

THE RECORD INDUSTRY IN AN ERA OF FILE SHARING: LESSONS FROM VERTICAL DIFFERENTIATION

To be presented at ICIS 2003

August 2003

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Abstract

The record industry is undergoing substantial changes from the expansion of the Internet and the opportunities for transferring files. There is a large debate surrounding how record labels should react to the Internet. This paper provides a rigorous economic analysis to identify the profit-maximization behavior for record labels. Using two widely accepted economic models of vertical differentiation, where competing products are priced according to their relative quality, this paper investigates the record labels' profit-maximizing behavior under the current industry structure. It is assumed that the quality of the music experience using a file sharing service is inferior to that of purchased music. This methodology, while relatively straightforward, provides valuable insight into current practices, as well as, recommendations for the record industry. The most surprising result is that, consistent with the labels' behavior, introducing a downloadable music service usually does not increase profits. In addition, closing music sharing services; suing ISPs and universities who are complacent about sharing; and "polluting" the pool of available music are all in the labels' best interest. However, a number of results also contradict current practices. On the one hand, prices for CDs should decline with the introduction of music sharing services, recognizing that users have an alternative to purchasing CDs. On the other hand, the record labels should aggressively introduce online content exclusively for CD purchasers, to increase the quality of CDs. Sound economic analysis is key for companies evaluating how to respond to the challenges of the Internet.

KEYWORDS: Economic analysis, Music, File sharing, MP3

* I would like to thank Chester Chambers and the ICIS reviewers, and AE for helpful comments on previous versions of this paper. All remaining errors or omissions are my responsibility.

I. Introduction

The record industry is undergoing substantial changes from the expansion of the Internet and the opportunities for transferring files. The industry faces major opportunities, as well as substantial threats in an era of ubiquitous network services. Opportunities arise from new media channels for selling products. Digital downloads of music, music on demand and complementing CD sales with online content, offer new revenue streams for the record industry. However, the threat of substitution may be an even more formidable challenge. File sharing services, such as Napster (shut down in September 2002), KaZaA, Morpheus, Audiogalaxy, and Grokster enable individuals to trade music files among themselves, for free. Users can easily make digital copies of their CDs in MP3 format and redistribute the music to anyone in the world. Free file sharing threatens to cannibalize the authorized sale of music by record labels.¹

The impact of the Internet on the industry, and appropriate responses, has long-term implications for this multi-billion dollar industry. CD sales declined in the years 2001 and 2002 and are expected to decline in 2003. CD sales are now at 1999 levels (RIAA, 2003). The Recording Industry Association of America (RIAA) blames free music sharing for the decline in sales. Investigating the causes for the decline in CD sales, Liebowitz (2003) finds support for this argument. Meanwhile, music sharing services have seen tremendous growth. At its peak Napster had 60 million users (Boston Globe, September 4, 2002). Currently, CNET's download.com sees 2.7 million downloads of KaZaA a week (CNET News, April 25, 2003). Industry critics contend that the success of music sharing services and decline in sales is due to the labels' inadequate responses to the new media (Business 2.0, April 3, 2002; O'Reilly, 2002). The labels' main response to music sharing is campaigning aggressively against file sharing and suing organizations that enable or even consent to music sharing (Los Angeles Times, March 18, 2003). Introducing new services and exploiting new technologies has been extremely slow. Listen.com, the first comprehensive Internet downloading service, began its Rhapsody service only in late 2002. The first for-pay service available for Apple users, iTunes Music Store began in April 2003. Exclusive online content for CD buyers was introduced for the first time when

¹ This paper does not make any assertions on the legality or the legitimacy of sharing music. It is assumed that free music services exist and offer a venue for sharing files. This is consistent with the evidence that new music sharing services gained popularity when Napster was closed.

Universal Music Group unveiled Bon Jovi's CD "Bounce" in October 2002 (Tech Investor, 2002).

The heated debate around how the record labels should respond to the Internet has, to date, been based on very general statements about the economic viability of introducing new services. This main question, yet unanswered, is what are the profit-maximizing actions the record labels should undertake. Some view the popularity of music sharing services as evidence of an untapped market, which would be willing to pay for an appropriate product. By introducing a downloadable music service, in MP3 format, the record labels should be able to tap into this segment and increase profit (O'Reilly, 2002). This argument, however, ignores the cannibalization effect on CDs of introducing a new music format, albeit of lower quality.

Using two widely accepted economic models of vertical differentiation, where competing products are priced according to their relative quality, this paper investigates the record labels' profit-maximizing behavior under the current industry structure. "Quality" in this analysis encompasses all facets of music, including, but not limited to, acquisition and enjoyment of music. It is assumed that the quality of music, in this multi-attribute sense, using a file sharing service is inferior to that of purchased music. This methodology, while relatively straightforward, provides valuable insight into current practices, as well as, recommendations for the record industry. The most surprising result is that, consistent with the labels' behavior, under a broad set of assumptions, introducing a downloadable music service does not increase profits for record labels. In addition, closing music sharing services, suing ISPs and universities who are complacent about sharing, and "polluting" the pool of available music are all in the labels' best interest. However, a number of results also contradict current practices. On the one hand, prices for CDs should decline with the introduction of music sharing services, recognizing that users have an alternative to purchasing CDs. On the other hand, the record labels should aggressively introduce online content exclusively for CD purchasers, to increase CD quality.

II. Quality Differentiation in Music

Music "quality" in this analysis is more complex than simply sound quality. In comparing different media available for music distribution additional attributes should be taken into account. Some of the factors included in identifying the multi-attribute utility associated with a certain music media include investment of time and effort in attaining the music, possibilities for

using music in that media, social and legal ramifications, and availability of complementary content.

Traditionally, a record label is a monopolist provider of the music he offers. This status is conferred to a record label through the long-term, binding, contract signed with an artist. Since individual songs and albums do not have obvious substitutes, the label disregards other entertainment offerings. As a monopolist, the label sells music in the formats it desires, taking into account consumer demand. As in other economic analyses, a profit-maximizing label prices CDs so that only part of the market is served. Consumers with high willingness-to-pay for the album will buy it, while others prefer not to own a copy of the music. Consistent with monopolist behavior, labels choose which formats to offer, and have changed formats over time from vinyl records to CDs to DVD music.² The transition from vinyl records to CDs is viewed, in this analysis, as an example of improving quality. CDs are preferred to records in a number of attributes: sound quality, portability, resistance to damage, and longevity. In the economic analysis it is shown that improving music quality (in a multidimensional sense) increases labels' profits.

Music sharing services, such as Napster or KaZaA, offer an alternative media for music distribution. As peer-to-peer networks they allow individuals a venue for transferring music files among themselves. Through central databases individuals can find others who offer the music they desire and download it from the other user's computer. While music sharing provides a substitute to purchasing CDs, it is imperfect on many dimensions. The desire to dramatically compress music in MP3 format oftentimes produces music of audibly inferior sound quality. High compression rates are the norm on file sharing sites and users of these services will commonly receive inferior music.³ Furthermore, the process of identifying where the desired music is offered and downloading is time-consuming. Often, the initial attempt to download music fails, because the source version is unusable or because of problems with Internet connectivity. This requires identifying an alternative source for the music and attempting to download it again. If a user desires CD-quality music, he will probably have to download the file

² The same transition is evident in the movie industry where movie studios actively endorse the transition from VHS to DVD, as well as, deciding on release dates for movie theaters, pay-per-view, video rental, and home purchase.

³ This is not to say that the quality of MP3 files *must* be inferior to CD music, but rather that the end-product from a file sharing service is often inferior to a CD.

several times from different sources. Together, these imply that substantial effort is involved to achieve excellent sound quality, reducing the user's utility. Moreover, occasionally, downloaded files only appear to be music files, but instead contain computer viruses or ad-ware (New York Times, June 6, 2002).

In addition to the inherent traits of shared music, which make it inferior to CDs, the record labels are acting vigorously to de-legitimize and complicate file sharing. To this end, the RIAA sued Napster and individuals for music swapping and has warned universities and ISPs to ban access to file sharing (Los Angeles Times, March 18, 2003). Lawsuits against individual users for file sharing may explain the reduction of up to 30% in file sharing activity between April and June 2003. (Daily Variety, August 21, 2003). Another venue, which is gaining popularity among record labels, is "polluting" the pool of downloaded music. Overpeer offers KaZaA users a prize if they distribute a "spoof" version of a song, instead of the real song. These files appear to be the desired song, but contain only a portion of the song and then a commercial for the artist, advertising legitimate ways to buy the song (Wired News, January 13, 2003). In the context of this analysis, the outcome of these actions is a further reduction in the overall utility of shared music.⁴

Diverging quality for file sharing and CD music offer the record labels an opportunity to introduce an intermediate product. "Internet music" could be a viable alternative for file sharing for those music listeners desiring downloading music of higher quality than offered on file sharing services. A fee-based service could offer a music product superior to that offered by file sharing. Such a service would have higher quality for a number of reasons: it would be legitimate, removing legal and ethical questions; there would not be any uncertainty regarding the authenticity and completeness of the downloaded file; files can be encoded at different compression rates depending on the user's preferences for downloading time, file size and music quality; and threats of viruses or other unwanted files would be eliminated. Several services are

⁴ Music from file sharing systems does have redeeming attributes that make it occasionally superior to CD music. The fact that this music is already encoded as MP3 files makes it easier to play on a PC or MP3 player. Converting music from a CD to MP3 for similar use requires effort by the user. If, or rather when, record labels adopt technologies that inhibit conversion of music to MP3 format the value of music from file sharing systems will increase. Moreover, the breadth of music is broader on these systems when compared to traditional record stores. Notwithstanding, in this analysis it is assumed that CD music dominates file sharing music in terms of user utility.

currently available including, pressplay.com, Listen.com, musicnet.com, emusic.com and iTunes Music Store from Apple.

CD quality can also be enhanced using Internet technologies. Record labels can leverage the Internet to provide expanded content exclusively to CD owners. Providing access to online movie clips and detailed information about the artists and bands involved in creating the music increases the value of CD ownership. The first instance of exclusive online access was with Bon Jovi's CD "Bounce" by Universal Music Group, in late 2002 (Tech Investor, 2002). Other labels followed almost immediately with similar online content for their new CD releases.

III. General Model

We model behavior in the record industry by focusing on the smallest viable piece of music, either a compact disk (CD) or a single song on a CD. A record label is assumed to own all legal reproduction and performance rights, including selling CDs or digital distribution on the Internet. As such, the label is a monopolist provider with decision authority over distribution channels. In addition to authorized distribution channels the same music is available for free using a file sharing system such as KaZaA. In this analysis there are 3 different media for music: CDs, denoted by C ; Internet music (downloadable for a fee), denoted by I ; and File sharing, denoted by F . It is assumed that the marginal cost of producing music in each media is negligible.

We assume a multi-attribute utility function across the population, with agreement on the relationship between the various attributes and an item's overall quality. The quality of music using media j , $j=\{C,I,F\}$, is denoted by $q_j \in [\underline{q}, \bar{q}]$. Based on the previous discussion we assume that $0 < \underline{q} \leq q_F < q_I < q_C \leq \bar{q}$.

Consumers in the market for a specific music item have unit demand. Each consumer either has access to the music or does not. Consumers differ by a taste parameter $\mathbf{q} \in [\underline{\mathbf{q}}, \bar{\mathbf{q}}]$, with higher values of \mathbf{q} associated with placing more value on the music. The value of music using media j to consumer with taste parameter \mathbf{q}_i is $v(\mathbf{q}_i, q_j)$. If the price of media j is p_j , the net utility for a consumer with taste parameter \mathbf{q}_i is:

$$U(\mathbf{q}_i, q_j, p_j) = v(\mathbf{q}_i, q_j) - p_j \quad (3.1)$$

A result from equation (3.1) is that if consumers q_i prefer product j at price p_j to inferior products, consumers with higher values of q will also prefer product j to inferior products.

This framework is the foundation for the label's strategic behavior. The file sharing service is not viewed as a strategic, profit maximizing entity because it offers its services for free. The label behaves as a monopolist taking into account external factors. Customer heterogeneity and preferences are given, as are the attributes of file sharing (free service of a known quality). Assuming the quality of CDs is determined, the label's decisions are setting the price for CDs, deciding whether to offer Internet music, and choosing quality and price for Internet music, if it is offered. The label's profit is composed of two components. Profit from CD sales, denoted by p_C and profit from Internet music (p_I). Total profit is p_R where $p_R = p_C + p_I$.

The nature of the decisions generates a three-stage game. The first stage involves deciding whether to offer Internet music. In the second stage the label chooses the quality of Internet music; and prices for CDs and Internet music are chosen in stage three. As in other strategic games, the solution is derived by backwards induction (Fudenberg and Tirole, 1991), solving first the pricing decisions, then quality, and finally whether to introduce Internet music.

The general case for a arbitrary $v(q_i, q_j)$ and $q \sim F(q)$ does not generate meaningful results for the label's decisions. To analyze behavior we restrict attention to two functional forms. These forms are often used in the quality-differentiation literature and provide insight into the range of decision scenarios. The first is based on the vertical differentiation literature (see, e.g., Bhargava and Choudhary 2001 or Tirole, 1998, pg. 296). A tri-modal distribution is analyzed as well, with a different relationship between quality and value for different customer "types", based on the price discrimination literature (see, e.g., Varian, 1989). In both cases the market size is assumed to equal 1, w.l.o.g.

IV. Scenario 1 – Linear Value Function

Case A – Vertical Differentiation

Following the vertical differentiation literature (see e.g., Bhargava and Choudhary, 2001, or Tirole, 1998, pg. 296) it is assumed that customers differ in their taste parameter for quality (q), but the relationship between quality and value is linear for all customers. Formally, denote q_i as the taste parameter for customer i , then:

$$U(\mathbf{q}_i, \mathbf{q}_j, p_j) = v(\mathbf{q}_i, \mathbf{q}_j) - p_j = \mathbf{q}_i \mathbf{q}_j - p_j \quad (4.1)$$

For ease of exposition this case is Case A and superscripts are used to denote Cases.

The analysis in the scenario follows the derivation in Bhargava and Choudhary (2001).⁵ The distribution of taste (\mathbf{q}) has a cdf of $F(\mathbf{q})$ and pdf $f(\mathbf{q})$. In identifying the profit opportunity from introducing new alternatives, it is useful to constrain the hazard rate of the distribution of taste.

Where the hazard rate is defined as: $\frac{f(\mathbf{q})}{1-F(\mathbf{q})}$. It is assumed that $F(\mathbf{q})$ has a non-decreasing

hazard rate.⁶ This property holds for a wide range of commonly used distributions including Binomial, Normal, Uniform, Exponential, Logistic and Laplace (Fudenberg and Tirole, 1991). Define the inverse of the hazard rate as $\mathbf{g}(\mathbf{q})$, which is non-increasing in \mathbf{q} .

$$\mathbf{g}(\mathbf{q}) \equiv \frac{1-F(\mathbf{q})}{f(\mathbf{q})} \quad (4.2)$$

With these assumptions the nature of competition between a monopolist label and free file sharing can be analyzed. It is assumed that customers have access to file sharing and that it offers an imperfect substitute to purchased music. The label offers CDs and is deliberating whether to offer Internet music as a second distribution media. In addition, the label has to choose prices for CDs and Internet music. It is shown, in the following analysis, that introducing Internet music is not profit maximizing (similar to the results of Bhargava and Choudhary, 2001).

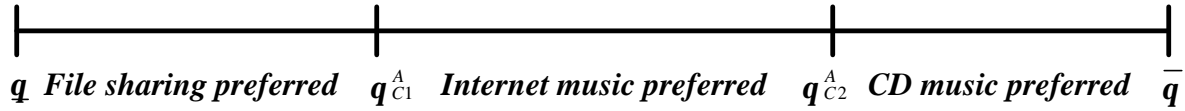
Customers are differentiated in this market by their taste parameter $\mathbf{q} \in [\underline{\mathbf{q}}, \bar{\mathbf{q}}]$. They face three alternatives when the label offers both CDs and Internet music and file sharing exists. As discussed previously preferences are monotonic along the taste dimension. If a certain customer prefers a higher quality product to a lower quality product (at a certain price point), customers with higher values of \mathbf{q} exhibit the same preferences over both products. This generates two critical points that divide customers into three regions. Define the taste parameter for the customer who is indifferent between file sharing and Internet music as \mathbf{q}_{C1}^A , and for the customer who is indifferent between Internet music and CD music as \mathbf{q}_{C2}^A (where superscripts

⁵ The results of Bhargava and Choudhary (2001) cannot be directly used here, because they analyze behavior by a monopolist when substitute products are not available. However, the derivation here follows immediately from their analysis.

⁶ This is a sufficient condition for identifying profit-maximizing opportunities and analyzing comparative statics.

denote cases), with $q_{C1}^A \leq q_{C2}^A$, Figure 1 depicts the relationship between these critical points and customer preferences. Customers with $q \leq q_{C1}^A$ prefer file sharing, customers with $q_{C1}^A < q < q_{C2}^A$ prefer Internet music, and those with $q_{C2}^A < q$ prefer CDs.

Figure 1: Market Share for Differentiated Products



To identify these critical points we identify the customer who is indifferent between two options. Customers who prefer Internet music to file sharing have (from 4.1):

$$U_I(q_i, q_j, p_j) \geq U_F(q_i, q_j, p_j) \quad \Leftrightarrow \quad qq_I - p_I^A \geq qq_F - p_F = qq_F$$

which defines

$$q_{C1}^A \equiv \frac{p_I^A}{q_I - q_F} \quad (4.3)$$

A similar analysis for the preference of CDs to Internet music shows that:

$$q_{C2}^A \equiv \frac{p_C^A - p_I^A}{q_C - q_I} \quad (4.4)$$

Given these preferences the demand for each product is:

For CDs: $D_C^A = 1 - F(q_{C2}^A)$ (4.5a)

For Internet music: $D_I^A = F(q_{C2}^A) - F(q_{C1}^A)$ (4.5b)

For file sharing: $D_F^A = F(q_{C1}^A)$ (4.5c)

Thus, the record label's profit maximization problem is:

$$\begin{aligned} \mathbf{p}_R^A &= \underset{(p_C^A, p_I^A)}{\text{Max}} \{p_C^A + p_I^A\} = \underset{(p_C^A, p_I^A)}{\text{Max}} \{p_C^A D_C^A + p_I^A D_I^A\} \\ &= \underset{(p_C^A, p_I^A)}{\text{Max}} \{p_C^A(1-F(\mathbf{q}_{C2}^A)) + p_I^A(F(\mathbf{q}_{C2}^A)-F(\mathbf{q}_{C1}^A))\} \end{aligned} \quad (4.6)$$

Analyzing the profit functions yields the main result for this scenario. A profit-maximizing record label prefers not to introduce Internet music, as shown in Proposition 1.

Proposition 1: With a linear relationship between quality and value, and when $F(\mathbf{q})$ has a non-decreasing hazard rate, a profit maximizing label offers a single product.

*Proof:*⁷

$$\text{From the F.O.C. w.r.t. } p_C^A: \quad \frac{\partial \mathbf{p}_R^A}{\partial p_C^A} = 1 - F(\mathbf{q}_{C2}^A) - \frac{(p_C^A - p_I^A)f(\mathbf{q}_{C2}^A)}{q_C - q_I} = 0$$

$$\text{Rearranging:} \quad \frac{(p_C^A - p_I^A)}{q_C - q_I} = \frac{1 - F(\mathbf{q}_{C2}^A)}{f(\mathbf{q}_{C2}^A)} \quad (4.7)$$

Noting that $\mathbf{q}_{C2}^A \equiv \frac{p_C^A - p_I^A}{q_I - q_F}$ from (4.4) and the definition of $\mathbf{g}(\mathbf{q})$ in (4.2) the solution is:

$$\mathbf{q}_{C2}^A = \text{solve } \{\mathbf{q} = \mathbf{g}(\mathbf{q})\} \quad (4.8)$$

Since $\mathbf{g}(\mathbf{q})$ is non-decreasing \mathbf{q}_{C2}^A is unique.

From the F.O.C. w.r.t. p_I^A :

$$\frac{\partial \mathbf{p}_R^A}{\partial p_I^A} = \frac{(p_C^A - p_I^A)f(\mathbf{q}_{C2}^A)}{q_C - q_I} + F(\mathbf{q}_{C2}^A) - F(\mathbf{q}_{C1}^A) - \frac{p_I^A f(\mathbf{q}_{C1}^A)}{q_I - q_F} = 0 \quad (4.9)$$

Rearranging and inserting the F.O.C. from (4.7)

$$\frac{p_I^A}{q_I - q_F} = \frac{1 - F(\mathbf{q}_{C1}^A)}{f(\mathbf{q}_{C1}^A)}$$

Noting that: $\mathbf{q}_{C1}^A \equiv \frac{p_I^A}{q_I - q_F}$ from (4.3) and the definition of $\mathbf{g}(\mathbf{q})$ in (4.2) the solution is:

$$\mathbf{q}_{C1}^A = \text{solve } \{\mathbf{q} = \mathbf{g}(\mathbf{q})\} \quad (4.10)$$

⁷ This proof follows the derivation in Bhargava and Choudhary (2001), Corollary 1.

Note that the equation defining q_{C1}^A (4.10) is identical to the one defining q_{C2}^A (4.8). Thus, $q_{C1}^A = q_{C2}^A$ and Internet music will be priced by the label to have zero market share. QED

The key result here is that adding the option of offering Internet music does not increase profit. Conversely, the label prices Internet music so that it realizes zero market share, and hence no profit. If there is any cost associated with developing the service the label will not offer it. This explains the labels' balking at early introduction of online music services.

This result is surprising because richer product variety does not increase profit. The intuition for this result is that Internet music is a substitute to CD music. It is more profitable to offer customers CD music than Internet music, so the label's optimal response is not offering the intermediary product.

Case B – Only CDs Offered

Another question of interest is what impact file sharing has on record label profit, when only CDs are offered. In this case (Case B) there is only one critical point q_{C1}^B , with

$$q_{C1}^B \equiv \frac{p_C^B}{q_C - q_F} \quad (4.11a)$$

demand for CDs is: $D_C^B = (1 - F(q_{C1}^B))$ (4.11b)

and the label's profit is: $p_C^B = p_C^B (1 - F(q_{C1}^B))$ (4.11c)

From the proof of Proposition 1 (4.8) the optimal solution is:

$$q_{C1}^B = \text{solve } \{q = g(q)\} \quad (4.12)$$

Corollary 1 shows that file sharing reduces the label's profit and that the quality of file sharing is an important factor. Increasing the quality of the free substitute reduces the label's profit.

Corollary 1: With a linear relationship between quality and value, and $F(q)$ exhibits a non-decreasing hazard rate, the label's market share remains constant, while price and profit are increasing in CD quality and decreasing in file sharing quality.

Proof:

From (4.12), q_{C1}^B and demand (4.11b), depend only on the distribution of q , not the parameters p_C^B, q_C, q_F .

To maintain constant market share, price changes positively to q_C and negatively to q_F . Profit is positively related to price, from (4.12), so price and profit change as described. QED

The result of Corollary 1 appears counter-intuitive, at first. Why is maintaining market-share an optimal response to the introduction of file sharing? A simple example shows that this result is derived from a common result in monopoly pricing. When the taste is distributed $q \sim U[0,1]$ the monopolist label faces a linear, downward-sloping, demand curve. Demand in this case is, from

(4.11): $D_C^B = (1 - \frac{p_C^B}{q_C - q_F})$; and the label's profit is $p_C^B = p_{C1}^B (1 - \frac{p_C^B}{q_C - q_F})$. The label's demand

curve and marginal revenue curves are shown in Figure 2.⁸ In this case it is optimal to set

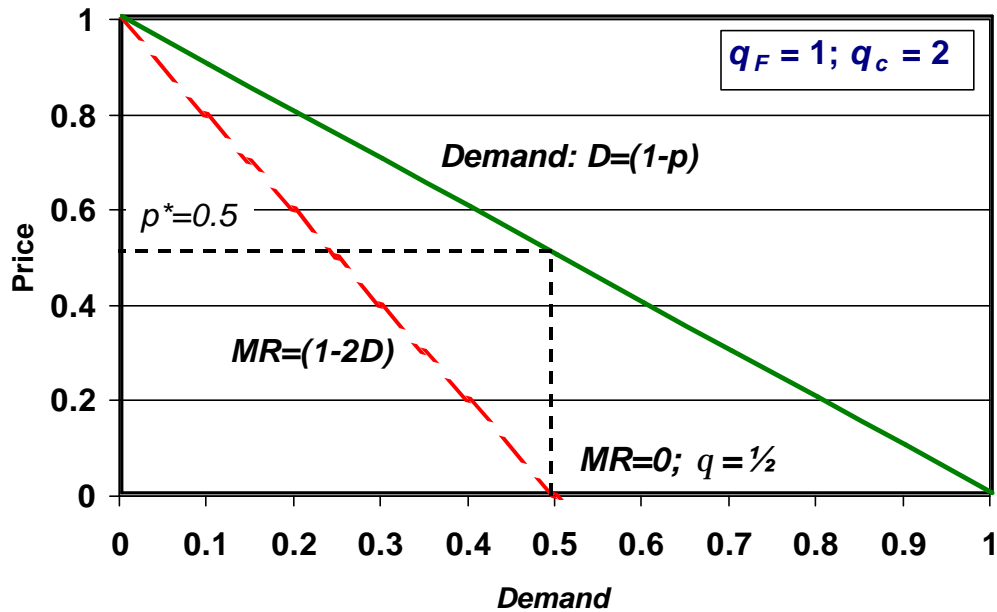
$p_{C1}^B = \frac{q_C - q_F}{2}$, so $q_{C1}^B = 1/2$ and exactly half the market is served. Constant market-share is a well-

known result when a monopolist faces a linear, downward-sloping, demand curve.

⁸ In this case $D_C^B = (1 - \frac{p_C^B}{q_C - q_F})$, so $p(D_C^B) = (q_C - q_F)(1 - D_C^B)$; and

$p(D_C^B) = (q_C - q_F)(1 - D_C^B) D_C^B$. Thus $MR = (q_C - q_F)(1 - 2D_C^B)$ and when $MR = 0$, $D_C^B = 1/2$.

Figure 2: Uniform Distribution of Taste



Ongoing improvement in music quality is explained by the positive relationship between CD quality and profit. One example is the transition for LP to CD media, where the latter offers greater longevity and portability. Another implication is that record labels should embrace the Internet to improve the quality of CDs. The labels were late adopters, instead of early adopters, of technologies that integrate CD ownership with Internet experiences. Only recently has online content been made available solely to owners of CDs, with the debut of the “Bounce” CD, in late 2002.

Corollary 1 provides insight into the changes we would expect to see when Napster and later KaZaA were introduced. File sharing offers customers an alternative. The record label’s optimal response is to lower prices in order to preserve market share. Lowering prices reduces profit. However, this is not the venue chosen by the labels. Prices have been *increasing* over the past few years (Leibowitz, 2003), making substitutes more attractive. As a result consumers who previously purchased CDs are now choosing to file sharing services as their preferred venue for getting music. Price-sensitive consumers, with Internet access, are the most likely to adopt file sharing services. This is consistent with data from the RIAA that shows that the decline in CD purchasing is most pronounced for the 20-30 year old age group (RIAA, 2003).

Moreover, the label's profit function (4.11c) shows that profit is negatively related to the quality of file sharing, suggesting that the label is interested in lowering the quality of file sharing. This is consistent with the record labels' extensive campaign against Napster and other file sharing services. By shutting down these services and de-legitimizing file sharing, users find it more difficult and immoral to share music, in effect reducing the quality of the service.

IV. Scenario 2 – Tri-modal Distribution of Taste

The previous analysis, where quality is linearly related to customer value, suggests that the record label should not introduce Internet music, and that even if introduced it would be priced so that it did not have any market share. One explanation for this counterintuitive result is that it depends on the assumed linear relationship between quality and value. Results would differ with a different relationship. To address this issue we analyze the label's behavior when customer taste has a tri-modal distribution and quality sensitive customers place increasing value on quality. There are three types of customers $i = l, m, h$, with taste parameters \mathbf{q}_i such that $\mathbf{q}_l < \mathbf{q}_m < \mathbf{q}_h$. The ratio of each customer type is r_i with $r_l + r_m + r_h = 1$.

Additionally, the relationship between quality and value is assumed to differ among customer types. It is assumed that for \mathbf{q}_l and \mathbf{q}_m customers, value increases linearly with quality, while a quadratic relationship exists for \mathbf{q}_h customers. In other words, value increases in quality for high types at a higher rate than for other types. Formally, the relationship between value and quality is:

$$v(\mathbf{q}, q) = \begin{cases} \mathbf{q}q^2 & \mathbf{q} = \mathbf{q}_h \\ \mathbf{q}q & \text{otherwise} \end{cases} \quad (5.1)$$

A final set of assumptions is that $(q_C + q_F) > 1$; $(q_l + q_F) > 1$ and $(q_C + q_l) > 1$. These assumptions are not restrictive because the taste parameter (\mathbf{q}) is unconstrained.

This model follows the 2nd degree price discrimination literature (e.g., Varian 1989) where a monopolist chooses prices to segment users, with users self-selecting the "appropriate" product. It is often assumed in this literature that the quality-value relationship differs across customer types (e.g., Varian, 1989). The price discrimination literature identifies two types of constraints. One is an Individual Rationality constraint (IR), which states that a consumer will not have negative utility. The second is the Incentive Compatibility constraint (IC), which determines that

a consumer behaves in his own self-interest. When the IC constraint holds the consumer self-selects to purchase the “appropriate” product. Formally these require:

$$\forall i \text{ at type } i \text{'s chosen } j \text{ IR}_{i,j}: U(\mathbf{q}_i, \mathbf{q}_j, p_j) = v(\mathbf{q}_i, \mathbf{q}_j) - p_j \geq 0 \quad (5.2)$$

For customer type i to prefer product j over product k at given prices

$$\text{IC}_{i,j}: U(\mathbf{q}_i, \mathbf{q}_j, p_j) \geq U(\mathbf{q}_i, \mathbf{q}_k, p_k) \quad \Leftrightarrow \quad v(\mathbf{q}_i, \mathbf{q}_j) - p_j \geq v(\mathbf{q}_i, \mathbf{q}_k) - p_k \quad (5.3)$$

Case C: Monopolist Record Label without File Sharing

With this notation in place we can identify the monopolist label’s optimal behavior in selling CDs before file sharing is introduced. In essence the label has a choice regarding which customer segments to serve. Since customer value is increasing in \mathbf{q} the monopolist charges a price equal to the value of the lowest desired segment (from the respective IR constraints). For example, if he wants to attract both \mathbf{q}_h and \mathbf{q}_m customers the optimal price is: $p_C^C(\mathbf{q}_h, \mathbf{q}_m) = \mathbf{q}_m q_C$. To determine optimal behavior we identify prices and profit from serving each segment.

If only customers with taste parameter \mathbf{q}_h are served the label offers the following price:

$$p_C^C(\mathbf{q}_h) = \mathbf{q}_h q_C^2 \quad (5.4a)$$

and generates profit:

$$\mathbf{p}_C^C(\mathbf{q}_h) = r_h \mathbf{q}_h q_C^2 \quad (5.4b)$$

If customers with taste parameter \mathbf{q}_h and \mathbf{q}_m are served these become:

$$p_C^C(\mathbf{q}_h, \mathbf{q}_m) = \mathbf{q}_m q_C \quad (5.5a)$$

$$\mathbf{p}_C^C(\mathbf{q}_h, \mathbf{q}_m) = (r_m + r_h) \mathbf{q}_m q_C \quad (5.5b)$$

If the label opts to serve all customers, we get:

$$p_C^C(\mathbf{q}_h, \mathbf{q}_m, \mathbf{q}_l) = \mathbf{q}_l q_C \quad (5.6a)$$

$$\mathbf{p}_C^C(\mathbf{q}_h, \mathbf{q}_m, \mathbf{q}_l) = (r_l + r_m + r_h) \mathbf{q}_l q_C = \mathbf{q}_l q_C \quad (5.6b)$$

Again, profit is increasing in CD quality. This strengthens the recommendation that record labels improve the CD purchasing experience. However, the label’s optimal decision cannot be uniquely ascertained based simply on these profit equations. Under different distributions of taste and different product quality levels behavior changes. If, for example, \mathbf{q}_h is a large group and these customers place substantially more value on CDs than other groups, it is optimal to serve only them. However, if the group of \mathbf{q}_m customers dominates in size and value, the label prices

CDs to attract both q_h and q_m customers. We can identify sufficient conditions for serving each segment. These conditions provide a baseline for investigating how the label's behavior changes in response to new technologies.

Following the earlier discussion it appears that in the past labels chose not to serve the entire market of consumers. Thus, it is assumed that the label did not serve customers with taste parameter q_l .

Comparing equations (5.4b), (5.5b) and (5.6b) generates sufficient conditions for profit maximization. The monopolist label prefers to offer CDs only to customers with taste q_h if $p_c^c(q_h) \geq p_c^c(q_h, q_m)$, which places the following conditions on the distribution of tastes:

Comparing (5.4b) and (5.5b):
$$r_h q_h q_c \geq (r_m + r_h) q_m \quad (5.7)$$

This relationship is important in the following analyses and is defined as relationship 1 (R1):

R1:

$$r_h q_h q_c \geq (r_m + r_h) q_m$$

When $R1$ holds, the profit from q_h is greater than that offered by serving the entire market, so, from comparing (5.4b) and (5.6b):
$$r_h q_h q_c \geq q_l \quad (5.8)$$

The label chooses to sell to customers of taste parameter q_h and q_m when $R1$ does not hold (denoted as $\overline{R1}$):

Comparing (5.5b) and (5.4b): $\overline{R1}: \quad (r_m + r_h) q_m > r_h q_h q_c \quad (5.9)$

When $R1$ does not hold serving q_h and q_m segments is more profitable than serving the entire market so, comparing (5.5b) and (5.6b):
$$(r_m + r_h) q_m \geq q_l \quad (5.10)$$

Figure 3 depicts the label's profit from offering CD music to the different segments. When the size of the middle customer segment is small the label prefers to target only q_h customers. To achieve this goal, CDs are priced to extract all value for the high segment, leaving demand by q_m and q_l customers unsatisfied. In this region $R1$ holds. The profitability of q_m customers increases with this segment's size. If the size of this segment is sufficiently large, the label prices CD music to attract q_h and q_m customers. Here $R1$ does not hold.

Case D: Monopolist Record Label facing free File Sharing

Analyzing the label's decisions before the introduction of other options is useful as a baseline analysis. When free file sharing is available users have multiple choices. This requires the label

to price CDs to attract the desired customer segment, assuring that the relevant IC constraints are not violated.

If the label desires that only customers of taste parameter q_h buy CDs, their IC constraint binds, given their alternatives:

$$\text{From IC}_{h,C}: \quad q_h q_C^2 - p_C^D(q_h) \geq q_h q_F^2 - p_F^D = q_h q_F^2 - 0$$

$$\text{So:} \quad p_C^D(q_h) \leq q_h(q_C^2 - q_F^2) \quad (5.11a)$$

By choosing price $p_C^D(q_h) = q_h(q_C^2 - q_F^2)$ other segments prefer file sharing over CD purchases, and profit from segment q_h is maximized. Profit is:

$$p_C^D(q_h) = r_h q_h(q_C^2 - q_F^2) \quad (5.11b)$$

If the label desires that customers of taste parameter q_h and q_m buy CDs, the IC constraint for both these groups have to hold:

$$\text{From IC}_{h,C}: \quad q_h q_C^2 - p_C^D(q_h, q_m) \geq q_h q_F^2$$

$$\text{So:} \quad p_C^D(q_h, q_m) \leq q_h(q_C^2 - q_F^2)$$

$$\text{And for } q_m \text{ customers:} \quad q_m q_C - p_C^D(q_h, q_m) \geq q_m q_F$$

$$p_C^D(q_h, q_m) \leq q_m(q_C - q_F)$$

So the label chooses⁹ $p_C^D(q_h, q_m) = q_m(q_C - q_F)$, q_l customers prefer file sharing and profit is:

$$p_C^D(q_h, q_m) = (r_m + r_h) q_m(q_C - q_F) \quad (5.12)$$

Comparing (5.11b) and (5.12) indicates when the label prefers to sell to q_h customers and when he prefers selling to q_h and q_m customers. The condition for preferring only q_h customers is denoted as relationship 2:

R2:

$$r_h q_h(q_C + q_F) \geq (r_m + r_h) q_m$$

Similarly, the label prefers to sell to both q_h and q_m customers when $R2$ does not hold (denoted by $\overline{R2}$). Figure 4 (below) shows these relationships. It is straightforward to show that $R1$ implies $R2$, but $R2$ does not imply $R1$. Also, $\overline{R2}$ implies $\overline{R1}$, but $\overline{R1}$ does not imply $\overline{R2}$.

⁹ Note that $(q_C^2 - q_F^2) = (q_C - q_F)(q_C + q_F)$ so $(q_C^2 - q_F^2) > (q_C - q_F)$ when $(q_C + q_F) \geq 1$, as assumed.

When either $R1$ or $\overline{R2}$ hold the served segments do not change by introducing free file sharing (with only q_h served in the former case and both q_h and q_m served in the latter). However, the label's optimal response is to lower prices, by comparing (5.4) with (5.11) and (5.5) with (5.12). Only when $\overline{R1}$ and $R2$ hold (which occurs rarely) is there a change in the served segments. Before file sharing the label offered CDs to both q_h and q_m customers, while the introduction of file sharing induces the label to restrict output only to q_h customers. Even in this case profit declines (from $\overline{R1}$).

The record label's optimal response to file sharing would lower their profit. As in Scenario 1, the reduction in profit is related to the distribution of taste and the difference in quality between CDs and file sharing. Again the label has an incentive to maximize the quality difference between CDs and file sharing. This is achieved either by increasing the quality of CDs or by reducing the quality of file sharing.

One remaining question in this case is whether the label finds it attractive to serve the entire market now. Since file sharing depresses CD prices it may be that the label could increase profit by serving the entire market. To serve all customers prices would be set at:

$$p_C^D(q_h, q_m, q_l) = q_l(q_C - q_F)$$

with profit:

$$p_C^D(q_h, q_m, q_l) = q_l(q_C - q_F)$$

This level of profit is lower than serving only part of the market. If initially (as a monopolist) the label chose to sell only to q_h customers then, from (5.8), $r_h q_h q_C \geq q_l$ and $p_C^D(q_h) > p_C^D(q_h, q_m, q_l)$. If initially the label chose to sell to q_h and q_m customers then, from (5.10), $(r_m + r_h) q_m \geq q_l$ and $p_C^D(q_h, q_m) > p_C^D(q_h, q_m, q_l)$.

In summary, in response to the availability of file sharing the labels should lower price and only occasionally reduce the served customer segment (when both $\overline{R1}$ and $R2$ hold). The label's optimal response never increases its market share. Profit declines with the introduction of an imperfect substitute.

Case E: Record Label offers CDs & Internet Music while File Sharing is free

When faced with free file sharing, the label may want to version the music product. Offering a lower quality product, such as Internet music, at a lower price should induce some of the

customers with low willingness-to-pay to adopt Internet music. In essence, the label is trying to “steal back” customers from the file sharing alternative (O’Reilly, 2002). Internet music may be introduced and targeted to q_m customers with CDs targeted to q_h customers. To achieve this segmentation prices for CDs and Internet music have to be priced so that customers self-select the “appropriate” product. This constrains the prices charged for each product. While it is intuitively appealing to believe that Internet music can divert users from file sharing, economic analysis shows that it is not always profitable. The following exposition derives the conditions when introducing Internet music increases the label’s profit. These conditions are neither universal nor intuitive, justifying the reluctance to introduce Internet music.

This analysis is limited to the case where the label targets CDs only to q_h customers; Internet music is targeted to q_m customers; and q_l users adopt file sharing. Other combinations are worthy of consideration, but do not provide additional insight. With this allocation of products to consumers we have three sets of IC constraints. Each customer segment has to prefer their allocated product to the other two offerings.

For type q_h this implies:

$$\text{From IC}_{h,I}: \quad q_h q_C^2 - p_C^E(q_h) \geq q_h q_I^2 - p_I^E(q_m) \quad \Leftrightarrow \quad p_C^E(q_h) - p_I^E(q_m) \leq q_h(q_C^2 - q_I^2) \quad (5.13a)$$

$$\text{From IC}_{h,F}: \quad q_h q_C^2 - p_C^E(q_h) \geq q_h q_F^2 \quad \Leftrightarrow \quad p_C^E(q_h) \leq q_h(q_C^2 - q_F^2) \quad (5.13b)$$

Requiring, for customer segment q_m :

$$\text{From IC}_{m,C}: \quad q_m q_I - p_I^E(q_m) \geq q_m q_C - p_C^E(q_h) \quad \Leftrightarrow \quad p_C^E(q_h) - p_I^E(q_m) \geq q_m(q_C - q_I) \quad (5.14a)$$

$$\text{From IC}_{m,F}: \quad q_m q_I - p_I^E(q_m) \geq q_m q_F \quad \Leftrightarrow \quad p_I^E(q_m) \leq q_m(q_I - q_F) \quad (5.14b)$$

And for q_l :

$$\text{From IC}_{l,C}: \quad q_l q_F \geq q_l q_C - p_C^E(q_h) \quad \Leftrightarrow \quad p_C^E(q_h) \geq q_l(q_C - q_F) \quad (5.15a)$$

$$\text{From IC}_{l,I}: \quad q_l q_F \geq q_l q_I - p_I^E(q_m) \quad \Leftrightarrow \quad p_I^E(q_m) \geq q_l(q_I - q_F) \quad (5.15b)$$

Together these equations constrain feasible prices, to segment the customer base. Equation (5.13b) constrains CD prices so that q_h customers prefer CDs to file sharing, similar to Equation (5.11a) earlier. Equations (5.13a) and (5.14a) constrain the difference in price between CDs and Internet music to assure segmentation. Constraints (5.14b) and (5.15b) require that Internet music is priced to attract q_m customers, not q_l customers.

To maximize profit the label would desire to deliver a unique product to each segment while charging each segment their value. Corollary 2 shows that offering CDs to segment \mathbf{q}_h at a price equal to the value of CD's to these customers presents a product-price combination which violates the IC constraint of segment \mathbf{q}_m . (A similar result is shown in Varian, 1997.)

Corollary 2: There does not exist a pricing scheme that segments customers where CD prices are equal to the willingness-to-pay of \mathbf{q}_h customers.

Proof: If, from (5.13b), $p_C^E(\mathbf{q}_h) = \mathbf{q}_h(q_C^2 - q_F^2)$

From (5.13a): $p_I^E(\mathbf{q}_m) \geq \mathbf{q}_h(q_C^2 - q_F^2) - \mathbf{q}_h(q_C^2 - q_I^2) = \mathbf{q}_h(q_I^2 - q_F^2) > \mathbf{q}_m(q_I - q_F)$ violating (5.14b)

QED

Corollary 2 indicates that, if the label wishes to offer a different product to each segment, \mathbf{q}_h customers benefit from the introduction of Internet music, since it limits the label's pricing ability for \mathbf{q}_h customers. The label maximizes profit by extracting the entire surplus from \mathbf{q}_m customers (constraint 5.14b) and pricing CDs to assure that (5.13a) holds. Formally, set:

$$p_I^E(\mathbf{q}_m) = \mathbf{q}_m(q_I - q_F) \quad (5.16a)$$

$$p_C^E(\mathbf{q}_h) = p_I^E(\mathbf{q}_m) + \mathbf{q}_h(q_C^2 - q_I^2) = \mathbf{q}_m(q_I - q_F) + \mathbf{q}_h(q_C^2 - q_I^2) \quad (5.16b)$$

Other constraints hold from the assumptions on taste ($\mathbf{q}_l < \mathbf{q}_m < \mathbf{q}_h$) and product quality ($q_l < q_C$).

The label's profit is:

$$\begin{aligned} p_R^E &= p_C^E + p_I^E = r_m p_I^E(\mathbf{q}_m) + r_h p_C^E(\mathbf{q}_h) = \\ &= (r_m + r_h)\mathbf{q}_m(q_I - q_F) + r_h\mathbf{q}_h(q_C^2 - q_I^2) \end{aligned} \quad (5.17)$$

With the segmenting pricing scheme identified the question remains when the label increases profit by introducing Internet music. This has to be verified against two different initial situations. When faced with a file sharing competitor (equations 5.11 & 5.12) the label chose to target only \mathbf{q}_h customers when $R2$ holds (i.e., $r_h\mathbf{q}_h(q_C + q_F) \geq (r_m + r_h)\mathbf{q}_m$), otherwise he would target both \mathbf{q}_h and \mathbf{q}_m customers (when $\overline{R2}$). The profit implications of introducing Internet music are shown in Propositions 2 and 3.

Proposition 2: When $R2$ holds, initially the record label prices CDs to attract only q_h customers. When file sharing is available introducing Internet music and segmenting customers increases profit when:

$$q_F < q_I < \frac{(r_h + r_m)q_m}{r_h q_h} - q_F < q_C \quad (5.18)$$

Proof: From (5.11b) and (5.17): $p_C^D(q_h) < p_R^E$

$$\Leftrightarrow r_h q_h (q_C^2 - q_F^2) < (r_m + r_h) q_m (q_I - q_F) + r_h q_h (q_C^2 - q_I^2)$$

$$\Leftrightarrow r_h q_h (q_I^2 - q_F^2) < (r_m + r_h) q_m (q_I - q_F)$$

$$\Leftrightarrow r_h q_h (q_I + q_F) < (r_m + r_h) q_m$$

On the other hand, From $R2$: $(r_m + r_h) q_m < r_h q_h (q_C + q_F)$

Combining the two results and rearranging yields (5.18)

QED

Equation (5.18) indicates that the range of increased profitability from introducing Internet music is quite narrow, when $R2$ holds. First, if the quality of file sharing is too high ($q_F \geq \frac{(r_h + r_m)q_m}{r_h q_h}$), Internet music never increases profit. Second (5.18) restricts the quality level of Internet music. If Internet music is, inherently, of high quality the LHS is violated, and the label prefers to serve only q_h customers (from $R2$). The intuition for this is that a high quality intermediate-product reduces the viable price for CDs (5.16b). In essence, the label prefers that CDs compete with file sharing, rather than Internet music. Since the label initially preferred not to serve q_m customers, serving these customers has a high risk of cannibalization. Finally, q_I is constrained from below, because the label cannot offer a product of lower quality than file sharing.

This is demonstrated in Figure 4, which shows when $R2$ holds and the profit implications of introducing Internet music, for a given set of parameters. If the ratio of q_m customers (r_m) is very low the label prefers to offer only CDs, targeting high type customers ($R2$ holds). In this region offering Internet music with $q_I = 1.5$ forces the label to lower the price for CDs, reducing profit. As r_m increases the profitability of Internet music increases.

Figure 3: Profit form Various Offerings – Before File Sharing

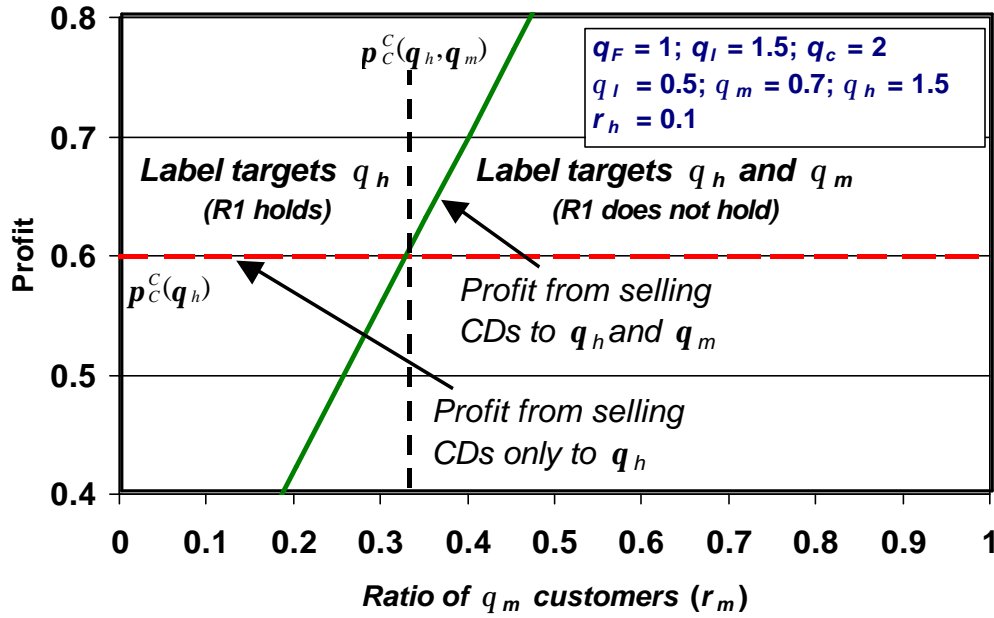
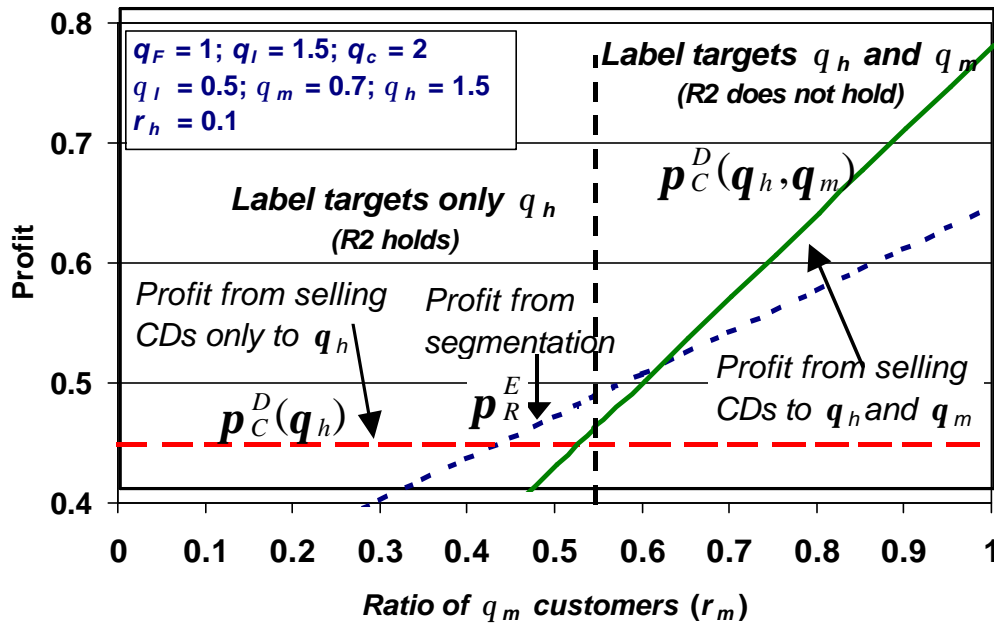


Figure 4: Profit form Various Offerings – Facing free File Sharing



When R2 does not hold there is a different narrow range for increased profit from Internet music.

Proposition 3: When $R2$ does not hold, the record label initially prices CDs to attract both q_h and q_m customers. When file sharing is available introducing Internet music and segmenting customers increases profit when:

$$q_F < \frac{(r_h + r_m)q_m}{r_h q_h} - q_C < q_I < q_C \quad (5.19)$$

Proof: From (5.12) and (5.17): $p_C^D(q_h, q_m) < p_R^E$

$$\Leftrightarrow (r_m + r_h)q_m(q_C - q_F) < (r_m + r_h)q_m(q_I - q_F) + r_h q_h(q_C^2 - q_I^2)$$

$$\Leftrightarrow (r_m + r_h)q_m(q_C - q_I) < r_h q_h(q_C^2 - q_I^2)$$

$$\Leftrightarrow (r_m + r_h)q_m < r_h q_h(q_C + q_I)$$

On the other hand, From $\overline{R2}$: $r_h q_h(q_C + q_F) < (r_m + r_h)q_m$

Combining the two results and rearranging yields (5.19)

QED

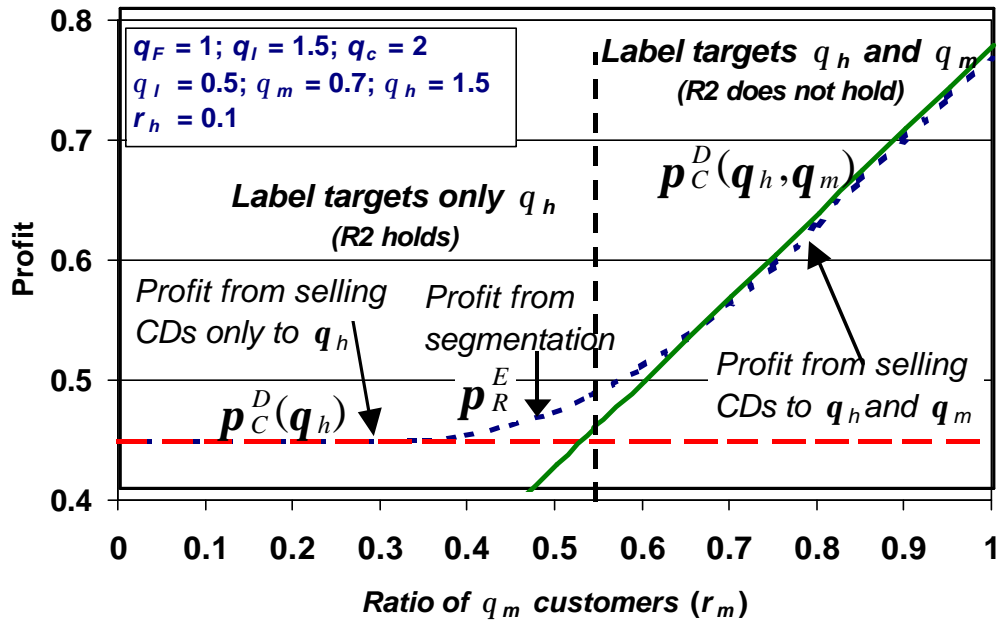
In this situation the quality of Internet music has to be sufficiently high for its profitable introduction. The reasoning behind this result is that initially the label preferred to serve both q_h and q_m segments (from $\overline{R2}$). The label introduces Internet music at a lower price than CDs for q_m customers, while raising the price on CDs for q_h customers. If the reduction in price and profit from offering Internet music is too severe the label prefers not to offer this media. Since the price for Internet music is linearly related to its quality, higher quality for this media raises profit. This generates a minimal quality level for Internet music to be profitable. Here CD quality constrains the quality of Internet music. Returning to Figure 4, when r_m is too high the label prefers to offer only CDs at a price that is attractive to both q_h and q_m customers.

Once optimal prices are known the next stage is choosing quality levels, knowing how prices react to quality. Optimal quality policies for CDs and file sharing remain unchanged when Internet music is available. The label still prefers to raise CD quality and lower file sharing quality (from 5.17). Obviously there are technological limitations to both of these, but the general insight remains that these changes are in the label's best interest. Choosing the quality of Internet music involves a trade-off between raising prices and profit from q_m customers against cannibalizing prices and profit from CD sales. The optimal quality level is derived from the F.O.C. of p_R^E in (5.17). The result is that:

$$q_I^* = \frac{1}{2} \frac{(r_h + r_m)q_m}{r_h q_h} \tag{5.20}$$

Returning to Figure 4 the decreased profit from introducing Internet music stems from the fact that its quality is set. Optimizing the quality of Internet music would improve the profit of this alternative, somewhat. However, setting this quality has to be aligned with the constraints on q_I , which are that $q_F < q_I < q_C$. Figure 5 replicates Figure 4 when quality of Internet music is chosen optimally. In Figure 4 there are two regions where it is unprofitable to offer Internet music. In the left region the label only targets q_h customers ($R2$ holds). Here the ideal alternate product would be of equal quality to file sharing, generating zero profit. In the right region (where $R2$ does not hold) the ideal alternate product is identical to CD music, indicating that differentiation is mute. Both of these results can be seen in Figure 5.

Figure 5: Profit when Optimizing quality for Internet Music (q_I^*)



V. Discussion

This paper identifies the economic impact of recent changes in the music industry. According to many industry notables, the record labels have taken the wrong path in responding to the Internet and threats of file sharing (O'Reilly, 2002). Critics often complain that the industry

places too much emphasis on combating file sharing, rather than adopting the Internet as a new media for distributing music (Business 2.0, April 3, 2002; O'Reilly, 2002).

A key contribution of this paper is assessing the merit of various suggestions from an economic perspective. To generate robust results and analyze the impact of different assumptions two economic models are used. Together these provide the required conditions for the various recommendations. Taking the view of the record label as a monopolist provider of music provides partial support for both sides of the argument.

Consistent with the criticism of the industry, part of the response to file sharing should be lowering the price of CDs. This maximizes the labels' profits when there exists a free, low-quality substitute, by reducing the attractiveness of file sharing (O'Reilly, 2002). Furthermore, both models show that the labels' benefit from increasing the quality of CDs. Embracing the Internet to provide exclusive content for buyers of CDs, as a means of expanding entertainment value for buyers of legitimate music, would increase the quality and profit of CD sales.

Economic analysis also indicates that the RIAA's aggressive legal and advertising action against file sharing increases the labels' profit. Examples of these actions are the lawsuits against Napster and other file-sharing systems; suing individual users and distributors of copyright music (Los Angeles Times, March 18, 2003); "polluting" the pool of shared music (Wired News January 13, 2003); and sending out millions of "instant messages" to users of file sharing services (The New York Post, April 30, 2003). From an economic perspective these actions are aimed at impeding and de-legitimize music sharing. The net result is reducing the quality of file sharing for potential users, as evidenced by the recent reduction in music sharing (Daily Variety, August 21, 2003).

Contrary to the criticism of the labels, however, online distribution of music does not always increase the labels' profits. This justifies the labels' slow adoption of technologies for direct downloading of music, such as Rhapsody (available from Listen.com) and the recently announced iTunes Music Store from Apple (applemusic.com) (The New York Times, May 1, 2003). For these services to be profitable they have to target a niche audience, while not cannibalizing CD sales. Economic analysis shows that the profit opportunity for Internet music is quite narrow. First, with a linear relationship between quality and value the record labels do not increase profit by introducing a second product. Second, when the relationship between quality

and value is unequal across customers the opportunity for a profitable Internet music service is quite narrow. In the analysis presented here, high “type” customers appreciate quality at a higher rate than other customers. Yet, the introduction of downloadable music does not uniformly increase profits. The potential profit and optimal quality of this service depend on the distribution of taste and the quality of CDs and file sharing.

VI. Conclusion

As Internet adoption increases the music industry is facing opportunities from generating new products and enhancing existing products, while feeling pressure from file sharing that threatens to undermine legitimate music sales. The response to new technologies appears to be quite slow with many criticizing the industry for its stagnation. What has been missing from the debate, to date, is an economic analysis of the merits of different suggestions. The analysis in this paper offers guidance on profit-maximizing behavior by current copyright owners.

Free distribution of information goods will have much broader effects than the music industry. Other forms of entertainment, such as movies, are already seeing the first examples of potential file sharing threats, while considering ways of embracing the Internet to facilitate video-on-demand as a new product. Software makers also face competition from free information goods. Here the threat is from open-source software, which offers an imperfect substitute for traditional software development efforts. Economic analysis of profitable opportunities for other industries will provide guidance for traditional players in responding to networking technologies.

References:

Bhargava, Hemant K. and Vidyanand Choudhary (2001) “Information Goods and Vertical Differentiation,” *Journal of Management Information Systems* Vol. 18, No. 2, (Fall 2001) pp. 89-106

Bhargava, Hemant K. and Vidyanand Choudhary (2002) “One Size Fits All? Optimality Conditions for Market Segmentation via Second-degree Price Discrimination,” *GSIA Working Paper 2001-10, Carnegie Mellon University*

[The Boston Globe](#) (September 4, 2002) “Napster Officially Shuts As Judge Blocks Firm's Sale,” by D.C. Denison

Business 2.0 (Apr 03, 2002) “[A Proposal for the Recording Industry: Embrace MP3!](#),” By Eric Hellweg

- CNET News.com “Judge: File-Swapping Tools are Legal” By John Borland April 25, 2003,
- Daily Variety (August 21, 2003) “Pirates Broadsided,” By Meredith Amdur
- Denekere, Raymond and R. Preston McAfee (1996) “Damaged Goods,” *Journal of Economics and Management Strategy* Vol. 5 No.2, (Summer 1996) pp. 149-174.
- Fudenberg, Drew and Jean Tirole (1991) *Game Theory* MIT Press: Cambridge, MA
- Liebowitz, Stan (2003) [Will MP3 downloads Annihilate the Record Industry? The Evidence so Far](#) June, 2003
- [Los Angeles Times](#) (March 18, 2003) “Industry Targets File Swappers' Employers,” by Jon Healey
- [New York Post](#) (April 30, 2003) “Pirates Get A Warning From RIAA,” By Tim Arango
- [New York Times](#) (May 1, 2003) “State Of The Art; Online Piper, Payable By The Tune,” By David Pogue
- New York Times* (June 6, 2002) “Gnat or Parasite? Angst Over Adware,” By John Biggs
- O’Reilly, Tim (2002) “Piracy is Progressive Taxation, and Other Thoughts on the Evolution of Online Distribution,” December 11, 2002. Online at OpenP2P.com (visited April 1, 2003): <http://www.openp2p.com/pub/a/p2p/2002/12/11/piracy.html>
- RIAA (2003) *The Recording Industry Association Of America – 2002 Consumer Profile*
- Tech Investor (September 18, 2002) “Music Industry Turns a Corner” By Eric Hellweg
- Tirole, Jean (1998) *The Theory of Industrial Organization* MIT Press: Cambridge, MA
- Varian, Hal R. (1989) “Price Discrimination,” In Richard Schmalensee and Robert Willig, editors, *Handbook of Industrial Organization*. North-Holland Press, Amersterdam
- Varian, Hal R. (1997) “Versioning Information Goods,” in Brian Kahin and Hal R. Varian, editors, *Internet Publishing and Beyond*. MIT Press, 2000. Online (visited April 1, 2003): <http://www.sims.berkeley.edu/~hal/Papers/version.pdf>
- Wired News (January 13, 2003) “[Hitting P2P Users Where It Hurts](#)” By James Maguire