Piracy repression and "Proustian" effects in popular music markets

Leonardo Becchetti and Simone Eleuteri

Abstract

We extend the Gayer-Shy (2005) approach and outline a theoretical model with typical characteristics of contemporary music markets in which record sales and life performances are two fundamental components of industry profits and illegal recording has positive effects on the second source of revenues. We show how (cross-sectional) network externalities and (intertemporal) "Proustian" effects (emotional quasi rents of adult consumers generated by "musical imprinting" when they were young) enhance the conflict of interest on piracy repression between artists and record publishers. Endogenisation of the bargained property right shares and of the penalty for piracy shows that, under reasonable parametric conditions, the absence of piracy repression maximizes total industry profits. We finally show that the conflict of interest on piracy may be solved via diversification of the record publisher revenues through his participation to live performance profits, or entry into the market of new products, such as hardware music players, which are complement to (legal and illegal) downloading.

Kewords: music industry, piracy, Proustian effects.
JEL Numbers:

1. Introduction

Following Lowenstein's (2005) generalisation standard economic theory usually discriminates between underlying preferences (tastes) and final preferences (demand). The former are generally assumed to be stable, while the latter vary across time according to fashion and fads (Hayek, 1948; Becker-Stigler, 1977).
The reason why for economists *de gustibus non est disputandum* (or preferences are assumed to be fixed and their law of motion is hardly modeled) is that they generally do not have any insightful theory of preference formation and prefer to leave this ground to psychologists (Lowenstein, 2005). The problem though is that the two spheres of knowledge investigated by economists and psychologists (preference formation and evaluation of economic effects of entrepreneurial action) are not independent. This is because, the propensity to consume depends not only from quantitative and qualitative features of a given good, but also from a series of side conditions which significantly affect the evolution of preference patterns. Hence, the ignorance of the evolution of preferences and side conditions which determine the propensity to consume may lead to suboptimal corporate strategies.
In this paper we work out this general problem for the case of popular music. In such field a recent econometric study from Holbrock and Schindler (1988) shows that preferences are mainly formed during late adolescence or early adulthood. The two authors provide robust evidence which demonstrates that the relationship between age and development of musical tastes follows a U-shaped pattern, reaching its peak around the 24^{th} year of age. The authors interpret their findings with intrinsic (critical periods in which sensitivity is highest as in ethological studies of imprinting) or extrinsic (periods in which peer pressure and social environment in which music is listened have the highest influence) rationales.
In our paper we develop the concept that the above mentioned pattern of preference evolution generates "*emotional quasi-rents*". With such concept we mean that musical imprinting in adolescence is such that a given artist (appreciated in this crucial emotional moment of one's own life) becomes a (quasi) exclusive supplier of music for a given group of consumers for the rest of their life and therefore the condition of the latter is analogous to that of a producer which is given a (quasi) exclusive license for selling a given product. We define these quasi rents as "emotional rents" because the above mentioned quasi-exclusivity is not imposed by legislation but by the power of our emotions. We also define them as "Proustian" effects for the close analogy with the famous writer concept. As it is well known, Marcel Proust developed, in his famous novel *In Search of Lost Time,* the notion of involuntary memory contrasted with the traditional voluntary memory. While voluntary memories are retrieved by "intelligence" with our conscious effort, involuntary memories are a by-product of a non-mnemonic activity, exactly as a deja-vu. In the famous example of the madeleine (French biscuit), the author tells that the aroma and taste of a madeleine dipped in tea, without a conscious effort, brings him back vividly the memory of his childhood when he was used to live the same experience. Our intertemporal effect works exactly in the same way: the "madeleine"

is replaced by the listening of a song associated to a significant emotional experience of the adolescence, which involuntarily brings back the memories and the emotions of that experience in the past.

The scenario in which emotional "quasi rents" must be analysed is that of an industry in which piracy is significantly modifying the profit breakdown of the music industry. Beyond the outburst of piracy we have a technological innovation (which made musical files downloadable from internet) reducing almost to zero the (opportunity) cost of consuming music illegally if we abstract from risk of prosecution and moral costs.
This breakthrough innovation explains the sudden increase of downloaded music and its effects on the music industry. According to ITIC American peer-to-peer users downloaded 4,383,918,151 songs in 2003 (other top countries are Germany (377M), Canada (258M) and the United Kingdom (154M)).
The opportunity of illegal downloading is equivalent to the creation of a free (if we abstract from the risk of prosecution and moral costs) perfect substitute of the costly good represented by legal records sold. Unpaid cost of illegal downloads has been quantified by the IFPI Digital Music Report 2006 which considers one song to be 0.99 USD and provides a country ranking for the cumulative commercial value of [*pirated Software* (BSA 2003) + *pirated music* (DIC 2003)] per Internet connected capita. The first country is Russian Federation with 185 USD per Internet user while for the 90 countries analyzed, the average Theft / Capita was 42 USD in 2003. In terms of aggregate figures, in August 2003, CRIA issued a news release claiming $425 million in losses over the previous three years.
Another typical consequence of this revolution is the *partial replacement of old* (vinyl disks, analog tapes and compact disk sales) *with new sources of income for the music industry which partially compensate losses from piracy*. According to the IFPI Digital Music Report 2006, LP album sold per capita peaked at 5.3 in the year 1999 in which Napster began and then fell to 4, against a forecasted level of 6, before Napster entry. Compact disk sales have fallen by a 6% in 2005 respect the past year, but 420 million single tracks (without incuding ringtones) were downloaded in 2005 globally - more than double the number downloaded in 2004 (156 million). Ringtones and online mp3 sales have totalled 1.1 billions of dollar net sales for the 2005, three times the 2004 results. Legitimate online services at world level passed from 50 in 2003 to over 335 in 2005. The most famous online music store (iTunes) with a dominant market share of 70 percent have extended its services to 21 countries all over the world, and has sold 850 millions of digital tracks till 2005. Subscription services, such as Rhapsody and Napster, saw the number of their users rising from 1.5 to 2.8 million globally in 2005.
At the same time (by considering the last decade interval) overall life performance sales have increased as a result of a rise in the ticket price well above inflation which more than compensates a reduction in the total number of tickets sold (source: Rolling Stone Encyclopedia Artist). These two stylized facts are not at odd, at least from a descriptive point of view, with the hypothesis of a *complementarity between*

(legal and illegal) internet downloading of music files and participation to live performances.

In conclusion, piracy has not necessarily to be seen as a straightforward loss for the entertainment industry as legal downloads and net sales from costly new products and services complementary to new forms of legal and illegal fruition are compensating the fall in sales from legal fruition through CD sales.

In the light of the stylized facts mentioned above it is clear that, in order to analyze profits of the music industry, we need a model which takes into account its crucial characteristics: i) the interaction of piracy, legal selling of records, new complementary products to legal and illegal downloading and life performances in the determination of industry profits; ii) the division of profits and property rights between the artist and publisher in this new scenario; iii) the role of cross-sectional network externalities and of emotional quasi rents identified by Holbrock and Schindler (1988) in their study.

Our theoretical approach tries to integrate these features by extending the Gayer-Shy (2005) model into a two period framework under the assumption of the existence of "Proustian emotional quasi-rents" implying that consumption in the first period (when young) affects the propensity to consume in the second period (when adults). The originality of our work with respect to the mentioned authors lies in i) the introduction of the Proustian effects; ii) the different interpretation of the consumer interval; iii) the endogenisation of the bargaining on property right shares on legal record sales; iv) the introduction of (costly) products (i.e. hardware music players such as I-pods or Sony Walkman players) which are complementary to (legal and illegal) music downloading and v) the evaluation of the optimal piracy repression policies.

A more general reference for our model is that of the "open source economics", generally applied to the software and not to the music industry and, more specifically, the research of Conner and Rumelt (1991), Shy and Thisse (1999), Boldrin and Levine (2002), Gopal et al. (2005), Varian (2005) and the empirical findings of Peitz and Waelbroeck (2004) showing how piracy may have a positive effect on the distribution of legal sales, thereby not necessarily reducing firm profits. In our case we illustrate that this occurs in the music industry because of a model feature which is, in essence, common to some of these approaches: the complementarity between the free consumption of a first good (in our case illegal recording) and the purchase of related complementary goods and services (live performances and hardware music players) whose profits also accrue to the contributors to the production of the first good (artist and publisher). A novel point with respect to this literature is that, while generally these authors want to demonstrate that the absence of piracy repression is compatible with survival of industry profits (Varian, 2005 and Boldrin and Levine, 2002), we show that, under some circumstances, in our specific case it paradoxically maximizes them.

The paper is divided into four sections (introduction and conclusions included). In the second section we describe the basic features of the model and the equilibria

obtained with and without piracy. In the third section we compare the two equilibria outlining the conflict of interest between the artist and a "pure" publisher and evaluate the optimal punishment strategy against piracy in the perspective of the maximization of industry profits. In the fourth we endogenise with a bargaining approach the division of property rights on legal record sales between the artist and publisher. In the fifth we show how the conflict of interest may be reduced when we allow the publisher to participate to profits from the goods and services which are complementary to illegal music fruition.

2. The model

Consider the existence of a generation of individuals living for two periods and having different tastes for music which they may consume through legal or pirated recording. Following Gayer and Shy (2005), consumers differ for their position x on the segment $[0,x_{max}]$ where x indicates a declining taste for morality.

Consumers' preferences under the two different options are modeled in the first period as follows

(1) $U_0(l) = \alpha(1-x) + \gamma N_0 - P_0^R$ under legal recording, and

(2) $U_0(il) = \beta(1-x) + \gamma N_0 - pF$ under pirated recording.

As in Gayer-Shy (2005) $\alpha>\beta$ expresses, *coeteris paribus*, a preference for legal recording (related to some of its specific characteristics such as superior informational content in legal records), while γ is a network effect which implies that the utility in consuming music is increasing in the number of those who do it in the same period (N_0). Finally, P^R_0 is the cost of choosing legal recording (the market price of legal records), while pF is the expected cost of choosing pirated recording (the probability (p) of being detected times the penalty F associated to the illegal action).

A first difference of our model with respect to Gayer and Shy (2005) is in the introduction of the expected costs of piracy and in the interpretation of x as an indicator of declining individual morality[1] and not of a declining taste for music. This is because it is not clear why, for two given levels of x at the left and at the right of the position of the indifferent consumer, individuals with lower taste for music should prefer piracy and those with higher taste for music should prefer legal recording. Since passionate music lovers with low propensity to buy legal records may exist, it

[1] The recent literature on experimental games highlighted the importance of the individual morality assumption in economic behaviour (either under the form of a Kantian sense of duty, fairness or reciprocity) as a solution for the puzzling experimental findings of many standard (ultimatum, dictator, trust and gift exchange) experiments which depart from standard equilibria predicted by the theory under the assumption of self interested players (see, among others, Sobel 2002 and Fehr and Schmidt, 1999).

is not clear, in other terms, why taste for music should be necessarily related to the (legal or illegal) form of its fruition.

A first assumption we need when comparing first period utilities is that $\alpha - P_0^R > \beta - pF$ since, under this condition, we have a nonzero share of legal consumers. Consider in fact that the highest morality individual (indexed by x=0) will prefer legal recording only if the above mentioned condition holds. An individual with lower morality (i.e. x=1) still prefers legal recording only if $-P_0^R > -pF$ or, if the record price is lower than the expected costs of piracy. Finally, for values of x>1, morality is even lower and piracy may be preferred even if its expected costs are higher than the cost of buying record sales. These examples clearly show that, as far as x grows, there is only one intersection point between the utility under legal and pirated recording (*single crossing property*) and we can therefore draw the share of legal consumers from the equalization of the two utility levels.

In the model we assume that, in the second period, consumers preferences are substantially the same with one exception. According to a parameter $d \in [0,1]$ consumers may be more or less nostalgic about the music they listened when they were young.[2] In other terms, we model music as a two dimensional good whose characteristics are intrinsic quality (a subjective feature which depends on individual preferences) and the atmosphere it recalls when it is listened, which is related to the emotions lived in its past fruitions. Since the probability of being music listeners also in the first period is increasing in N_0, we simply assume that, in the second period, an "intertemporal" network effect adds up to the cross-sectional one.

As a consequence, preferences in the second period will be

(3) $U_1(l) = (1-d)[\alpha(1-x) + \gamma N_1 - P_1^R] + d[\alpha(1-x) + N_0 + \gamma(N_1) - P_1^R]$ under legal recording[3] and

(4) $U_1(il) = (1-d)[\beta(1-x) + \gamma N_1 - pF] + d[\beta(1-x) + N_0 + \gamma(N_1) - pF]$ under pirated recording.

2.1 The equilibrium with piracy

[2] As explained in the introduction the hypothesis is based on the idea that preferences for music are mainly formed during late adolescence or early adulthood. This hypothesis is supported by the empirical work of Holbrock and Schindler (1988) showing that the relationship between age and development of musical tastes follows a U-shaped pattern reaching its peak around the 24th year of age. Based on this evidence we assume that musical imprinting when young generates emotional "quasi rents" which increase the probability that the same listeners will consume the same music when adult.

[3] Our approach of modeling the intertemporal effect is based, without lack of generality, on the assumption that: i) there is only one type of music listened; ii) the larger the first period number of listeners, the higher the probability that the individual users have listened music in that period.

To find the equilibrium in the model with piracy we obtain from the consumer indifference condition the following number of consumers buying legal records in the period t (t=0,1)

$$(5)\quad x_t^* = \frac{\alpha - \beta - P_t^R + pF}{\alpha - \beta}$$

which is nonnegative under the previous assumption of $\alpha > \beta$ and $\alpha - P^R_t > \beta - pF$. As expected, the market share of legal recordings is decreasing in market price and increasing in the expected costs of piracy.

A fundamental result here is that the network externalities and the "Proustian" effects do not affect the share of legal consumers. The rationale is that the two effects have the same impact on consumers preferences under the two options and therefore, even though they increase the number of total music consumers, they do not affect the position of the consumer who is indifferent between the two options. In other terms, *both the (cross-sectional) network externalities and the (intertemporal) Proustian effects increase in the same way the utility from legal and illegal consumption of music and therefore do not change the position of the indifferent consumer.*

To calculate the total number of (legal and illegal) consumers in the first period we start from the indifference condition between consuming illegally or not consuming

$$(6)\quad \beta(1 - N_0) + \gamma N_0 - pF = 0$$

which yields the following number of total (legal and illegal) consumers

$$(7)\quad N_0^* = \frac{\beta - pF}{\beta - \gamma}$$

Consider that (7)>0 is also the condition of the existence of illegal consumers in the first period. If this condition is met, N_0^* also defines the total number of (legal and illegal consumers). This implies $\beta > \gamma$ and a bound for pF ($pF < \beta$) as conditions for the existence of illegal consumers.

The corresponding condition for the second period is equal to

$$(8)\quad (1-d)[\beta(1 - N_1) + \gamma N_1 - pF] + d[\beta(1 - N_1) + N_0 + \gamma(N_1) - pF] = 0$$

and the number of total (legal and illegal) consumers to

$$(9)\quad N_1^* = \frac{\beta - pF + Z}{\beta - \gamma}$$

where

$$(10)\quad Z = dN_0$$

Hence, by considering (7), and by replacing (10) in (9), we get

(11) $$N_1^* = \frac{(\beta - pF)\left[1 + d/(\beta - \gamma)\right]}{(\beta - \gamma)}$$

This condition clearly shows that the Proustian effect raises the number of consumers in the second period (or $\partial N_1^* \setminus \partial d > 0$).
In the basic version of the model profits on music may be realised through record sales or live performances. In the first case the artist divides the profits with a recording publisher. In the second case, he earns all profits. The demand for legal recording obviously includes only legal consumers, while that of live performances both types of (legal and illegal) consumers.
The demand for live performances in the period *t (t=0,1)* may therefore be written as

(12) $$q_t^P = \max\left[\delta N_t - P_t^P, 0\right]$$

as it depends on its price, on the total number of legal and illegal listeners (N_t) and on a preference parameter δ which coincides with the reservation price of the consumer with strongest musical preferences.
As a consequence, total profits from live performances will be

(13) $$\Pi^P = P_0^P\left[\max(\delta N_0 - P_0^P, 0)\right] + \rho P_1^P\left[\max(\delta N_1 - P_1^P, 0)\right]$$

where ρ=1/(1+r) is the common consumers' rate of time preference.

First order conditions yield the following optimal prices at time t

(14) $$P_t^P = \frac{\delta N_t}{2}$$

and the following profits

(15) $$\Pi_0^P = \frac{\delta^2 N_0^2}{4} \text{ and } \Pi_1^P = \rho\frac{\delta^2 N_1^2}{4}$$

for the artist which maximizes profits from live performances.

We assume that the agreement between the artist and the record publisher assigns a share of profits s (0≤s≤1) to the artist. As a consequence, the record publisher maximizes the following profits from record sales

(16) $$Max \quad \Pi^R(pu) = (1-s)\pi^R = (1-s)\left(P_0^R - c\right)x_0 + \rho(1-s)\left(P_1^R - c\right)x_1$$

which, by replacing for x_0 and x_1, become

(17) $$Max(1-s)\Pi^R = (1-s)\left(P_0^R - c\right)\frac{\alpha - \beta - P_0^R + pF}{\alpha - \beta} + \rho(1-s)\left(P_1^R - c\right)\frac{\alpha - \beta - P_1^R + pF}{\alpha - \beta}.$$

First order conditions with respect to prices in the first and second period yield the following optimal prices

$$(18) \quad P_t^R = \frac{\alpha - \beta + c + p * F}{2}.$$

Note that the price for legal records is positively related to the preference for legal over illegal recordings (α>β) and the penalty for piracy, while negatively related to the costs of the recording activity. Paradoxically, then, stronger preferences for legal recording (higher α), or a higher efficiency of the government prosecuting activity would increase the monopolistic rents of the publisher. As a consequence, in presence of a monopolistic publisher, the government may be willing to be lenient on piracy to increase consumer's welfare, while it might obtain the same result just by fostering competition in the publisher industry and being severe on piracy laws.
By replacing these optimal prices into the number of legal consumers we get

$$(19) \quad x_t = \frac{\alpha - \beta - c + pF}{2(\alpha - \beta)}$$

and the following record publisher profits

$$(20) \quad \Pi^R * (pu) = (1-s)(1+\rho)\frac{(\alpha - \beta - c + pF)^2}{4(\alpha - \beta)}$$

Once we have equilibrium profits from both legal records and live performances we may obtain the following total profits for the artist

$$(21) \quad \Pi^{TOT}(a) = \Pi^P(a) + \Pi^R(a) = \frac{\delta^2 N_0^2}{4} + \rho\frac{\delta^2 N_1^2}{4} + s(1+\rho)\frac{(\alpha - \beta - c + pF)^2}{4(\alpha - \beta)}$$

and, by replacing for N_0 e N_1,

(22)

$$\Pi^{TOT}(a) = \Pi^P(a) + \Pi^R(a) = \delta^2\frac{(\beta - pF)^2}{4(\beta - \gamma)^2} + \rho\delta^2\frac{\left[(\beta - pF)\left[1 + d\gamma/(\beta - \gamma)\right]\right]^2}{4(\beta - \gamma)^2} +$$

$$+ s(1+\rho)\frac{(\alpha - \beta - c + pF)^2}{4(\alpha - \beta)}$$

From this equation it is evident that artist life performance profits are positively related to the cross-sectional network externality and to the intertemporal Proustian effect.

2.2 The equilibrium without piracy

In order to better evaluate the effects of piracy we now examine the equilibrium of the model in absence of them. In such case the number of legal consumers coincides with the total number of consumers. To find such share in the first period we solve the following indifference condition for the marginal consumer without piracy $\alpha(1-N_o)+\gamma N_o - P_0^{R(NOP)} = 0$ and get

(23) $N_0^{NOP} = (\alpha - P^{R(NOP)}{}_0)/(\alpha - \gamma)$

While, in the second period we have

(24) $(1-d)\left[\alpha(1-N^{NOP}{}_1)+\gamma N^{NOP}{}_1 - P_1^{R(NOP)}\right] + d\left[\alpha(1-N^{NOP}{}_1)+N^{NOP}{}_0+\gamma(N^{NOP}{}_1) - P_1^{R(NOP)}\right] = 0$

and

(25) $N_1{}^{NOP} = \dfrac{\alpha - P_1^{R(NOP)}}{\alpha-\gamma} + d\,\dfrac{\alpha - P_0^{R(NOP)}}{(\alpha-\gamma)^2}$

Profits from live performances will be again

(26) $\Pi^{P(NOP)} = P_0^{P}\left[\max(\delta N^{(NOP)}{}_0 - P_0^{P(NOP)},0)\right] + \rho P_1^{P}\left[\max(\delta N^{(NOP)}{}_1 - P_1^{P(NOP)},0)\right]$

and optimal prices $P^{P(NOP)}{}_0 = \delta N^{NOP}{}_0/2$ and $p^{P(NOP)}{}_1 = \delta N^{NOP}{}_1/2$,

which yield, after replacing for N_0 and N_1, the following equilibrium profits:

(27) $P_0^{P(nop)} = \delta\dfrac{\alpha - P_0^{R(NOP)}}{2(\alpha-\gamma)}$

(28) $P_1{}^{P(NOP)} = \delta\dfrac{\alpha - P_1^{R(NOP)}}{2(\alpha-\gamma)} + d\,\dfrac{\alpha - P_0^{R(NOP)}}{2(\alpha-\gamma)^2}$

Hence

(29) $\Pi_0^{P(NOP)} = \delta^2\dfrac{\left(\alpha - P_0^{R(NOP)}\right)^2}{4(\alpha-\gamma)^2}$

(30) $$\Pi_1^{P(NOP)} = \rho\delta^2 \frac{\left(\alpha - P_1^{R(NOP)}\right)^2}{4(\alpha-\gamma)} + d\frac{\left(\alpha - P_0^{R(NOP)}\right)^2}{4(\alpha-\gamma)^2}$$

Under the same type of agreement between artist and publisher the record publisher profits will be

(31) Max $$(1-s)\Pi^{R(NOP)} = (1-s)\left[\left(P_0^{R(NOP)} - c\right)N_0 + \rho\left(P_1^{R(NOP)} - c\right)N_1\right]$$

or, by replacing for N_0 and N_1,

(32)

Max $$(1-s)\Pi^{R(NOP)} = (1-s)\left(P_0^{R(NOP)} - c\right)\frac{\alpha - P_0^{R(NOP)}}{(\alpha-\gamma)} + \rho(1-s)\left(P_1^{R(NOP)} - c\right)\left[\frac{\alpha - P_1^{R(NOP)}}{(\alpha-\gamma)} + d\frac{\alpha - P_0^{R(NOP)}}{(\alpha-\gamma)^2}\right]$$

First order conditions with respect to the two period prices yield respectively

(33) $$P_0^{R\ *(NOP)} = \frac{\alpha + c}{2}$$ and

(34) $$P_1^{R\ *(NOP)} = \frac{\alpha - c}{2} + d\frac{\alpha - c}{4(\alpha-\gamma)}$$

By replacing optimal prices into the number of consumer equation we get

(35) $$N_0\ ^{*(NOP)} = \frac{\alpha - c}{2(\alpha-\gamma)}$$

and

(36) $$N_1^{*(NOP)} = \frac{\alpha - c}{2(\alpha-\gamma)} + d\gamma\frac{\alpha - c}{4(\alpha-\gamma)^2}$$

Finally, we may replace these numbers into profit functions to obtain the equilibrium profit of the record publisher

(37) $$\Pi^{R\ *(NOP)}(pu) = (1-s)\left[\frac{(\alpha-c)^2}{4(\alpha-\gamma)} + \rho\frac{\alpha - c + Z}{4(\alpha-\gamma)}\right]$$

By replacing Z we obtain

(38) $$\Pi^{R\ *(NOP)}(pu) = (1-s)\left[\frac{(\alpha-c)^2}{4(\alpha-\gamma)} + \rho\frac{[(\alpha-c)(2\alpha-2\gamma+d)]^2}{16(\alpha-\gamma)^3}\right]$$

And that of the artist combining profits from record sales and live performances

$$\Pi^{TOT(NOP)}*(a)=\Pi^{R^{(NOP)}}*(a)+\Pi^{P^{(NOP)}}*(a)=s\left[\frac{(\alpha-c)^2}{4(\alpha-\gamma)}+\rho\frac{\left[(\alpha-c+Z)\right]^2}{4(\alpha-\gamma)}\right]+$$

(39)

$$+\delta^2(1+\rho)\left[\frac{\left(\alpha-P_0^{R(NOP)}\right)^2}{4(\alpha-\gamma)^2}+\rho\frac{\left[\left(\alpha-P_1^{R(NOP)}+Z\right)\right]^2}{4(\alpha-\gamma)^2}\right]$$

Which, by replacing for Z and by remembering that $P^{R(NOP)}{}_0{}^*= (\alpha +c)/2$ and $P^{R(NOP)}{}_1{}^*=[(\alpha+c+Z)/2]$, becomes

$$\Pi^{TOT(NOP)}*(a)=\Pi^{R(NOP)}*(a)+\Pi^{P(NOP)}*(a)=s\left[\frac{(\alpha-c)^2}{4(\alpha-\gamma)}+\rho\frac{\left[(\alpha-c)(2\alpha-2\gamma+d)\right]^2}{16(\alpha-\gamma)^3}\right]+$$

(40)

$$+\delta^2(1+\rho)\left[\frac{(\alpha-c)^2}{16(\alpha-\gamma)^2}+\rho\frac{\left[(\alpha-c)(2\alpha-2\gamma+d)\right]^2}{64(\alpha-\gamma)^4}\right]$$

.

3. Comparison between the two equilibria: the conflict of interest on piracy

An important point when comparing the two equilibria is that the (cross-sectional) network externality and the (temporal) Proustian effect have positive impact on artist profits (via their effects on live performances), but not on publisher profits in the equilibrium with piracy.
This is because, with piracy, $\partial\Pi^R(a)^*\backslash\partial\gamma>0$ and $\partial\Pi^P(a)^*\backslash\partial d>0$ but $\partial\Pi^R(pu)^*\backslash\partial\gamma=0$ and $\partial\Pi^R(pu)^*\backslash\partial d=0$. Consider also that, for the artist as well, extra profits from the cross-sectional network and the intertemporal Proustian effect come from life performances and not from record sales since $\partial\Pi^R(a)^*\backslash\partial\gamma=0$ and $\partial\Pi^R(a)^*\backslash\partial d=0$.
On the contrary, in the equilibrium without piracy the publisher can fully benefits from the two effects exactly as the artist since $\partial\Pi^{R(NOP)}(pu)^*\backslash\partial\gamma>0$, $\partial\Pi^{R(NOP)}(pu)^*\backslash\partial d>0$, $\partial\Pi^{R(NOP)}(a)^*\backslash\partial\gamma>0$, $\partial\Pi^{R(NOP)}(a)^*\backslash\partial d>0$ and $\partial\Pi^{P(NOP)}(a)^*\backslash\partial\gamma>0$, $\partial\Pi^{P(NOP)}(a)^*\backslash\partial d>0$.

This is because piracy is bad for record sale profits but good for live performance profits. Hence, if the property right agreement with the record publisher on the share of profits from record sales establishes a very low share for the artist (*s* close to zero), the conflict of interest between the artist and publisher on how to tackle piracy will be enhanced. More formally, for a low level of *s*, $\partial\Pi^{TOT}(a)^*\backslash\partial F$ may become negative in the equilibrium with piracy (with s=0 it is definitely the case).[4]

---

[4] This occurs when $s<\dfrac{2\delta^2 p\dfrac{(\beta-pF)}{4(\beta-\gamma)^2}+\rho\delta^2 p\dfrac{\left[1+d/(\beta-\gamma)\right]}{4(\beta-\gamma)^2}}{2(1+\rho)p\dfrac{(\alpha-\beta-c+pF)}{4(\alpha-\beta)}}$.

To sum up, with high network externalities and Proustian effects, and with low property rights on record sales, the artist will be in favor of piracy while the publisher will be against it.

3.1 Optimal piracy repression to maximize industry profits under decentralized price setting framework

An interesting viewpoint from which investigating properties of the model is the analysis of the optimal choice of a regulator which would maximize industry profits by fixing the proper fine for illegal recording. Such perspective also helps us to evaluate whether piracy repression is good or not in such perspective. The analysis of the problem leads us to formulate the following proposition.

Proposition 1. Under $\alpha>\beta>\gamma$, and under reasonable parametric conditions, absence of piracy repression is the optimal solution which maximises total industry profits. This solution coincides with the optimal one which would be chosen by the artist but not with the optimal one chosen by the publisher.

Total industry profits in the equilibrium with piracy are simply

$$(41)\ \Pi^{TOT}(in)=\Pi^{P}(a)+\Pi^{R}(a)\big|_{s=1}=\delta^2\frac{(\beta-pF)^2}{4(\beta-\gamma)^2}+\rho\delta^2\frac{\left[(\beta-pF)\left[1+d/(\beta-\gamma)\right]\right]^2}{4(\beta-\gamma)^2}+(1+\rho)\frac{(\alpha-\beta-c+pF)^2}{4(\alpha-\beta)}.$$

These profits incorporate the optimal price choices of the publisher (for record sales) and of the artist (for life performances). Note that the role of the intertemporal Proustian memories is that of increasing the total number of (illegal and legal) consumers in the second period without affecting the share of legal ones. Hence its positive effect is only on the second term of profits. This means that the intertemporal effect has positive impact on tickets sold for life performances in the second period, but not on the total number of legal record sales in the same period.
To evaluate the effect of a change in the fine for illegal recording consider that the first order condition with respect to F yields

$$(42)\ -2\delta^2 p\frac{(\beta-pF)}{4(\beta-\gamma)^2}-2\rho\delta^2 p\frac{(\beta-pF)\left[1+d/(\beta-\gamma)\right]^2}{4(\beta-\gamma)^2}+2(1+\rho)p\frac{(\alpha-\beta-c+pF)}{4(\alpha-\beta)}=0$$

the first two terms are negative and are the effects of a higher sanction for piracy on life performance sales in the first and in the second period. This is because a higher sanction reduces illegal music consumption in the first and in the second period and therefore also the demand for life performances in the same periods. In the second period the negative effect is enhanced by the reduced impact of Proustian memories since the lower number of listeners in the first period reduces the emotional quasi rents, with negative incidence on the potential number of life performance tickets sold in the second period. The third term is positive and is the effect of an increase in the sanction for piracy on the number of legal consumers. To sum up, an increase in F

reduces the number of illegal and total consumers but raises the number of the legal ones.
By deriving for F once again we find that the second order condition for a maximum is not met since

$$(43)\ \frac{+2\delta^2 (p)^2}{4(\beta-\gamma)^2}+\frac{2(1+\rho)(p)}{4(\alpha-\beta)}+2\rho\delta^2\frac{p\left[1+d/(\beta-\gamma)\right]^2}{4(\beta-\gamma)^2}>0$$

Hence, the optimal choice is a corner solution chosen between the two extremes of *F*=0* and *F*=β/p* (above this threshold no illegal consumers exist). The intuition for the lack of social optimum is the following. Imagine we start from F*=0 and increase F. The marginal benefit on legal record sales is lower than the marginal cost on life performances for low levels of F, while the situation is reversed after F reaches a given threshold. Hence profits follow a U-shape in the F∈ [0,βbeta/p] interval. The comparison of profits under the two extreme choices tells us which corner solution is optimal.
Consider also that, from the inspection of (41) the conflict of interests clearly emerges. For an artist with s=0 (or with profits from live performances only) only the first two terms exist and therefore $\partial\Pi^{TOT}$(a)*\ ∂F <0 and the optimal fine is zero. For a publisher only the third term applies and therefore $\partial\Pi^{TOT}$(pu)*\ ∂ F>0 and the optimal fine is the minimum needed to eliminate piracy (F*=β/p).[5]

By considering that the two corner solutions yield respectively

$$(44)\ \Pi^{TOT}(in)\Big|_{F=0}=\frac{(\delta\beta)^2}{4(\beta-\gamma)^2}+\rho\delta^2\frac{[\beta(1+d)/(\beta-\gamma)]^2}{4(\beta-\gamma)^2}+(1+\rho)\frac{(\alpha-\beta-c)^2}{4(\alpha-\beta)}$$

and

$$(45)\ \Pi^{TOT}(in)\Big|_{F=\beta/p}=(1+\rho)\frac{(\alpha-c)^2}{4(\alpha-\beta)},$$

the corner solution of no repression against piracy is the optimal solution of the problem if

$$(46)\ \frac{(\delta\beta)^2}{4(\beta-\gamma)^2}+\rho\delta^2\frac{[\beta(1+d)/(\beta-\gamma)]^2}{4(\beta-\gamma)^2}-(1+\rho)\frac{\beta^2+\beta(\alpha+c)}{4(\alpha-\beta)}>0.$$

From inspection of (46) it is clear that if cross-sectional network and intertemporal Proustian effects are sufficiently high the no piracy solution is the optimal one.

[5] Remember that the conditions for the existence of illegal consumers require just that pF≥β with β>γ to eliminate piracy. Consider also that F=0 does not necessarily imply zero legal consumers in period t if α>β $+P^R_t$.

3.2 The effect of the Proustian effects with time contingent policies of piracy repression

Consider the possibility of an optimal penalty different for each period. In this case the share of total consumers in the second period changes into

$$N_1^* = \frac{(\beta - pF_1)\left[1 + d(\beta - pF_0)/(\beta - \gamma)\right]}{(\beta - \gamma)} \quad (47)$$

Maximization of industry profits becomes

$$\begin{aligned} \Pi^{TOT}_{\{F_0,F_1\}}(in) &= \delta^2 \frac{(\beta - pF_0)^2}{4(\beta - \gamma)^2} + \rho\delta^2 \frac{\left[(\beta - pF_1)\left[1 + d(\beta - pF_0)/(\beta - \gamma)\right]\right]^2}{4(\beta - \gamma)^2} \\ &+ s\left\{\frac{(\alpha - \beta - c + pF_0)^2}{4(\alpha - \beta)} + \rho\frac{(\alpha - \beta - c + pF_1)^2}{4(\alpha - \beta)}\right\} \end{aligned} \quad (48)$$

Note that, the higher the Proustian memories, the more negative the effect on profits of a higher penalty for illegal consumers in both periods. The negative effect of piracy repression in the first period is in the reduction of the potential group of consumers which may be affected by the Proustian effect in the second. The negative effect of repression in the second period is in the prohibition of illegal downloading in the second period which prevents "nostalgic consumers" from having their Proustian memories with an effect of reduced audience in live performances in the same period.[6]

The two first order conditions from (48) are

$$\begin{aligned} &-2\delta^2 p^* \frac{(\beta - pF_0)}{4(\beta - \gamma)^2} - 2\rho\delta^2 \frac{\left[(\beta - pF_1)\left[1 + d(\beta - pF_0)/(\beta - \gamma)\right]\right](\beta - pF_1)dp/(\beta - \gamma)}{4(\beta - \gamma)^2} + \\ &+2p^* \frac{(\alpha - \beta - c + pF_0)}{4(\alpha - \beta)} = 0 \end{aligned} \quad (49)$$

and

$$-\rho\delta^2 p \frac{\left[1 + d\gamma/(\beta - \gamma)\right]}{4(\beta - \gamma)^2} + 2\rho p \frac{(\alpha - \beta - c + pF_1)}{4(\alpha - \beta)} = 0 \quad (50)$$

Again, the second order condition for a maximum is not met since, by inspection of first order conditions, we clearly have an Hessian with two positive signs on the main

[6] The logical sequence implied by the construction of our model is that the Proustian effect occurs when consumers who enjoyed music in the first period, listen to it (legally or illegally) also in the second period. The impact of Proustian effects on demand for life performances need therefore to be mediated by legal or illegal fruition of music in the second period.

diagonal and a positive and a zero on the second diagonal. The solution will be on the border of the *feasible set* - a rectangle delimited by: i) $0 \leq F_0 \leq \beta/p$ and ii) $0 \leq F_1 \leq \beta/p$. If we consider the four corner solutions

$$\Pi^{TOT}{}_0(in)\Big|_{F_0=0,F_1=0} = \frac{(\delta\beta)^2}{4(\beta-\gamma)^2} + \rho\delta^2 \frac{[\beta[1+d\beta/(\beta-\gamma)]]^2}{4(\beta-\gamma)^2}$$

(51)
$$+ s\left\{\frac{(\alpha-\beta-c)^2}{4(\alpha-\beta)} + \rho\frac{(\alpha-\beta-c)^2}{4(\alpha-\beta)}\right\}$$

$$(52)\ \Pi^{TOT}{}_0(in)\Big|_{F_0=\beta/p^*,F_1=0} = \rho\delta^2 \frac{\beta/(\beta-\gamma)^2}{4(\beta-\gamma)^2} + s\left\{\frac{(\alpha-c)^2}{4(\alpha-\beta)} + \rho\frac{(\alpha-\beta-c)^2}{4(\alpha-\beta)}\right\}$$

$$(53)\ \Pi^{TOT}{}_0(in) = \Pi^P(a)_0 + \Pi^R(a)_0\Big|_{s=1,F_0=0,F_1=\beta/p} = \frac{(\delta\beta)^2}{4(\beta-\gamma)^2} + s\left\{\frac{(\alpha-\beta-c)^2}{4(\alpha-\beta)} + \rho\frac{(\alpha-c)^2}{4(\alpha-\beta)}\right\}$$

$$(54)\ \Pi^{TOT}{}_0(in) = \Pi^P(a)_0 + \Pi^R(a)_0\Big|_{s=1,F_0=\beta/p,F_1=\beta/p} = s(1+\rho)\frac{(\alpha-c)^2}{4(\alpha-\beta)}$$

We see that the intertemporal effect increases the likelihood that the corner solution of no repression in both periods is the optimal solution of the problem. This is because a positive penalty in either the first or the second period reduces gains from nostalgic consumers consumption. More specifically, for a high d and a γ close to β, no piracy repression in both periods is the optimal choice which maximises industry profits.

3.3 A decentralised contractual solution to the conflict of interest

Consider also that the publisher might accept a reduction of penalty repression if the artist is willing to compensate him. The artist may give part of his marginal gains from lower piracy repression to compensate for the marginal costs of the publisher if the first are higher than the second as implied by the fact that industry profits are higher with reduced piracy repression (more formally this occurs when $\partial\Pi^{TOT}*\backslash \partial F < 0$, $\partial\Pi^{TOT}(a)*\backslash \partial F < 0$ and $\partial\Pi^{TOT}(pu)*\backslash \partial F > 0$ and $|\partial\Pi^{TOT}(a)*\backslash \partial F| > |\partial\Pi^{TOT}(pu)*\backslash \partial F|$).
By inspection of (41) the last condition is met when

$$(55)\ 2\delta^2 p * \frac{(\beta - p*F)}{4(\beta-\gamma)^2} 2\rho\delta^2 p \frac{(\beta-pF)\left[1+d/(\beta-\gamma)\right]^2}{4(\beta-\gamma)^2} > 2(1+\rho)p\frac{(\alpha-\beta-c+p*F)}{4(\alpha-\beta)}.$$

In such case the artist may propose a contract in which he transfers part of his gains such as, for instance, a positive amount which is equal in absolute terms to $|\partial\Pi^{TOT}(pu)*\backslash \partial F| + \varepsilon\ [|\Pi^{TOT}(a)*\backslash \partial F| - |\partial\Pi^{TOT}(pu)*\backslash \partial F|]$.
The intuition is that there is room for a decentralized contractual solution when a reduction of penalty for piracy generates a cost for the publisher in terms of reduced

sales which may be lower than the (net) benefit for the artist in terms of higher gains from concert ticket sales minus the artist loss for reduced record sales.

4. Bargaining

The discussion of the model has so far assumed an exogenously given share of property rights on legal record sales while it may be interesting to see which forces affect it. In this section we endogenize this variable by conveniently assuming that the division of property rights is bargained between the artist and the publisher before the choice of proper prices for profit maximisation. As it is well known the standard bargaining theory establishes that the equilibrium level of bargained property rights will arise from the solution of the following Nash Maximand

$$(56)\ [\Pi^{R}*(pu)\ |_{AGR} - \Pi^{R}*(pu)\ |_{NOAGR}]^{\theta}[\Pi^{TOT}*(a)\ |_{AGR} - \Pi^{TOT}*(a)\ |_{NOAGR}]$$

where the first (second) term in square brackets is the difference between the publisher (artist) profits with and without agreement and the exponent θ is the relative patience of the publisher with respect to the artist or, conventionally, the ratio of the discount rates of the two counterparts (discount rate of the artist scaled by the discount rate of the publisher).

In our problem the editor and publisher profits in case of agreement are respectively

$$(57)\ \Pi^{R}*(pu)\Big|_{AGR} = (1-s)(1+\rho)\frac{(\alpha-\beta-c+pF)^2}{4(\alpha-\beta)}$$

and

$$(58)\ \Pi^{TOT}(a)\Big|_{AGR} = \Pi^{P}(a)+\Pi^{R}(a)\Big|_{AGR} = \delta^2\frac{(\beta-pF)^2}{4(\beta-\gamma)^2}+\rho\delta^2\frac{\left[(\beta-pF)\left[1+d/(\beta-\gamma)\right]\right]^2}{4(\beta-\gamma)^2}+s(1+\rho)\frac{(\alpha-\beta-c+pF)^2}{4(\alpha-\beta)}$$

while the editor and publisher profits without agreement are respectively

$$(59)\ \Pi^{R}*(pu)\Big|_{NOAGR} = 0$$

and

$$(60)\ \Pi^{TOT}(a)\Big|_{NOAGR} = \Pi^{P}(a)+\Pi^{R}(a)\Big|_{NOAGR} = \delta^2\frac{(\beta-pF)^2}{4(\beta-\gamma)^2}+\rho\delta^2\frac{\left[(\beta-pF)\left[1+d/(\beta-\gamma)\right]\right]^2}{4(\beta-\gamma)^2}$$ [7]

[7] The assumption here is that, without the agreement with the monopolistic publisher, the artist may nonetheless upload his music files on internet thereby making illegal recording possible. Under this assumption the total number of listeners (in this case all illegal listeners) in the period t (t=0,1) will again coincide with N_t and the demand for life performances will remain unchanged.

under the assumption that the publisher outside option is equal to zero, while that of the artist is the profit from his life performances.
The Nash maximand may be simplified into

$$(61)\left[s(1+\rho)\frac{(\alpha-\beta-c+pF)^2}{4(\alpha-\beta)} \right]^{\theta}\left[s(1+\rho)\frac{(\alpha-\beta-c+pF)^2}{4(\alpha-\beta)} \right]$$

By taking logs and deriving with respect to the publisher share of property rights (s) we obtain the following first order condition

$$(62)\frac{-2\theta\left[(1-s)(1+\rho)\frac{(\alpha-\beta-c+pF)}{4(\alpha-\beta)} \right]}{\left[(1-s)(1+\rho)\frac{(\alpha-\beta-c+pF)^2}{4(\alpha-\beta)} \right]}+2s\frac{\left[(1+\rho)\frac{(\alpha-\beta-c+pF)^2}{4(\alpha-\beta)} \right]}{\left[(1+\rho)\frac{(\alpha-\beta-c+pF)}{4(\alpha-\beta)} \right]}=0$$

which simply yields s = 1/1+θ

Hence, the equilibrium share is affected only by the relative players' patience and is invariant in all other factors affecting their profits with and without the agreement. As it is reasonable to expect, when the index of relative patience is infinite (publisher infinitely more patient than the artist) all property rights go to the publisher ($\lim_{\theta\to\infty} s = 0$) while, if the relative patience of the publisher tends to zero, all property rights go to the artist ($\lim_{\theta\to 0} s = 1$).
Consider, though, that independence of the profit share from other model variables different from the two counterpart subjective discount rates does not hold anymore under some interesting extensions. Imagine for instance that the artist bargains not just profits from his current musical creation, but also exclusive rights for his future artistic creations. In that case the editor profits in case of agreement consist also of an exclusivity option for future artist production. As a consequence, his loss under failure of the agreement is higher and his bargaining power is weaker. In this case it is possible to show that most model variables do not cancel out and all those affecting profits from legal sales have an impact on the equilibrium bargained profit share. [8]

---

[8] In such case the Nash maximand turns into $[\Pi^{R}*(pu)\,|_{AGR}$ +EO- $\Pi^{R}*(pu)\,|_{NOAGR}]$ $^{\theta}[\Pi^{TOT}*(a)\,|_{AGR}$ - $\Pi^{TOT}*(a)\,|_{NOAGR}]$ where EO is the value of the exclusivity option which will be a function of the expected future productivity of the artist. By solving the bargaining problem we get s= (1+EO/ $\theta\Pi^{R}$)/(**2**+EO/θ Π^{R}) where Π^{R} are profits from legal sales. By reasonably assuming that the exclusivity option is function of a discounted expected value of future legal sales on new artistic creations (hence increasing in F which raises profits from legal sales), we get that the effect of an increase in F depends on the relative impact of F on the ratio between the exclusivity option and current sales. If the artist is very promising an increase of F raises that ratio and paradoxically increases the bargaining power and equilibrium share of the artist.

On the contrary, we can outline an opposite scenario if we assume that the failure of the agreement with the publisher has some negative effects on tickets sold for life performances the loss from failure of agreement becomes higher for the artist and his bargaining power is weaker

5.1 First best industry optimum and opportunities to reduce the conflicts of interest

In sections 3.1 and 3.2 we showed that a regulator may maximise industry profits, given the decentralised optimal price choices of the artist and the publisher, by choosing the optimal level of piracy repression (which may be equal to zero under reasonable parametric assumptions). In that framework the regulator acts as a Stackelberg leader which maximises industry profits by choosing the optimal policy for piracy repression, incorporating the reaction functions of the artist and publisher in terms of their optimal price choices. In such context the share of property rights remains exogenously determined.

If, however, we make the bargaining process endogenous as in section 4 the regulator knows that his policy for piracy repression may affect not just artist and publisher prices but also the share bargained between the two (in such case the sequence is such that in the first period the regulator chooses F, in the second the artist and the publisher bargain on the property right share on legal sales and in the third they maximise profits). What we showed in the basic bargaining equilibrium framework is that the property right share remains unaffected by the piracy repression policy, while this is not the case in the specific example of bargaining over the exclusivity option illustrated in footnote 8.

Hence, in the basic bargaining case, the regulator may not affect the level of (s).

To sum up our general findings, a first best solution for the regulator would be no piracy repression when conditions explained when commenting condition (46) in section 3.1 are realised.

In a decentralised price setting framework the conflict of interest will nonetheless remain but it may be reduced if pure publishers transform themselves into hybrid publishers in such a way that their share on legal records and profits from life performances are the same.

To illustrate this point consider now that the publisher may extend his activity to the production of complementary goods (i.e. hardware digital players (HDPs) such as I-pods and Sony Walkman players) necessary (or, however, highly demanded) for the fruition of illegal music files downloaded from the web. Assume for simplicity that only illegal consumers buy HDPs[9]

[9] Actually hardware digital players have been created to listen legally downloaded music files (i-Pod for iTunes and Walkman for Sony digital files) and the DRM (Digital Right Management) system aims to make digital music more excludable by reducing compatibility with illegal files. However the files can be easily cracked and therefore hardware digital players are commonly used to listen also illegally downloaded music files. Furthermore, the reasonable assumption in our model is that consumers of legal records (i.e. CDs) are "old-style" consumers with no expertise of

$$(63)\ q_{IP}^{IP} = \left[\max(\delta(N_t - x_t) - P_t^{IP}, 0) \right]$$

As a consequence, total profits from selling HDPs will be

$$(64)\ \Pi^{IP} = P_0^{IP} \left[\max(\delta(N_0 - x_0) - P_0^{IP}, 0)\right] + \rho P_1^{IP} \left[\max(\delta(N_1 - x_1) - P_1^{IP}, 0)\right]$$

where ρ=1/(1+r) is the consumers' rate of time preference.

First order conditions yield the following optimal prices for period t

$$(65)\ P_t^{IP} = \frac{\delta(N_t - x_t)}{2}$$

and the following profits from HDP sales

$$(66)\ \Pi_t^{IP} = \frac{\delta^2 (N_t - x_t)^2}{4}$$

As a consequence total publisher profits are

$$(67)\ \Pi^{TOT}(pu) = \Pi^{IP}(pu) + \Pi^{R}(pu) = \delta^2 \frac{(N_0 - x_0)^2}{4} + \rho\delta^2 \frac{(N_1 - x_1)^2}{4} + (1-s)(1+\rho)\frac{(\alpha - \beta - c + pF)^2}{4(\alpha - \beta)}$$

which, by considering that

$$(68)\ N_t - x_t = \frac{(\beta - pF)}{\beta - \gamma} - \frac{(\alpha - \beta - c + pF)}{2(\alpha - \beta)}$$

become

$$(69)\ \Pi^{TOT}(pu) = \Pi^{IP}(pu) + \Pi^{R}(pu) = \delta^2(1+\rho)\left[\frac{(\beta - pF)}{\beta - \gamma} - \frac{(\alpha - \beta - c + pF)}{2(\alpha - \beta)}\right]^2 + (1-s)(1+\rho)\frac{(\alpha - \beta - c + pF)^2}{4(\alpha - \beta)}$$

The third term shows that the publisher still has profits from record sales even in case of no piracy repression. Consider that, in this case, the no piracy repression corner solution might be optimal also for the publisher.
First order condition is

$$(70)\ -2\delta^2(1+\rho)\left[\frac{(\beta - p^*F)}{(\beta - \gamma)} - \frac{(\alpha - \beta - c + pF)}{2(\alpha - \beta)}\right]\left(\frac{p}{(\beta - \gamma)} + \frac{p}{2(\alpha - \beta)}\right) + 2(1+\rho)(1-s)p\frac{(\alpha - \beta - c + pF)}{4(\alpha - \beta)} = 0$$

Once again second order condition is positive and therefore the optimal policy for piracy repression in the perspective of the publisher is the solution - between the two corner ones (F*=0 and F*=β/p) - which maximises his profits.
Under F*=0

---

music files on the web and therefore do not listen music with iPods. Consider therefore the share of HDP consumers calculated in this extension of the model as a downward limit on the share of potential users.

$$\Pi^{TOT}(pu)\Big|_{F^*=0} = \Pi^{IP}(pu) + \Pi^{R}(pu) = \delta^2(1+\rho)\left[\frac{\beta}{\beta-\gamma} - \frac{(\alpha-\beta-c)}{2(\alpha-\beta)}\right]^2 + (1-s)(1+\rho)\frac{(\alpha-\beta-c)^2}{4(\alpha-\beta)}$$ [10]

(71)

while, under F*=β/p*,

$$(72)\ \Pi^{TOT}(pu)\Big|_{F=\beta/p^*} = \Pi^{IP}(pu) + \Pi^{R}(pu) = (1-s)(1+\rho)\frac{(\alpha-c)^2}{4(\alpha-\beta)}$$

when profits from selling HDPs are high enough the no piracy repression is optimal also for the publisher.

6. Conclusions

The market of popular music is a very particular market which has become all the more so in the internet era with the option of piracy. Recent psychological studies support the hypothesis that the fruition of popular music depends on three main characteristics: i) the intrinsic quality of the product (evaluated via subjective judgement of the consumer); ii) a "sociological" factor represented by the cross-sectional network externalities related to its fruition (i.e. music has a social value represented by its capacity of facilitating relationships within the group of individuals/friends which share the same musical passion); ii) a psychological factor represented by the intertemporal Proustian effect of the emotions lived in the past and rediscovered and associated to any new fruition.

To this complex pattern of preferences we must add that the possibility of illegal downloading is creating competition between a costly legal and a free illegal fruition of the good which are almost perfect substitutes, the decision between the two being uniquely based on individual morality, attitude for risk and taste for the small "packaging" differences between the two products.

The complexity grows if we consider two main actors which can profit from the music industry, the artist and the publisher, and the fact that popular music is traditionally sold through two main ways: records or life performances, with both legal and illegal fruition of records being complements to participation to life performances.

The main problem for a "pure" publisher (whose unique source of profit is legal record sales) in this complex market structure is that he has no indirect benefit from illegal recording since he does not participate to the artist's life performance profits.

The above described features clearly outline a conflict of interest between the artist and publisher. Differently from the publisher, the artist, by taking into account the Proustian intertemporal effect and the complementarity between (legal and illegal) recording and life performances will be in favour of a more lenient policy toward

[10] The positive third term indicates that the share of legal consumers is not necessarily zero in case of no piracy repression, since high morale (low x) individuals will still prefer legal sales.

illegal recording than the publisher. The conflict of interest will be higher the lower the property right share of the artist on legal recording.
After illustrating these basic features of the model we endogenize the sanction for piracy and show that the optimal policy which maximises industry profits under the decentralised price setting is that of no piracy repression if the cross-sectional and intertemporal externalities are strong enough.
We finally demonstrate that the conflict of interest is mitigated if we move from a "pure" to a "hybrid" publisher who can profit from illegal downloading and from its externalities by respectively participating to profits from sales of products and services which are complementary to the fruition of legal and illegal digital music files (such as hardware digital players or life performances).
We conclude the paper with a policy suggestion for regulators. In presence of the specific characteristics of the music market - two substitute "source" goods (the first legal and costly, the second illegal and free) and goods which are complementary to the first two (life performances but also hardware digital players) - under reasonable assumptions on consumer preferences and market structure, the optimal solution may be paradoxically that of: i) not (or mildly) repressing illegal consumption of the "source" good and ii) promoting the transformation of "pure" publishers (having profits only from the legal and costly source goods) into "hybrid" publishers (having profits from both the legal source good and the products and services complementary to the former).
The advantage of this policy would be that of maximising industry profits, eliminating costs of piracy prosecution and maximising welfare of consumers of the source good whose utility is increased by the two cross-sectional and intertemporal externalities.

References

Becker, G., and G. Stigler, 1977, "Degustus Non Est Disputandum", American Economic Review, Vol. 67, No. 2, pp. 76-90.

Boldrin M. & David K Levine, 2002. "The Case Against Intellectual Property," Levine's Working Paper Archive 618897000000000003, UCLA Department of Economics.

Conner, K. R. and R. P. Rumelt. 1991. "Software Piracy: An Analysis of Protecting Strategies." Management Science 37:125-139.

CRIA (Canadia Recording Indusrty Association www.cria.ca

Fehr, Ernst and Klaus Schmidt (1999) "A Theory of Fairness, Competition, and Cooperation," Quarterly J. Econ., 114, 817—868.

Gayer, A. and O. Shy (2005) "Publishers, Artist and Copyright Enforcement" (downloadable from www.ozshy.com)

Hayek, F. (1948). Individualism and Economic Order, Chicago University Press

Holbrook, Morris B & Schindler, Robert M, 1989. "Some Exploratory Findings on the Development of Musical Tastes," Journal of Consumer Research: An Interdisciplinary Quarterly, University of Chicago Press, vol. 16(1), pages 119-24, June.

IFPI Digital Music Report 200http://www.ifpi.org/site-content/press/20060119.html

ITIC "Digital Piracy - Definitive P2P piracy figures for Year 2003" (Aug 2004), www.itic.ca/index.html)

Loewenstein G. and C. Camerer, and D. Prelec (2005) "Neuroeconomics: how neuroscience can inform economics" Journal of Economic Literature , 2005, XLIII, 9-64.

Loewenstein G. and N. Ashraf, Colin F. Camerer (2005) "Adam Smith, Behavioral Economist" Page proofs for Journal of Economic Perspectives, 2005, Vol. 19, No. 3. (Posted 7/5/05)

Peitz, Martin and Waelbroeck, Patrick, "The Effect of Internet Piracy on CD Sales: Cross-Section Evidence" (January 2004). CESifo Working Paper Series No. 1122.

Available at SSRN: http://ssrn.com/abstract=511763

Shy O. & Jacques-Françlois Thisse, 1999. "A Strategic Approach to Software Protection," Journal of Economics & Management Strategy, Blackwell Publishing, vol. 8(2), pages 163-190, 06.

Varian Hal H. 2005 “Copying and Copyright” The Journal of Economic Perspectives Vol. 19, No. 2, Spring 2005