\delta}{2(1-\delta)}} \frac{a^{\frac{\delta}{1-\delta}}}{b^{\frac{\delta}{2(1-\delta)}} \cdot t^{\frac{\delta}{2(1-\delta)}}}, \\ p_{\sigma,\tau} &= h_{\sigma,\tau} \cdot f_{\sigma,\tau}^{\frac{\delta}{2(1-\delta)}}(h_{\sigma,\tau}) \cdot \delta^{\frac{\delta}{2(1-\delta)}} \frac{a^{\frac{1}{1-\delta}}}{b^{\frac{\delta}{2(1-\delta)}} \cdot t^{\frac{\delta}{2(1-\delta)}}}. \end{aligned}$$

Finally, maximizing  $P(h_{\sigma,\tau}, q_{\sigma,\tau}, n)$  with respect to the number  $n$  of varieties (approximated as a continuous variable) yields:

$$n_{\sigma,\tau} = f_{\sigma,\tau}^{\frac{1}{\gamma \cdot (1-\delta)}}(h_{\sigma,\tau}) \cdot \frac{(1-\delta)^{\frac{1}{\gamma}} \cdot \delta^{\frac{1}{\gamma} \cdot \frac{\delta}{1-\delta}}}{(1+\gamma)^{\frac{1}{\gamma}}} \cdot \frac{a^{\frac{1}{\gamma} \cdot \frac{2}{1-\delta}}}{b^{\frac{1}{\gamma} \cdot \frac{\delta}{1-\delta}} \cdot c^{\frac{1}{\gamma}} \cdot t^{\frac{1}{\gamma} \cdot \frac{1}{1-\delta}}},$$

and the expression of optimal profit is then derived as:

$$P_{\sigma,\tau} = f_{\sigma,\tau}^{\frac{1+\gamma}{\gamma} \cdot \frac{1}{1-\delta}}(h_{\sigma,\tau}) \cdot \frac{\gamma \cdot (1-\delta)^{\frac{1+\gamma}{\gamma}} \cdot \delta^{\frac{1+\gamma}{\gamma} \cdot \frac{\delta}{1-\delta}}}{(1+\gamma)^{\frac{1+\gamma}{\gamma}}} \cdot \frac{a^{\frac{1+\gamma}{\gamma} \cdot \frac{2}{1-\delta}}}{b^{\frac{1+\gamma}{\gamma} \cdot \frac{\delta}{1-\delta}} \cdot c^{\frac{1}{\gamma}} \cdot t^{\frac{1+\gamma}{\gamma} \cdot \frac{1}{1-\delta}}} - F.$$

One logically observes that, at the optimum :

- Quality  $q_{\sigma,\tau}$  is the greater as it is the more praised by consumers and the less costly to produce ( $q_{\sigma,\tau}$  increases with respect to  $a$  and decreases with respect to  $b$ ), or as it may be sold at a higher price because of a weaker requirement of consumers as regards the location of supply ( $q_{\sigma,\tau}$  decreases with respect to  $t$ ).
- Nominal price  $p_{\sigma,\tau}$  is the higher as customers are the less difficult to draw into the market ( $p_{\sigma,\tau}$  decreases with respect to  $t$ ), or as quality is the more valued and the less costly to provide ( $p_{\sigma,\tau}$  increases with respect to  $a$  and decreases with respect to  $b$ ), hence giving the industry an incentive to upgrade supply and, accordingly, to increase price.
- Scope of supply  $n_{\sigma,\tau}$  is the larger as the associated costs are the lower ( $n_{\sigma,\tau}$  decreases with respect to  $b$  and  $c$ ), and as the generated revenues are the higher, permitted by a greater valuation of quality or a weaker market resistivity ( $n_{\sigma,\tau}$  increases with respect to  $a$  and decreases with respect to  $t$ ).
- Profit  $P_{\sigma,\tau}$ , just as the differentiation scope  $n_{\sigma,\tau}$ , increases as parameters driving costs tend to reduce them ( $P_{\sigma,\tau}$  decreases with respect to  $b$  and  $c$ ) and as parameters driving revenues tend to augment them ( $P_{\sigma,\tau}$  increases with respect to  $a$  and decreases with respect to  $t$ ).

### 3.5 The impacts of piracy and revenues' internalization

What is the influence of live-shows revenues' internalization rate  $\sigma$  and of piracy rate  $\tau$  on industry's characteristics? Remembering that  $f'_{\sigma,\tau}(h_{\sigma,\tau}) = 0$ , then applying the envelop's theorem to the derivation of  $f_{\sigma,\tau}(h_{\sigma,\tau})$  and using the expression of  $h_{\sigma,\tau} < 1$  given above, we get:

$$\begin{aligned}\frac{\partial f_{\sigma,\tau}(h_{\sigma,\tau})}{\partial \sigma} &= (1 - \tau) \cdot (1 - h_{\sigma,\tau})^2 + \tau \cdot \left(1 - \frac{1}{3}h_{\sigma,\tau}^2\right) > 0, \\ \frac{\partial f_{\sigma,\tau}(h_{\sigma,\tau})}{\partial \tau} &= -\frac{2}{3} \cdot \frac{3 - 2\tau}{1 - \tau} \cdot h_{\sigma,\tau}^2 < 0.\end{aligned}$$

Consequently and unsurprisingly, the following proposition is derived:

**Proposition 1.**

*The internalization rate  $\sigma$  has a positive impact on quality  $q_{\sigma,\tau}$ , diversity  $n_{\sigma,\tau}$  and profit  $P_{\sigma,\tau}$ , whereas the piracy rate  $\tau$  has a negative impact:  $q_{\sigma,\tau}$ ,  $n_{\sigma,\tau}$  and  $P_{\sigma,\tau}$  increase with respect to  $\sigma$  and decrease with respect to  $\tau$ .*

The negative impact of piracy on quality and variety fits quite well with empirical observations. For several years, the termination of artists' contracts raised whereas the number of new contracts tend to decrease. For instance, in France, between 2002 and 2003, new contracts signed by majors fall by 23% whereas contracts terminated raise by 52%. Moreover, the growing marketing of "clone artists" (from Real-TV) has significantly restricted the diversity of supply (variety)<sup>11</sup>. As for the optimal nominal price  $p_{\sigma,\tau}$ , it falls down monotonically as P2P develops, since  $h_{\sigma,\tau}$  and  $f_{\sigma,\tau}(h_{\sigma,\tau}) = \sigma + (1 - \sigma) \cdot (1 - \tau) \cdot h_{\sigma,\tau}$  both decrease with respect to  $\tau$  for  $0 \leq \tau \leq 1$ . This conclusion also fits with empirical evidence. In 2003, Universal Music indeed decided to lower by 25% the price of all CDs in its catalogue in the US. In October 2004, Universal Music, Sony-BMG and EMI implemented price-cut in France for singles. Moreover, legitimate music downloads can also be seen as a way of price-cutting<sup>12</sup>.

Variations of  $p_{\sigma,\tau}$  with respect to the internalization rate  $\sigma$  are less straightforward: for sufficiently large values of  $\sigma$ , price  $p_{\sigma,\tau}$  is certainly a decreasing function of  $\sigma$ , as it collapses to  $p_{\sigma,\tau} = 0$  when  $\sigma = 1$ ; however, when  $\sigma$  is low, price  $p_{\sigma,\tau}$  may at first increase with respect to  $\sigma$ , provided that parameter  $\delta$  is large enough: indeed, in a vicinity of  $\sigma = 0$ , the increasing of  $f_{\sigma,\tau}^{\frac{\delta}{2(1-\delta)}}(h_{\sigma,\tau})$  with respect to  $\sigma$  offsets the decreasing of  $h_{\sigma,\tau}$  if:

$$\delta > \frac{2}{3} \cdot \frac{1 - 2\tau/3}{1 + 4\tau/9}.$$

Hence, the following proposition:

<sup>11</sup>Though the actual number of new releases does not decrease in the music industry, most of these new releases do not benefit from a real promotion policy: marketing expenses concentrate on a few artists. Hence, one observes simultaneously an over-production and a consumption focused on a small subset of CDs released. As a consequence, the time allocated to new releases to "match their demand" is much shorter than previously. After a few weeks, if sales do not take off, a CD is remove from shelving.

<sup>12</sup>At about 99 cents a song, and assuming that a consumer seldom has a significant willingness to pay for more than half the songs of a CD, legitimate music downloads can be considered as price-cutting.

**Proposition 2.**

*Piracy systematically leads to lowering CDs' price ( $p_{\sigma,\tau}$  decreases with respect to  $\tau$ ), whereas internalizing part of live music revenues may lead to increasing price  $p_{\sigma,\tau}$  in a first stage (if quality is not too costly to provide), as long as the rate of internalization  $\sigma$  is low enough; but when  $\sigma$  exceeds some threshold, then  $p_{\sigma,\tau}$  is a monotonic decreasing function of  $\sigma$ .*

The interpretation is as follows: when upgrading quality is not too costly (*i.e.*  $\delta$  is high) then, starting from a low internalization rate  $\sigma$ , the best strategy for the industry to cope with an increase in  $\sigma$  may be to augment price together with quality, in order to develop the dominant revenues derived from CD sales (through the direct positive impact of the price increase), while compensating through the quality enhancement the indirect negative effect due to demand price-elasticity ; however, as  $\sigma$  increases, the weight of CD sales in industry's revenues becomes less significant and the optimal strategy is then to lower the price of recorded music, in order to generate more consumer surplus and thus more live music revenues.

As its profit  $P_{\sigma,\tau}$  increases with respect to  $\sigma$  and decreases with respect to  $\tau$ , is this possible for the industry to offset piracy's damages (the negative impact of  $\tau$ ) by internalizing more of the live music revenues (positive impact of  $\sigma$ )?

**Proposition 3.**

*Provided that the live music market is large enough ( $\rho \geq 1/2$ ), then for any piracy rate  $\tau \in ]0, 1]$ , there exists a threshold  $\underline{\sigma}_\tau \in ]0, 1/2]$  such that, for any internalization rate  $\sigma \in ]\underline{\sigma}_\tau, \rho]$ , the industry is better-off with piracy and compensating internalization than without piracy nor internalization ( $\tau = \sigma = 0$ ).*

To prove proposition 3, suppose that there is initially no piracy, as well as no internalization. Then, if piracy occurs at some rate  $\tau$ , what is the minimal internalization rate  $\underline{\sigma}_\tau$  allowing industry to recover its losses ? By construction, this rate is the solution in  $\sigma$  of equation:

$$P_{\sigma,\tau} = P_{0,0} \iff f_{\sigma,\tau}(h_{\sigma,\tau}) = f_{0,0}(h_{0,0}) = \frac{1}{2}.$$

and easy computations yield :

$$\begin{aligned} \underline{\sigma}_\tau &= 1 - 2 \cdot \frac{3 - 2\tau}{3 + \sqrt{9 - 8\tau \cdot (3 - 2\tau) \cdot (3\tau - 2)}}, \\ \underline{\sigma}_0 &= 0 \quad , \quad \underline{\sigma}_1 = \frac{1}{2}, \\ \frac{d\underline{\sigma}_\tau}{d\tau} &\geq 0 \quad , \quad \left(\frac{d\underline{\sigma}_\tau}{d\tau}\right)_{\tau=0} = 2 \quad , \quad \left(\frac{d\underline{\sigma}_\tau}{d\tau}\right)_{\tau=1} = 0. \end{aligned}$$

Hence, when P2P develops, the internalization threshold  $\underline{\sigma}_\tau$  which must be reached to recover profits is an increasing concave function of the piracy rate  $\tau$  on the interval  $[0, 1]$ . Of course, full recovery is possible only if  $\underline{\sigma}_\tau < \rho$ , *i.e.* if the size of the live music market allows for surplus internalization at rate  $\underline{\sigma}_\tau$ . As  $\underline{\sigma}_1 = 1/2$ , such is the case for any  $\tau \in ]0, 1]$ , provided that  $\rho \geq 1/2$ . Then, for any internalization rate  $\sigma \in ]\underline{\sigma}_\tau, \rho]$  the industry is better-off than in the initial state of no-piracy and no-internalization.

Now, the internalization rate  $\sigma$  is not set unilaterally by the industry, which would then clearly set  $\sigma = \rho$  in order to maximize profits (or minimize losses);  $\sigma$  is rather a stake of negotiation between the industry and the artists.

### 3.6 Artists' revenues maximization

The artists are assumed to act as Stackelberg leaders<sup>13</sup> in their play with the music industry as regards the value of  $\sigma/\rho$  (or equivalently the value of  $\sigma$ , since  $\rho$  is exogenous). Substituting  $h_{\sigma,\tau}$  for  $h$  and  $q_{\sigma,\tau}$  for  $q$  in the above expression of  $A(h, q)$ , the per artist revenue writes:

$$A_{\sigma,\tau} = (\rho - \sigma) \cdot f_{\sigma,\tau}^{\frac{\delta}{1-\delta}}(h_{\sigma,\tau}) \cdot g_{\tau}(h_{\sigma,\tau}) \cdot \delta^{\frac{\delta}{1-\delta}} \frac{a^{\frac{2\delta}{1-\delta}}}{b^{\frac{\delta}{1-\delta}} \cdot t^{\frac{\delta}{1-\delta}}},$$

Thus an artist's maximization program amounts to:

$$\max_{\sigma \in [0, \rho]} (\rho - \sigma) \cdot f_{\sigma,\tau}^{\frac{\delta}{1-\delta}}(h_{\sigma,\tau}) \cdot g_{\tau}(h_{\sigma,\tau}).$$

Intuition dictates that, at least for some values of  $\rho$  and  $\delta$ , this program has an interior solution,  $\sigma_{\tau} \in ]0, \rho[$ , since an increase in  $\sigma$  influences an artist's revenues in two opposite directions : on the one hand, the artist's share of live music revenues is lowered; but, on the other hand, those revenues are globally increased as the industry has an incentive to enhance quality and decrease price of recorded music, which in turn generates consumer surplus and stimulates the consumption of live music. This intuition is comforted by studying the two particular cases of no-piracy ( $\tau = 0$ ) and of pervasive piracy ( $\tau = 1$ ).

In the case  $\tau = 0$ , we have:

$$h_{\sigma,0} = \frac{1-\sigma}{2-\sigma} \quad f_{\sigma,0}(h_{\sigma,0}) = \frac{1}{2-\sigma} \quad g_0(h_{\sigma,0}) = \frac{1}{(2-\sigma)^2},$$

so that an artist's maximization program writes:

$$\max_{\sigma \in [0, \rho]} \frac{\rho - \sigma}{(2 - \sigma)^{\frac{2-\delta}{1-\delta}}}.$$

Simple computations lead to the following solution:

$$\begin{cases} 0 < \rho \leq 2(1-\delta)/(2-\delta) & \implies \sigma_0 = 0 \\ 2(1-\delta)/(2-\delta) < \rho \leq 1 & \implies \sigma_0 = \delta \cdot \rho - 2(1-\delta) \cdot (1-\rho) \end{cases}.$$

The following proposition derives:

**Proposition 4.**

*In a world of no-piracy ( $\tau = 0$ ), then the artists are better off keeping all revenues, as long as the size of the live-music market stands below some threshold ( $\rho > 2(1-\delta)/(2-\delta)$ ). But beyond that threshold, they benefit from sharing some of their revenues with the industry and the share then accruing to the latter*

<sup>13</sup>Such an assumption is consistent with empirical observations. In negotiations that majors recently initiated with some artists to obtain a share of non-recorded music revenues (see section 4), artists clearly benefit from the highest bargaining power.

( $\sigma_0/\rho = \delta - 2(1 - \delta) \cdot (1/\rho - 1)$ ) is all the greater as the market is developed ( $\sigma_0/\rho$  increases with respect to  $\rho$ ) and as a quality upgrade is less costly ( $\sigma_0/\rho$  increases with respect to  $\delta$ ), making the sampling effect more effective.

In the opposite case  $\tau = 1$  of total piracy, we have:

$$h_{\sigma,1} = 0 \quad f_{\sigma,1}(h_{\sigma,1}) = \sigma \quad g_1(h_{\sigma,1}) = 1 ,$$

so that an artist's maximization program writes:

$$\max_{\sigma \in [0, \rho]} (\rho - \sigma) \cdot \sigma^{\frac{\delta}{1-\delta}} .$$

The solution is then:

$$\sigma_1 = \delta \cdot \rho .$$

Hence:

**Proposition 5.**

*In a world of generalized piracy ( $\tau = 1$ ), in which recorded music is available for free and the whole musical market is displaced towards live music, artists do systematically benefit from sharing live-shows' revenues with the industry. The share accruing to the latter ( $\sigma_1/\rho = \delta$ ) is all the greater as a quality upgrade is less costly, making the sampling effect more effective.*

From propositions 4 and 5, we observe that in both polar cases  $\tau = 0$  and  $\tau = 1$ , the industry's share of revenues,  $\sigma_\tau/\rho$ , is all the more important as parameter  $\delta$  is the higher, *i.e.* as enhancing perceived quality is the less costly, a factor which favours the sampling effect and thus inclines artists to yield more revenues to the industry, in exchange of an increased notoriety. Moreover, as  $\sigma_1/\rho > \sigma_0/\rho$ , the more P2P networks develop, the larger the share of revenues the artists are likely to leave to the industry.

Interpolating between the limit cases  $\tau = 0$  and  $\tau = 1$ , an argument of continuity finally leads to the following proposition:

**Proposition 6.**

*Whatever is the piracy rate  $\tau$ , an artist always gains from sharing revenues of live music with the industry, provided that the market is large enough, *i.e.*, an artists' maximization program has a unique interior solution  $\sigma_\tau \in ]0, \rho[$  for any  $\tau \in [0, 1]$  under the condition  $\rho \in ]2(1 - \delta)/(2 - \delta), 1[$ .*

Since the industry's profits increase with respect to  $\sigma$  (see above) and as artist's revenues do the same within the interval  $[0, \sigma_\tau] \subset [0, \rho[$ , then both the industry and the artists do benefit from a greater internalization rate  $\sigma$ , as long as  $\sigma$  lies below  $\sigma_\tau$ . Beyond that limit, more internalization would of course still favour the industry, but penalize artists. This holds for a given piracy rate  $\tau$ . Now, in a transition from an initial state without piracy ( $\tau = 0$ ) towards a final state with pervasive piracy ( $\tau = 1$ ), who is better off and who is worse off? The answer stands in the following proposition:

**Proposition 7.**

*If there is initially no piracy ( $\tau = 0$ ) and if it is then in the artists' interest not to share revenues with the industry ( $0 < \rho < 2(1 - \delta)/(2 - \delta) \implies \sigma_0 = 0$ ), when P2P proliferates ( $\tau = 1$ ) the strategic game between the artists and the*

industry leads to an equilibrium where the industry is worse off than initially and the artists may be better off, provided that the live music market is sufficiently large ( $\delta^{-1} \cdot (1 - \delta)^{-\delta/(1-\delta)} \cdot 2^{-(2-\delta)/\delta} < \rho < 2(1 - \delta)/(2 - \delta)$ ).

The proof first consists in observing that  $2(1 - \delta)/(2 - \delta) < 1/2\delta$  for any  $\delta \in [0, 1]$ , so that  $\sigma_0 = 0$  implies  $\rho < 1/2\delta$ , *i.e.*,  $\sigma_1 = \delta \cdot \rho < \underline{\sigma}_1 = 1/2$ . As a result, the internalization rate  $\sigma_1$  which maximizes an artist's profit under piracy makes the industry worse off, as compared to the ex ante situation of no-piracy. As regards the situation of artists, we have:

$$A_{\sigma_1,1} > A_{\sigma_0,0} = A_{0,0} \iff \rho > \frac{1}{\delta \cdot (1 - \delta)^{\frac{\delta}{1-\delta}} \cdot 2^{\frac{2-\delta}{\delta}}}.$$

It can be easily checked that  $\delta^{-1} \cdot (1 - \delta)^{-\delta/(1-\delta)} \cdot 2^{-(2-\delta)/\delta} < 2(1 - \delta)/(2 - \delta)$  for any  $\delta \in [0, 1]$ , so that the above inequality is consistent with the assumption  $\sigma_0 = 0$ . When it is satisfied, *i.e.* when the live music market is large enough, then the artists do benefit from piracy.

Proposition 7 reveals that, as artists are in a better position than the industry when faced with P2P development, the industry could well react through a vertical integration, thus bypassing the strategic game with artists and enforcing the maximal internalization rate  $\sigma = \rho$ . Such a global maximization of the consolidated profit leads to a maximum which is greater than the sum of separate profits of the industry and of the artists at equilibrium. The industry is indeed able to reach an unconstrained optimum characterized by the capture of all of the consumers' surplus (provided that  $\rho = 1$ ), through a kind of first degree price discrimination. Hence, industry would maximize social welfare while maximizing profit, so that the optimal price would be zero ( $h_{\sigma,\tau} = 0$ ), since marginal cost is zero. And if piracy were fully pervasive ( $\tau = 1$ ), then it would be in the interest of the industry to set the CDs' price to zero ( $h_{\sigma,\tau} = 0$ ), in order to maximize consumer surplus and thus to increase the revenues derived from live shows. Furthermore, assuming that CDs are given for free in P2P networks would allow majors to reduce the distribution fixed cost  $F$ . This also contribute to increase social welfare in a world of fully pervasive P2P.

The industry can then offer the artists a remuneration which makes both types of actors benefit from the integration, as compared to Stackelberg equilibrium. This is summarized in the following proposition.

**Proposition 8.**

*In case of pervasive P2P ( $\tau = 1$ ), were the recorded and live music markets vertically integrated and controlled by the majors, then profits could be redistributed ex post in a way which Pareto-dominates the equilibrium issue of the sharing game.*

Proposition 8 reveals that attempts to vertical integration are not unlikely in reaction to P2P, as the industry can integrate the live music market while satisfying the participation constraint of the artists.

## 4 Discussion

Although integrating the concert industry and ancillary goods in their business turns out to be a key-strategy to accommodate piracy, since deterring it seems

difficult, this strategy remains up to now unfamiliar to majors. We mentioned in section 3 that usual contracts in the music industry allocate CDs revenues to labels and live-shows as well as ancillary products revenues to artists. However, when signing new contracts, record companies more and more negotiate to secure a share of these revenues. Hence, in 2003 EMI signed a deal with Robbie Williams that gives the label a cut of the UK-artist's merchandise, publishing, touring revenue and sponsorship. EMI officials say they are pursuing similar deals with other musicians, both superstars and new acts (Kafka, 2003). Likewise, in most of the new contracts it is signing, SonyBMG asks for a share of the revenues from live concerts, merchandising and sponsorship deals (Groendhal, 2004). As far as ringtones are concerned, record companies also seek for a "fairer" sharing of revenues. Up to now, mobile phone companies and retailers capture most of the huge profits. Hence, on Vodafone Live!, 40% of the price of a downloaded ring accrues to the mobile phone company and 60% to a business intermediary who then pays back record labels<sup>14</sup>.

However, we shown in proposition 7 that to compensate the loss on CDs sales by raising the rate  $\sigma$  of integration of ancillary revenues in their profits, record companies will generate a conflict with artists. The level of  $\sigma$  that allow firms to benefit from piracy is higher than the value that maximizes artists revenues. This raises two issues. First, can majors bypass artists reluctance to the increase of  $\sigma$  in the present music industry contractual environment? Second, if the answer is negative, what alternative solution does exist?

#### 4.1 Can majors really integrate live-shows and ancillary products in their business model?

Do majors really have the power to impose a new sharing of music revenues to artists and to other actors in the industry? Obviously, market power of record companies towards mobile phone companies is limited by the high concentration that also prevails in the latter industry. As for the bargaining with artists, the point is whether artists have an outside option beyond contracting with a major or with an independent record company that distributes its products through a major. It seems that technological change in music production and consumption has indeed weaken record companies' negotiation power by offering artists significant alternative to contracting with majors. With the digitization of music, that not only generated file-sharing but also a drop in recording costs, majors have lost their highly dominant position in the music industry (Regner, 2002; Bourreau and Labarthe-Piol, 2003).

Up to now, revenues generated by a CD were, with seldom exceptions, an increasing function of marketing and distribution investments. In the physical world, the big record companies have the advantage of scale. In addition to marketing power, they control the physical distribution of CDs as well as the play-lists on radio<sup>15</sup>, by far the most effective medium for promoting a new CD<sup>16</sup>. Therefore, majors were the only ones able to have a significant impact

<sup>14</sup>Midem: le mobile au secours du disque?, January 26th 2004.

<http://www.silicon.fr/getarticle.asp?ID=3762>

<sup>15</sup>Until AOL-Time Warner sold Warner Music in 2004, EMI was the only major that was not a subsidiary of a medias conglomerate owning a TV network as well as a radio one.

<sup>16</sup>See note 7.

on sales. Hence, CDs released by an independent producer (an indie) that encounter success are most often distributed by a major. However, the ability of major record companies to "build up" an artist's notoriety was a win/win game: the company benefited from increased sales revenues and the artist from a higher demand for live shows.

With the emergence of P2P networks, both marketing and distribution can be done online. Therefore, for an artist who yielded few revenues from CDs sales, or even no revenues at all, music file-sharing is probably surplus improving. It allows her to freely broadcast her music at a large scale and to increase her notoriety, and thus to draw more attendance to her live shows. As pointed out by Bourreau and Labarthe-Piol (2003), P2P networks reduce entry barriers in the music industry by decreasing distribution costs as well as favoring a better access to consumers for artists who do not belong to star-system. Hence, majors lose their competitive advantage on indies or even on artists who manage themselves their career. For instance, UK-artist George Michael announced in March 2004 that he would stop making CDs and that fans will be invited to download his music from his website (Bakker, 2004). Provided this "outside option", artists will indeed probably be very reluctant to accept to share ancillary revenues with majors. According to the manager of the Red Hot Chili Peppers, Shania Twain and Metallica, "[they] will do everything and anything in [their] power to stop the majors from grabbing any share of non-recorded income from [their] bands." He adds that one way artists and managers may follow in order to fight back would be to start their own record company.

Yet, as we shown in proposition 6, artists likely would benefit from retroceding to record companies a limited share of their non-recorded music income. Such a retrocession should transform into higher quality investments (in recording as well as promotion expenses), and thus ensure an higher demand for CDs as well as for live performances and ancillary goods. Proposition 8 even shows that artists and majors may both benefit from a contractual arrangement that give to the record company the entire responsibility of the management of the career of an artist because the company would thus be able to fully extract consumers' surplus from (recorded and non-recorded) music consumption. Although the Robbie William's example shows that such an arrangement is not impossible, the reluctance of most artists to conclude such deals probably reflects the low trust artists have in their record companies. Given the risk generated by the unavoidable incompleteness of a contract that would give a major full control of their career, most artists probably would prefer a contractual status quo. Such a position is of course reinforced for artists that benefit from a positive net impact of piracy on their consolidated (recorded and non-recorded) music revenues.

## 4.2 Towards a vertical integration of the majors in ancillary products?

Therefore, it clearly appears that it could turn out difficult for the majors to impose to artists to share ancillary revenues that used to contractually accrue to them. To solve this contradiction, may be music firms will have to proceed to downstream vertical integration towards ancillary products and above all

towards the concert industry<sup>17</sup>.

Today, the US concert industry has been consolidated into three dominant firms (Clear Channel, HoB and AEG), a handful of large indies, and several dozens of prominent smaller players. It seems to remain opportunities, through acquisitions, for record conglomerates in a search for more dependable revenue streams<sup>18</sup>. Furthermore, owning simultaneously a concert halls network and radio stations would undoubtedly reinforce majors' market power. Clear Channel, who benefits from such a position in the US, has been suspected to threaten artists who refuse to tour in their own network with a reduction in their broadcasting time. In the same vein, the economies of scope between music and mobile phones, today with ringtones (see above) and tomorrow with the mobile phone as a portable driver, make new sense to the diversification strategy of media firms that link mobile phone and music (like Vivendi Universal). Despite the tremendous failures of the previous wave of diversification in the Media industry (see Peltier, 2004), may be are we on the eve of a new wave of diversification for medias conglomerates that run business in the music industry. Of course, we can also imagine that major record companies could seek to enter industries that benefit from piracy, such as hardware producers (especially MP3 players), Internet Access Providers, software producers that provide technological solutions for legitimate music downloads (iTunes from Apple, MSN Music Store from Microsoft, etc.). However, at a first glance, entry barriers appear as especially high in these businesses, given the size of the firms involved and the uncertainty about the result of the standard battle between the various new devices for playing digital music<sup>19</sup>.

## 5 Conclusion

Major record companies fight against piracy through several ways: (i) legal actions, (ii) price-cuts, either through legitimate music downloads or through a decrease of CDs' listed price, (iii) developing CDs' content that is more difficult to duplicate (lyrics, photos, protected link to online bonus, etc.) and (iv) releasing music DVDs that are, up to now, less affected by piracy. It seems however doubtful that such a strategy could be sustainable in the long run. For instance, legal actions seem poorly efficient as well as hardly acceptable by the public opinion and by some artists' organizations<sup>20</sup> as well. Moreover, it will be more and more difficult, due to technological change, to maintain a significant difference between the original CD or DVD and the digital copy.

In this paper we have shown that, rather to adapt their existing business model to deter piracy (which is probably an unavoidable corollary of P2P networks and thus of the Internet itself), record companies should better try to accommodate piracy by exploiting one of its main feature: its ability to ensure a large scale diffusion to music at a very low cost. Saving on distribution costs,

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<sup>17</sup>By purchasing several years ago the most famous concert hall in Paris (*L'Olympia*), Vivendi Universal likely acted as a pionner of such a strategy.

<sup>18</sup>Source : [www.pollstaronline.com/sf-ye2003-biz.asp](http://www.pollstaronline.com/sf-ye2003-biz.asp)

<sup>19</sup>The only exception could be Sony-BMG that already runs a hardware business as well as an online store, Sony Connect. However the latter does not ensure interoperability with iPod, the best seller MP3 players!

<sup>20</sup>See for instance the position of the ADAMI in France ([www.adami.fr](http://www.adami.fr)).

which are high fixed costs, and at a lesser extent on marketing expenses, and benefiting from higher ancillary revenues due to a larger diffusion and to a renegotiation of contracts with artists, major record companies could increase their profits by allowing cheap or even free downloads of music from their legitimate websites. In such a scenario, record companies should support the implementation of a *global licence*<sup>21</sup>, instead of a strict copyrights enforcement policy that consists in suing pirates. In such a system, which is already used by the radio industry to pay for the music they broadcast, revenues yielded from the fixed fee that internauts would pay when subscribing to an Internet broadband access, could accrue to artists as well as to record companies and partially compensate for the allegedly losses due to piracy.

However, such an evolution significantly reduces artists' incentive to sign with majors, since their main motivation used to be to benefit from massive marketing campaigns and from an efficient distribution network. Indies' incentive to conclude a distribution agreement with majors is thus reduced as well. Since the majors will experience some (high) difficulties to impose to artists to share ancillary revenues, we can expect them seek to proceed to a downstream vertical integration mainly by entering the concert industry.

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<sup>21</sup>On this topic, see for instance Lessig (2002).

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## 7 Appendix

Table 1 - US Concert Industry Data 1990-2004

	CD sales <sup>a</sup>	Concert tours revenues <sup>a</sup>	Average ticket's price <sup>b</sup>
1990	3,451.6	1,100	na
1991	4,337.7	830	na
1992	5,326.5	1,000	na
1993	6,511.4	900	na
1994	8,464.5	1,400	na
1995	9,377.4	950	26.05
1996	9,934.7	1,050	25.81
1997	9,915.1	1,300	29.81
1998	11,416.0	1,300	32.20
1999	12,816.3	1,500	36.84
2000	13,214.5	1,700	40.74
2001	12,909.4	1,750	43.86
2002	12,044.1	2,100	46.56
2003	11,232.9	2,500	50.35
2004	na	2,800	52.39

<sup>a</sup> in millions USD (source: RIAA)

<sup>b</sup> in USD (source: Pollstar Magazine)