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Strategic Use of Copyright Protection to Deter Entry

Jin-Hyuk Kim

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Once upon a time there was a struggling young California band. Its music was too loud and its image too unpolished for MTV. Its social and political messages were a little too disturbing for radio. But it built a passionate following among underground-rock fans by touring relentlessly, staying true to its message and encouraging fans to record its live shows and distribute bootlegged tapes as widely as possible. Metallica, once copyright poor, ... filed a copyright infringement suit against Napster. (*The Nation*, July 24, 2000)

1 Introduction

In copyrighted goods markets, such as music, artists of different status levels typically have opposing views on what the appropriate level of copyright protection should be. Specifically, established artists seem to favor stronger copyright protection than relatively unknown or new artists — a conflict of interest that seems to be growing. For example, more than 70 well-established artists organized a group called Artists Against Piracy to launch a nationwide anti-Napster campaign. In Britain the same coalition was led by Paul McCartney and Elton John, who are the richest and the second richest rock stars.¹

Interestingly, while most of the stars were against digital copying, relatively unknown artists endorsed Napster for its promotional role for new artists. That is, the less-known recording artists and professionals briefed the court in support of Napster, saying that “Napster is a great vehicle and tool for new artists and independent labels that are desperately in need of access to the public ear,” and “the increase in the number of people listening to music means a better chance in an increase in the demand for the music and for live performances.”² In a survey, 43 percent of the artists agreed that “file-sharing services aren’t really bad for artists, since they help to promote and distribute an artist’s work to a broad audience.”³

The populist view that well-known artists are not happy about consumer piracy may not be surprising, but the cause and effect of possibly excessive

¹More recently, over 50 high-profile artists signed on to the amicus brief urging the courts to find P2P systems such as Grokster liable for copyright infringement.

²Declarations of Michael E. Lawrence and Randy J. Nichols in support of defendant Napster. See also declarations of Steven W. Isaacs, Lawrence W. Railey, and Jim Guerinot. <<http://news.lp.findlaw.com/legalnews/lit/napster/index3.html>>.

³Pew Internet & American Life Project. Press Release 12/5/2004. <http://www.pewinternet.org/press_release.asp?r=94>.

copyright protection seems to have been neglected in the literature. While various theoretical and empirical works have addressed the sales displacement issue, most of them have not emphasized that the vested interest might try to use copyright protection strategically, which has implications for different types of players in the market. This paper puts forth some insights gained from the theory of strategic entry deterrence in order to understand the conflict of interest involved in copying and copyright protection.

My approach is based on considering complementary markets. There are mainly three sources of income in the music industry: recorded albums, radio broadcasting, and live performances. The latter two markets are what we refer as the complementary market, while the market for recorded music is the primary market. Artists get income mainly from albums and concerts, and music companies get income mainly from albums and broadcasting. In the following, my discussion is adapted to the perspective of artists for expositional clarity, however, the same analysis would apply if I instead considered music companies as the players and broadcasting as the complementary market.

Connolly and Krueger (2005) present evidence that a large share of celebrities' incomes have been generated from such complementary activities as live performances, and that the market for live concerts is highly concentrated.⁴ Since the revenue generated from this complementary market can be surprisingly large, the focus of the incumbents may not be so much on their primary market, but on the less obvious complementary market.⁵ Thus, narrowly focusing on the sales substitutability in the primary market may not appropriately address overall market behavior and the impact of copyright policy.

The link between primary and complementary markets can be explained by the so-called economics of superstars (Rosen 1981).⁶ Since people prefer to go to concerts put on by superstars as opposed to little-known artists, introducing live performances in addition to recordings would increase the overall returns to superstars.⁷ On the other hand, a new artist needs a large

⁴The idea that you can use one activity to prove your ability and another activity to make a profit applies more generally. For example, best-selling novels are made into movies; popular programs draw more advertisements; and successful open-source programmers receive high-wage offers.

⁵Mortimer and Sorensen (2005) show that artists may switch their efforts toward live performances from album productions.

⁶This theory observes that, at the top of the talent distribution where the superstars are found, a small difference in talent is associated with large differences in revenue resulting in skewed income distribution.

⁷Here I am referring to live concerts at large venues. There are of course many small-venue live performances, but those tend to be less lucrative and incorporating them would

audience listening to her music to become a star and profit from live concerts. Thus, the incumbent would have more incentive to suppress the entrant's success, and this leads to more entry deterrence in the primary market.

Copying promotes the artist and album by lowering consumer search costs; that is, increased exposure boosts demand for the album. Gopal et al. (2006) and Peitz and Waelbroeck (2006a) formalize the idea that allowing pre-purchase sampling may even increase record sales. As I assume in the model, copying has a positive effect on building a fan base without the traditional means of promotion, such as TV and radio. Although a bootlegged album does not contribute to an artist's sales profit, all other things being equal, it provides recognition, which increases the possibility of participating in the complementary market.

The conventional wisdom of earlier literature is that copyright protection increases the artist's profit, and this in turn spurs the supply of creative works. This, however, does not distinguish established artists from potential entrants and might be flawed by the conflict of interest between the two types of artists. This paper explains why the incumbent may advocate strong copyright protection and shows that extending excessive protection can hurt the incentive of potential artists to create. Although a similar argument can be made without the complementary market, my approach incorporates the above evidence and yields the same net prediction.⁸

My first result is that a complementary market causes the incumbents to prefer stronger copyright protection than is needed to maximize their sales profit in the primary market. Thus, an incumbent would choose to reduce the entry probability even if it hurts his own primary-market profit. By setting the level of protection high, the incumbent impairs demand for the entrant's album, making it more difficult for the entrant to achieve stardom. My second result is that if the entrant can deviate and profitably opt out of the copyright system, then this can mitigate the incumbent's strategic behavior. Because the opt-out choice increases the entrant's outside option, the incumbent must accommodate more types to enter as well as to opt in.

The remainder of this paper is organized as follows. Section 2 briefly mentions the relevant literature. Section 3 lays out the model, and section 4 contains the main result. Section 5 extends the model to incorporate the

not change the main results.

⁸Suppose, for example, the artist competes only in the primary market, but over multiple periods. If an unsuccessful first album prevents the entrant from producing a second album, as is often the case, then the incumbent would still have an incentive to suppress the exposure of unknown artists to reduce future competition in album sales. In this case, the subsequent album serves as the complementary product.

entrant's opt-out choice. Section 6 concludes.

2 Related Literature

The classic trade-off that optimal IP protection must strike a balance between the incentive to create and monopoly distortion has been at the center of copyright policy debates.⁹ A distinct issue regarding copyrights is that copying allows end-users to directly infringe the copyrights, thus, the level of protection is important for consumers as well as for producers.¹⁰ Novos and Waldman (1984) showed that increasing copyright protection can reduce the social welfare loss due to underproduction; Johnson (1985) similarly found that protection can increase consumer welfare as larger revenue induces an increase in supply.

However, the literature has also noted some benefits of copying, or costs associated with copyright protection. In particular, the literature on indirect appropriability (e.g., Liebowitz 1985, Besen and Kirby 1989, and Takeyama 1997) showed that the seller could appropriate the surplus of copiers by selling the initial units of the original product at a higher price. Landes and Posner (1989) argued that copyrights could impose a social cost because most creative works were based on existing ones. Boldrin and Levine (2007) showed that in general equilibrium the stock of innovation was lower with a monopoly on intellectual property than without it.

The work closest to ours is that of Ben-Shahar and Jacob (2004). They discuss a strategic aspect of copyright protection where the incumbent tries to deter the entrant by selectively enforcing copyrights in one market but not in the others. In essence, the incumbent engages in predatory pricing, which makes it harder for the entrant to recoup her fixed costs. However, this seems somewhat inconsistent with the real world as rarely do we see incumbent artists discard copyrights and offer their products at predatory low prices. My approach demonstrates instead that the incumbent prefers stronger copyright protection to deter entry.¹¹

⁹See, for example, Akerlof et al. (2002), and Liebowitz and Margolis (2005) regarding the Copyright Term Extension Act of 1998; Boldrin and Levine (2002), Klein et al. (2002), and Romer (2002) regarding the Napster case.

¹⁰I do not attempt to survey the copyright literature here. Peitz and Waelbroeck (2006b) provide an excellent survey.

¹¹The current paper is also related to the large literature on entry deterrence, especially one that emphasizes "raising the rival's costs" (Salop and Scheffman 1983). In my model, the incumbent can preempt copyright policy to impair the demand of new artists' albums and preserve the monopoly stardom.

3 The Model

This section lays out a simple game-theoretic model that is loosely based on Novos and Waldman (1984). There is one incumbent star and one potential entrant, designated as he and she, respectively. Both are risk neutral and thus maximize expected profit. The star can produce an album of quality \bar{Q} , but the quality of the potential entrant, Q , is uncertain prior to entry. Q is uniformly distributed on the interval $[\underline{Q}, \bar{Q}]$, and $F(Q)$ denotes its distribution. The entrant must incur a fixed entry cost, F , to produce her album, whereas the incumbent has already sunk the cost. To make things nontrivial, the entry cost is neither low nor high enough to guarantee or block the entry.

Recorded music that the artists create is copyrightable and thus protected from copyright infringements. However, copyright protection is not perfectly enforced. For example, digital copying is widespread, and the government or the court can consider shutting down the file-sharing systems or increasing the infringement fine. Formally, denote the level of copyright protection as $H \in [0, 1]$, where $H = 0$ is minimal and $H = 1$ maximum protection. I assume that the incumbent can influence the copyright policy to set the level of copyright protection he desires. This can be due to the incumbent's lobbying.¹²

The potential entrant then makes her entry decision. If she enters, both artists produce albums at a constant marginal cost c to sell in the primary market.¹³ If the potential entrant stays out, she earns a zero profit and only the incumbent produces. Artists, as copyright holders, can charge a monopoly price, p , for their albums; and, when they set the price, they consider the sales substitution due to illicit copying. I assume that the seller cannot indirectly expropriate the surplus up front by charging a higher price for the first unit of the album. Hence, the seller does not price discriminate, but must charge a uniform price to all consumers.

On the demand side, there are two groups of consumers for each artist's album. The two groups differ by their valuation of musical items. Individuals in group 1 have a high valuation, v_h , while those in group 2 have a low valuation, v_l . In plain terms, group 1 represents music fans, and group 2 is the general public who derives small utility from listening to music. The size of group 2 is normalized to unity, and the size of group 1 is a state variable, x .

¹²There seems to be limited scope for potential entrants' lobbying because entrants cannot devote enough resources to influence, and they are less organized to overcome the free-rider problem. Although it might be useful to model such lobbying process, it is beyond the scope of this paper.

¹³I abstract from the contractual relationship between artists and record labels and treat them as the same entity. See, e.g., Caves (2003) and Gayer and Shy (2006) for this.

Copyright protection impairs the demand by reducing exposure; on the other hand, the album quality has a positive effect on the demand. Therefore, the actual demand of the high valuation group is $\gamma(H, Q)x$, where $\gamma_H < 0$, $\gamma_Q > 0$.

Individual consumers also vary by their cost of copying. A parameter, z , represents an individual's cost of obtaining a copy, and the continuum of individuals are assumed to be distributed on the interval $[0, Z]$ with respect to this dimension. The consumer's cost of copying can reflect a variety of factors; for example, people might have differential access to copying technologies, varying opportunity costs, and different beliefs regarding copyrights. The cost is private information and only its distribution is known to the artists. For the sake of simplicity, the distribution, $U(z)$, of z in each group is identical and uniform on $[0, Z]$.

Each individual buys at most one album per artist, but both albums can be purchased because albums are differentiated products and usually not too expensive. Thus, the artists do not directly compete in the primary market.¹⁴ Consumers gain utility $vQ - e$ from an album. The cost, e , of obtaining an album depends on the mode of consumption: if the individual buys the original, then it is the market price, $e = p$, but, if he copies, he incurs a reproduction cost, $e = c + z + H$, instead. I assume that the general public's valuation, v_l , is sufficiently low, and the fan clubs' valuation, v_h , is sufficiently high ($c + \frac{Z}{2} + \frac{1}{2} < v_h Q$), so that the artists sell only to high-valuation consumers.

If the entrant is successful and becomes a star, then she has access to the complementary market; for example, only those who have produced a hit album can earn a large profit from going on tour.¹⁵ The entrant's probability of achieving stardom is $w(q, Q) \in (0, 1)$, which depends positively on the market penetration, q , measured by the total consumption, and the quality of the album, Q . The specific structure of the complementary market is not modeled here, but competition in the complementary market is more direct since concert tickets are expensive.¹⁶ The incumbent gains a monopoly complementary profit $\Pi^M > 0$ if there is no entry. If the entrant becomes a star, each earns a duopoly profit $\alpha\Pi^M$, where $0 < \alpha < 1$ measures the degree of competition.

¹⁴This seems realistic in the sense that adding an album to the long music catalog is not likely to have a large effect on primary-market competition. Even if the artists were to compete in the primary market, the incumbent may prefer copyright protection to low prices as a strategic instrument.

¹⁵Since there would be a fixed cost for performing at a large venue, non-star artists would not sell enough concert tickets to cover this cost, thus, I simply assume that they stay out of this market.

¹⁶Similarly, if we were to consider music companies that receive broadcasting royalties, then having songs aired over the radio is likely to be more competitive than selling CDs as long as stations tend to play songs by well-known artists.

The timing of the game is as follows. In period 1, nature decides the state of the demand, and the incumbent determines the level of copyright protection that will prevail until the game ends. Then the potential entrant decides whether to enter, active artists produce and sell their recorded music, and consumers decide whether to buy, copy, or do neither. In period 2, the entrant becomes a star with some probability. Stars participate in the complementary market, and the game ends. The solution concept is subgame perfect Nash equilibrium, and there is no discounting between the periods.

4 Analysis

Consider the benchmark case in which there is no complementary market in the second period ($\Pi^M = 0$). Consumers would pay up to vQ , but they would copy rather than purchase the original when their copying cost is less than the market price; that is, $c + z + H < p$. Since z is a random variable, the demand function of group 1 is $D(p) = x\gamma(H, Q)(1 - U(p - c - H))$ if $p \leq v_h Q$; $D(p) = 0$ if $p > v_h Q$. Given x , H , and Q , the artist's problem is to maximize $D(p)(p - c)$ subject to $p \leq v_h Q$. The first-order condition is that the marginal revenue equals the marginal cost, which comes from the last unit of demand substituted by a copy.

It is easy to see that the optimal monopoly price is $p^* = c + \frac{H+Z}{2}$ with a corresponding profit of $\Pi^*(x, H, Q) = \frac{x\gamma(H, Q)}{Z} \left(\frac{H+Z}{2}\right)^2$. Thus, high-valuation consumers for whom $z < p^* - c - H$, or $z > p^* - c - H$ would respectively copy or buy the item. In contrast, low-valuation consumers would copy if $z < v_l Q - c - H$, but abstain from consumption if $z > v_l Q - c - H$. The only difference for the two types of artists is that the potential entrant will stay out if $\Pi^* < F$.

One thing to note here is that copyright protection, H , and consumers' copying costs, Z , appear to be substitutes: the monopoly price and profit are both functions of $H + Z$. Digital copying may have reduced Z causing a fall in record sales, but would trying to solve this problem by increasing H instead result in the same outcome as if increasing Z ? The answer may be no. As I demonstrate below, stronger protection can cause entry deterrence making the incumbent better off. Thus, from a social planner's perspective, it may not be the most efficient way to deal with consumer piracy.

Since the problem is solved backwards, the incumbent would choose the level of copyright protection knowing the solution to this record-sales problem. The potential entrant's quality, Q , is not known to the incumbent, but the incumbent would not care because the primary market is not competitive.

Given any state, x , the profit-maximizing level of H is denoted by $H^\circ = \arg \max_H \Pi^*(x, H, Q)$. Accordingly, the star has no incentive to deter entry, and the level of protection is set to maximize the sales profit. In fact, if the exposure effect of H is the same for all Q , then there is no conflict of interest between the two types of artists as to the desired level of protection.

Proposition 1. Suppose that $\Pi^M = 0$ and $\frac{\gamma_H}{\gamma}$ does not depend on Q . Then in equilibrium both the incumbent and the entrant prefer the same level of copyright protection, H° , which maximizes the primary-market profit.

Proof. Since demand for the two albums is assumed to be independent, the incumbent's profit does not depend on the potential entrant's quality or on the entry decision. The incumbent's quality is \bar{Q} , and his sales profit would be $\Pi^*(x, H, \bar{Q}) = \frac{x\gamma(H, \bar{Q})}{Z} \left(\frac{H+Z}{2}\right)^2$ given his own choice of protection, H , and the realization of demand, x . Likewise, the entrant knows her own quality, Q , and expects to earn $\Pi^*(x, H, Q) = \frac{x\gamma(H, Q)}{Z} \left(\frac{H+Z}{2}\right)^2$ if she enters. Maximizing this expression over H given x , the first-order condition yields $\gamma_H(H, Q) \left(\frac{H+Z}{2}\right) + \gamma(H, Q) = 0$, the solution of which is independent of Q . Note that if the entrant cannot profitably enter, then she would be indifferent regarding H . *Q.E.D.*

Proposition 1 says that, in the absence of the secondary source of income and as long as the exposure effect is the same for all artists in percentage terms, the incumbent would not use copyright protection as a strategic tool for entry deterrence. For some specification of function $\gamma(H, Q)$, the optimal protection could be at the corner ($H = 1$), but this is not because the incumbent wants to deter the entry of the new artist. Thus, without a loss of generality, I restrict the model's parametrization to have a unique interior solution, H° , $0 < H^\circ < 1$, that maximizes a concave profit function, $\Pi^*(x, H, Q)$, which I maintain throughout this paper.

Now consider the full model in which there is a complementary market in the second period ($\Pi^M > 0$). The entrant's prospect in the complementary market depends on her success in the primary market. Note that the incumbent is already a star. The entrant's probability of success, $w(q, Q)$, depends on the total consumption, q , which measures the population who copied or bought the entrant's album. Everyone in group 1 contributes to this measure because $p^* < v_h Q$ implies that they either copy or purchase the album. In group 2, only low-cost individuals, $z < v_l Q - c - H$, count because the rest would abstain. Therefore, q is equal to $x + (v_l Q - c - H)/Z$, which is decreasing in H since more group 2 individuals abstain as their cutoff value, $v_l Q - c - H$, decreases.

It is important to note that the total consumption, q , does not depend on the price, p . Thus, the album price has no effect on the complementary market prospect, accordingly the artists have no incentive to deviate from the monopoly-pricing strategy. Given the parameters of the model, the price affects the degree of sales substitution by copies, but it does not affect the total size of consumption versus non-consumption, which matters for becoming a star. Since x and Q are given from the entrant's perspective, it is the H the incumbent chooses that determines the size of the total consumption.

To illustrate the main result, let us look at the entrant's and the incumbent's problems in turn. The entrant faces her entry decision after x is realized and H is chosen. The entrant would enter if and only if her expected profit is larger than F , which is the sum of the first- and second-period profit, $\Pi^*(x, H, Q) + w(q, Q)\alpha\Pi^M$. Both terms are increasing functions of the entrant's quality Q . Thus, there exists a critical value $Q^* \in (\underline{Q}, \bar{Q})$, such that the entrant will enter if and only if $Q > Q^*$. From the incumbent's point of view, the entrant's quality is unobserved, so he only knows the entry probability, $P = \int_{Q^*}^{\bar{Q}} dF(Q)$.

Next, consider the incumbent's decision regarding H . The incumbent's expected profit is contingent upon the entry and success of the new artist; that is, upon entry, the incumbent's second-period profit is Π^M with probability $1 - w$ and $\alpha\Pi^M$ with probability w . Thus, if the entrant were to enter, the incumbent's expected profit would be $\Pi_{entry}^*(x, H, Q) \equiv \Pi^*(x, H, \bar{Q}) + (1 - w(q, Q))\Pi^M + w(q, Q)\alpha\Pi^M$. However, if entry does not occur, then he gets $\Pi_{no_entry}^*(x, H, Q) \equiv \Pi^*(x, H, \bar{Q}) + \Pi^M$ for sure. The incumbent's problem is to choose an H that maximizes the expected profit, $\int_Q^{Q^*} \Pi_{no_entry}^*(x, H, Q)dF(Q) + \int_{Q^*}^{\bar{Q}} \Pi_{entry}^*(x, H, Q)dF(Q)$.

Note that the driving force of the main result is not the presence of the complementary market *per se* or the existence of the potential entrant. Without the link between the two markets via the promotional effect, the incumbent would choose the same level of copyright protection, H° , as in the benchmark. For example, if the entry decision and the success probability were fixed, then the incumbent would just maximize his primary-market profit. More essential to the incumbent is to choose stronger copyright protection than H° in order to reduce dissemination of the copyrighted album via tighter copyright protection.

When the entrant's success depends on the consumption of her album as in the original model, the new artist would be unambiguously hurt by stringent copyright protection because her expected complementary as well as primary profit would fall. The new artist needs more exposure and would actually

prefer lenient copyright protection so more people can listen to her music; that is, the entrant prefers an H_E^* , $H_E^* \leq H^\circ$, because the expected gain from wider dissemination is larger than the loss from record sales.

The incumbent, on the other hand, never prefers lenient copyright protection because that will only reduce his expected complementary income. Thus, he prefers an H_I^* , $H_I^* \geq H^\circ$ to squeeze the entrant's total expected profit, even if doing so may also decrease his own profit from record sales. This shows the fundamental conflict of interest between the established and the new artist and suggests that the incumbent may have an incentive to deter entry into the primary market in the first place. Contrary to conventional wisdom, stronger copyright protection can discourage potential artists from creating new goods.

Proposition 2. Suppose that $\Pi^M > 0$. Then the incumbent would choose an H_I^* , $H_I^* > H^\circ$, in the unique equilibrium; the probability of entry at H_I^* is lower than at H° . In contrast, the entrant's preferred choice would be an H_E^* , $H_E^* < H^\circ$.

Proof. First, note that we can restrict the incumbent's choice set to $[H^\circ, 1]$, because for any H' , $H' < H^\circ$ he can find an H'' , $H'' > H^\circ$ that yields the same primary-market profit but larger expected complementary-market profit. From the entry condition, we know that $\Pi^*(x, H, Q^*) + w(q, Q^*)\alpha\Pi^M = F$ defines the critical value Q^* , above which the entrant will enter. Note that $q = x + (v_l Q - c - H)/Z$, which increases with Q but decreases with H . Now, implicitly differentiating both sides of the entry condition with H , we get $\frac{\partial\Pi^*}{\partial H} + \frac{\partial\Pi^*}{\partial Q^*} \frac{\partial Q^*}{\partial H} + [\frac{\partial w}{\partial q} \frac{\partial q}{\partial H} + \frac{\partial w}{\partial q} \frac{\partial q}{\partial Q^*} \frac{\partial Q^*}{\partial H} + \frac{\partial w}{\partial Q^*} \frac{\partial Q^*}{\partial H}] \alpha\Pi^M = 0$. Since $\frac{\partial\Pi^*}{\partial H}|_{H=H^*} = 0$ and $\frac{\partial q}{\partial H}|_{H=H^*} < 0$, one can check that $\frac{\partial Q^*}{\partial H}|_{H=H^*} > 0$.

Consider next the incumbent's expected profit, $\int_{Q^*}^{\bar{Q}} [\Pi^*(x, H, \bar{Q}) + \Pi^M] dF + \int_{Q^*}^{\bar{Q}} [\Pi^*(x, H, \bar{Q}) + (1 - (1 - \alpha)w(q, Q))\Pi^M] dF$. Differentiating with respect to H , we get $\frac{\partial Q^*}{\partial H} [\Pi^* + \Pi^M] + \int_{Q^*}^{\bar{Q}} \frac{\partial\Pi^*}{\partial H} dF - \frac{\partial Q^*}{\partial H} [\Pi^* + (1 - (1 - \alpha)w)\Pi^M] + \int_{Q^*}^{\bar{Q}} [\frac{\partial\Pi^*}{\partial H} - (1 - \alpha)\Pi^M \frac{\partial w}{\partial q} \frac{\partial q}{\partial H}] dF$. Using $\frac{\partial Q^*}{\partial H}|_{H=H^\circ} > 0$, $\frac{\partial q}{\partial H}|_{H=H^\circ} < 0$ and $\frac{\partial\Pi^*}{\partial H}|_{H=H^\circ} = 0$, this reduces to $(1 - \alpha)\Pi^M [\frac{\partial Q^*}{\partial H} w - \int_{Q^*}^{\bar{Q}} \frac{\partial w}{\partial q} \frac{\partial q}{\partial H} dF]|_{H=H^\circ} > 0$. Therefore, the incumbent's profit-maximizing H_I^* lies strictly to the right of H° . Corresponding cutoff value Q^* goes up, so that the probability of entry, $P = \int_{Q^*}^{\bar{Q}} dF(Q)$, also decreases.

Similarly, differentiating the entrant's expected profit with H yields $\frac{\partial\Pi^*}{\partial H} + \frac{\partial w}{\partial q} \frac{\partial q}{\partial H} \alpha\Pi^M = 0$. Since $\frac{\partial w}{\partial q} < 0$, it must be that $\frac{\partial\Pi^*}{\partial H} > 0$, which implies that the entrant's preferred level of protection, H_E^* , lies to the left of H° . Note that for some low-quality entrant the net profit can still be negative, in

which case the entrant is indifferent as to the level of protection. *Q.E.D.*

Proposition 2 says that, if the complementary market is an important source of income, then the incumbent has an incentive to increase the level of copyright protection beyond the profit-maximizing level for the primary market in order to preserve his monopoly in the complementary market. This strategic use of copyright protection lowers both the incumbent's and the entrant's sales profit, however, it increases the incumbent's total expected profit. The incumbent suppresses the dissemination of the entrant's album to make it harder for the entrant to gain access to the complementary market. Therefore, strong copyright protection ($H_I^* \geq H^o$) discourages entry in the sense that the probability of entry is reduced.

The main message of this analysis is simple. While copyright protection, if adequately set and enforced, could maximize the artists' profits from selling their copyrighted works and accommodate new aspiring artists leading to more competition between stars, excessive protection can serve as a strategic tool by the established artists who care about the complementary market. An implication for policymakers is that they should be more cautious about over-protecting the established to the detriment of new entrants. Although more protection can reduce illicit copying, it can also reduce product variety and increase market power.

A simple comparative statics exercise shows that the incumbent's strategic choice of H_I^* increases as the size of the complementary profit, Π^M , increases and the degree of competition in that market is higher (α smaller). This means that the incumbent's opportunity cost of losing monopoly stardom increases if entry is not deterred, so that he is more likely to seek stringent copyright protection. On the other hand, when the demand, x , is high, the incumbent's optimal choice, H_I^* , decreases because high demand makes it more difficult for the incumbent to suppress the potential entrant. Note that this means a lower demand, x , leads to more incentive to deter entry because the opportunity cost in the primary market is lower.¹⁷

Proposition 3. Other things being equal, the incumbent's choice of H_I^* increases with larger Π^M and smaller α ; H_I^* decreases with higher state of the demand, x .

¹⁷While such empirical studies as Oberholzer-Gee and Strumpf (2007) could not reject the hypothesis that downloads have no effect on overall sales, proposition 3 may provide an alternative explanation. When the recording demand falls for reasons not related to copyrights, the incumbent has more incentive to increase copyright protection because there is less opportunity cost in the primary market.

Proof. The first-order condition of the incumbent's objective function reduces to $\int_Q^{\bar{Q}} \frac{\partial \Pi^*}{\partial H} dF + (1-\alpha)w\Pi^M \frac{\partial Q^*}{\partial H} - (1-\alpha)\Pi^M \int_{Q^*}^{\bar{Q}} \left[\frac{\partial w}{\partial q} \frac{\partial q}{\partial H} \right] dF = 0$. Substituting $\frac{\partial \Pi^*}{\partial H} = \frac{x\gamma_2(Q)}{Z} [\gamma_1'(H)(\frac{H+Z}{2})^2 + \gamma_1(H)(\frac{H+Z}{2})]$, this is $\frac{x}{Z} [\gamma_1'(H)(\frac{H+Z}{2})^2 + \gamma_1(H)(\frac{H+Z}{2})] \int_Q^{\bar{Q}} \gamma_2(Q) dF + (1-\alpha)w\Pi^M \frac{\partial Q^*}{\partial H} - (1-\alpha)\Pi^M \int_{Q^*}^{\bar{Q}} \left[\frac{\partial w}{\partial q} \frac{\partial q}{\partial H} \right] dF = 0$. Since the second and the third term is positive numbers, the first term must be negative. Note that x appears in the first term and $(1-\alpha)\Pi^M$ in the last two terms. It is easy to see that higher x implies weaker H relative to the optimal choice, $H^\circ < H < H_I^*$. Similarly, larger values of $(1-\alpha)\Pi^M$ mean an H , $H > H_I^*$. Q.E.D.

5 Opt-Out Choice

This section considers the ex-post enforcement issue that is relevant to the real world. Ex-post enforcement refers to effective copyright protection in the market after the copyright policy has been set. A crucial question concerning the above entry-deterrence result is what happens when the entrant can undo the copyright protection that is determined by the incumbent. Two points will be made. One is that an arbitrary deviation from the protection policy is not realistic, but opting out of copyright protection entirely is plausible. The other is that, if opting out indeed provides a profitable entry opportunity, it can sometimes constrain the incumbent's strategic behavior.

First, major actions by the government or the courts affect the system through which consumers can make copies. For instance, the decision to shut down Napster affects all artists whether or not they want to circulate their work on that system. Second, consumers, not the artists, bear the responsibility to abide by the law and pay the penalty in case of violations. Even if an artist would like to encourage distribution of bootlegged copies, consumers have to be equally cautious about copying any artist's work. Third, there is a communication problem in that even if some artists want to encourage illicit copying of their albums and convey this message, such communication might not be feasible due to the legal environment. Therefore, it is difficult for the entrant to deviate from the given level of copyright protection as long as the work is copyrighted.

However, if an artist's work is not copyrighted in the usual sense, then it is possible to freely circulate the created work without such concerns as above. Opting out of copyright protection is a growing phenomenon in creative industries; there are various legal licenses that make such opt-out choices possible. "Copyleft" licenses typically allow free use, modification, and distribution of

intellectual properties.¹⁸ Thus, new artists may post their songs online at such social networking sites as MySpace.com and YouTube.com. There are also open-source record labels (e.g., LOCA Records, Magnatune) that release albums under copyleft licenses.

Unlike arbitrary deviation from the prevailing policy, these licenses provide artists a way to enable free reproduction of their goods and still get the credit for their original creation.¹⁹ This is what is referred to here as an opt-out choice, and it corresponds to marginal-cost pricing of the album, or $H = 0$, in terms of the model. I assume that the entrant now has the counterstrategy of opting out of copyright protection; the entrant can choose either to opt in ($H_E = H_I$) or opt out ($H_E = 0$), where H_I is the incumbent's choice. Thus, the entrant's expected profit at $H_E = 0$ becomes her reservation payoff.

To illustrate the effect of the opt-out choice, I assume that the success probability $w(q, Q)$ is linear in both elements. Then the entrant's expected profit function satisfies the single-crossing condition, that is, $\frac{\partial^2}{\partial H \partial Q} [\Pi^*(x, H, Q) + w(q, Q)\alpha\Pi^M] > 0$. This means that the difference in expected profit due to type Q is increasing in H . Thus, opting out is relatively more plausible for a low-quality than for a high-quality entrant. An interpretation is that a low-quality album will not sell well if copyright protected, so it is relatively better to hope to recoup the fixed cost under a copyleft regime. A high-quality artist, on the other hand, has more chance to succeed in the market, so copyleft is less attractive.

Note that H_I^* is the incumbent's previous choice, and Q^* is the entrant type that is marginally deterred without the opt-out possibility. By the single-crossing property, there exists a critical value, $\Theta \in (Q, \bar{Q})$, such that the entrant type Θ would be indifferent between opt-out and opt-in. The effect of the opt-out possibility on the incumbent's preference for copyright protection can be understood intuitively. First, if H_I^* promises the type Q^* entrant a larger profit than her reservation payoff, then the opt-out option is not a binding constraint. H_I^* will remain unchanged because no entrant opts out and the marginal condition is not affected.

¹⁸The term "copyleft" refers to the novel licensing scheme as well as the ideological movement that every person will be able to copy, use, modify, and redistribute the product freely as long as the redistributed work is licensed under the same condition. GNU General Public License is a copyleft license, of which Linux is a well-known example. Creative Commons licenses applies to video, audio, and written materials so that authors and artists can post their work for free distribution.

¹⁹Another possibility is to distribute some quantity of albums free as a promotion while opting in for copyright protection. This, however, would not be effective if those who would obtain the promotion pack are the likely buyers, so that it would just substitute out the demand without affecting the total consumption.

Second, the opt-out choice can be a binding constraint. In this case, the incumbent must loosen the copyright protection because the entrant will enter anyway by opting out and appeal to a larger audience. This means that there is less marginal gain at H_I^* : those who opt out are not affected by H anymore, so the incumbent is unnecessarily reducing his primary market profit. Therefore, he has an incentive to bid down H_I . Compared to the equilibrium without the opt-out choice, more entrant types are allowed to enter at the margin by opting out, and some higher types will be induced to opt in rather than opt out.

Proposition 4. Suppose that the entrant has the opt-out choice and $w(q, Q)$ is linear in both elements. (a) If $\Theta \leq Q^*$, then $H_I = H_I^*$ and entry is accompanied by opting in. (b) If $\Theta > Q^*$, then $H_I < H_I^*$ and there exists a value Q' below (above) which entry is accompanied by opting out (in).

Proof. Taking the derivative of the entrant's expected profit with respect to Q and H , we get $\frac{x\gamma_{HQ}(H,Q)}{Z}(\frac{H+Z}{2})^2 + \frac{x\gamma_Q(H,Q)}{Z}(\frac{H+Z}{2}) - \alpha\Pi^M w_{qq}(q, Q)\frac{v_l}{Z^2} - \alpha\Pi^M w_{qQ}(q, Q)\frac{1}{Z}$. Since $\frac{\partial}{\partial Q}(\frac{\gamma_H}{\gamma}) = 0$, $\gamma_{HQ} = \frac{\gamma_Q\gamma_H}{\gamma} > 0$. Also, the last two terms vanish because $w_{qq} = 0$, $w_{qQ} = 0$. Therefore, $\frac{x\gamma_{HQ}(H,Q)}{Z}(\frac{H+Z}{2})^2 + \frac{x\gamma_Q(H,Q)}{Z}(\frac{H+Z}{2}) > 0$, that is, the single-crossing property is satisfied, and there exists a critical value, $\Theta \in (Q, \bar{Q})$, such that the potential entrant type Θ would be indifferent between opt-out and opt-in. First, consider the case $\Theta \leq Q^*$. This means that the profit from opting out must be smaller than that from opting in for the marginal type Q^* . Thus, the opt-out choice is not a binding constraint for the incumbent's maximization problem. Since all entering types, $Q, Q > Q^*$, opt in, the marginal condition at H_I^* is not affected. Thus, the incumbent's optimal choice remains the same, $H_I = H_I^*$.

Second, consider the case $\Theta > Q^*$. Then it must be true that for $Q, Q^* \leq Q \leq \Theta$, the entrant's expected profit from opting out exceeds that from opting in. Thus, with the previous choice of H_I^* , entrant types in $[Q^*, \Theta]$ enter by opting out, and they are not further affected by H because they opt in. This implies that there is less marginal gain for the incumbent at H_I^* than previously. From the first-order condition, $\int_Q^{\bar{Q}} \frac{\partial \Pi^*}{\partial H} |_{H=H_I^*} dF + (1 - \alpha)\Pi^M [\frac{\partial Q^*}{\partial H} w - \int_{\Theta}^{\bar{Q}} \frac{\partial w}{\partial q} \frac{\partial q}{\partial H} dF] |_{H=H_I^*} < \int_Q^{\bar{Q}} \frac{\partial \Pi^*}{\partial H} |_{H=H_I^*} dF + (1 - \alpha)\Pi^M [\frac{\partial Q^*}{\partial H} w - \int_{Q^*}^{\bar{Q}} \frac{\partial w}{\partial q} \frac{\partial q}{\partial H} dF] |_{H=H_I^*} = 0$. Thus, the incumbent is better off by reducing his choice of H_I , $H_I < H_I^*$. At the new equilibrium, the entrant's opt-out choice is again characterized by the single-crossing condition: there exists some critical value Q' , $Q' < \Theta$, such that she opts out if $Q < Q'$ and opts in if $Q > Q'$. *Q.E.D.*

Proposition 4 shows that the availability of the opt-out choice can work in favor of the potential entrant and mitigate the incumbent's incentive to deter entry. Since the opt-out choice essentially creates a participation constraint, he has to allow more entrant types to enter as well as to switch them to opt in. Although this choice sometimes provides the entrant a sort of safeguard against the incumbent's preemption, the magnitude of this mitigating effect may be small, or nonexistent, so potential entries still could be deterred.

The opt-out choice is also risky in the sense that a typical artist could hope to succeed might be just too slim. Moreover, if the entrant has to finance the entry cost from the financial market, the lender might have reservations to the borrower's opt-out choice. We actually see few serious artists produce copyleft-licensed albums and subsequently gain nationwide recognition. Finally, the opt-out option can potentially create further tension because the incumbent would then try to eliminate the possibility of opting out itself.

6 Conclusion

Copyright protection has been a contentious issue both among scholars and practitioners. Based on the idea that copyrights can suppress the promotion of the potential entrants, this paper has formalized a strategic aspect of the copyright protection in a two-tiered market. That is, in addition to the record market, such complementary markets as live performance and radio broadcasting are important sources of income for the artists and the music companies. The incumbent may have an incentive to raise the level of protection to preserve his monopoly as well as to prevent consumer piracy, while the entrant likely favors lenient protection to encourage dissemination of her original work. Allowing the entrant to opt out of the copyright regime can sometimes weaken the incumbent's subtle incentive to deter entry, but it may not be fully effective.

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