An Analysis of the Effectiveness of Law Enforcement Against Online Music Piracy

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INTRODUCTION

Obtaining a copy of music without permission from the music's copyright owner is illegal. Yet, millions of consumers engage in exchanging illicit music files over the Internet. Unlike other illegal activities, file sharing appears to be widespread among consumers across all walks of life. In order to curtail widespread music file-sharing activities, the music industry has sought to increase the enforcement of existing copyright laws (Liebowitz 2006). Initially, lawsuits were filed against operators of file sharing networks such as Napster and Audio Galaxy. Using these lawsuits, the industry was able to shut down file-sharing networks that engaged directly in helping computer users locate music files on other users' computers (see, Napster, for example). However, the legal victory was short-lived. As soon as the operator of a file-sharing application is defeated in court, new file-sharing applications usually emerge quickly and draw a large number of consumers to start new, viable electronic networks for sharing music (Black, 2002). After Napster was ordered to shut down, new generations of file-sharing applications using updated and more decentralized technologies such as KaZaA, BearShare, and LimeWire appeared on the Internet.

Subsequently, the music industry turned to individual consumers who allegedly engaged in illegal music file sharing. In September 2003, the industry filed lawsuits against 261 individuals who the industry claimed traded a large number of music files online (BBC News, 2003). Prior to these lawsuits, individual file sharers were almost completely immune from any liability of their online activities. These lawsuits, the industry hopes, would alter that notion of online immunity. Coupled with successes in shutting down operators of file-sharing networks (see, shutting down of Grokster and KaZaA, for example (Borland, 2005)), the industry has been emboldened and has expanded its legal efforts to countries outside of the U.S. In this paper, we use economic modeling and data analysis to evaluate the effectiveness of these lawsuits.

The remainder of the paper is divided into two sections. The first section presents an economic model that explores consumers' decisions about whether or not to engage in illegal file-sharing activities. The second section outlines our data analysis plan to validate key assumptions and estimate the parameters included in our economic model. Integral and essential to this data analysis is our data collection effort to track actual file-sharing activities on KaZaA, one of the most well-known and largest file sharing networks. Our data collection process covers a period of 6 months between November 2005 and May 2006.

ECONOMIC MODEL

In this section, we model the file sharer's behavior using the approach taken by Becker (1968), Ehrlich (1973 and 1972), and Garoupa and Jellal (2002). To obtain a music product, an individual consumer can either purchase a legal copy or download an illegal copy of the music. First, we consider a situation where a consumer looks to obtain a single song. Let U denote the utility function derived from listening to a song, v denote a consumer's expected valuation for a song, p the consumer's perceived risk of getting caught, f the monetary penalty from being sued, and q the ratio of expected reduction of value of v due to factors such as uncertain quality of music files from illegal sources and reduced utility from consuming illegal products (i.e., when $q \rightarrow 1$, the utility received from an illegal copy of a music file is almost as high as that from purchasing a legal copy). Thus, the expected utility from downloading the song illegally is:

$$EU(v, q, p, f) \tag{1}$$

where EU denotes the expected value of U.

If the consumer wants to purchase the song, he/she has two options: 1) purchasing the song online or 2) purchasing a CD. For the online option, the consumer's expected utility is:

$$EL_1(v, s_1, r_1) \tag{2}$$

where L_1 denotes the utility function derived from purchasing a legal copy of music, EL_1 the expected value of L_1, r_1 the ratio of reduction in utility due to the restriction of usage of the digital file, and s_1 the lowest price of the song the consumer can purchase online.

The consumer's expected utility from purchasing a CD is:

$$EL_2(v, s_2, r_2) \tag{3}$$

where L_2 denotes the utility function, EL_1 the expected value of L_2 s_2 the price of the single CD (or other physical media formats), and r_2 the ratio of reduction in utility. From these retail options, the consumer would choose the one that yields the maximum expected utility.

$$EL = Max\{EL_1(v, s_1, r_1), EL_2(v, s_2, r_2)\} \tag{4}$$

where EL denotes the expected utility derived from a legal retail purchase.

It follows that if (1) > (4) and (1) > 0, the consumer would download an illegal copy of the song; otherwise the consumer would purchase the song. In order to influence the consumer's decision, the music industry can employ its technical resources to interfere with the online exchange of music files (i.e., the value of q) by injecting seemingly-legitimate-but-fake music files onto peer-to-peer networks, in addition to increasing the values of p and f. The industry can also influence the consumer's behavior by changing the retail prices of its music.

If the consumer wants to obtain multiple songs (say, n songs), he/she may decide whether to pirate or purchase each song individually. The consumer's total expected utility would simply be the summation of the utility expected from individual songs, or:

$$\sum_{i=1}^{n} Max\{EL_i, EU(v_i, q_i, p, f), 0\} \tag{5}$$

Alternatively, the consumer may choose to purchase an online subscription. We assume that the consumer can download all desired songs by purchasing one

subscription. Let c_1 denotes the subscription fee and $\mathbf{v} = \{v_1, v_2, v_3, \ldots, v_n\}$ the expected valuation of the songs the consumer wants to download. The expected utility from purchasing an online subscription is.

$$EW_1(\mathbf{v}, c_1, r_1) \quad (6)$$

where W_1 denotes the utility function derived from purchasing an online subscription.

For a compilation of songs in on CDs, we define c_2 as the total retail price of the CD(s) the consumer needs to purchase in order to obtain all the desired songs. The expected utility from purchasing compilations of songs in a CD would be

$$EW_2(\mathbf{v}, c_2, r_2) \quad (7)$$

where W_2 denotes the utility function derived from purchasing songs in a physical media format.

As a result, among the other retail options, the consumer would choose the choice that maximizes his/her utility, or

$$Max\ \{EW_1(\mathbf{v}, c_1, r_1),\ EW_2(\mathbf{v}, c_2, r_2)\} \quad (8)$$

The consumer's decision whether to pirate or purchase the songs would depend on the values of (5) and (8). Specifically, if (8) ≥ (5) and (8) ≥ 0, the consumer would purchase all songs legally, otherwise his/her decision will be made on an individual song basis.

In a multiple-period situation where the consumer re-evaluates his/her choice after obtaining each song, our model can be extended as follows. If the consumer initially chooses to obtain an individual song either by pirating or purchasing a legal copy, then the subsequent decision in the second period would be based on comparing the value of (9) and (10) as shown below.

$$\sum_{i=1}^{n} Max\{E_i, E(v_i, q_i, p, f), 0\} \quad (9)$$

Figure 1. Number of KaZaA users (5-day moving average) in millions)

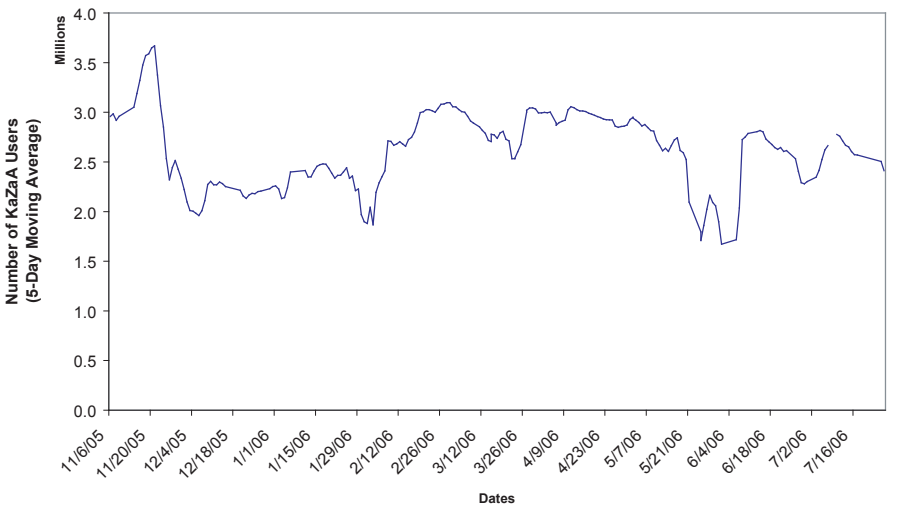
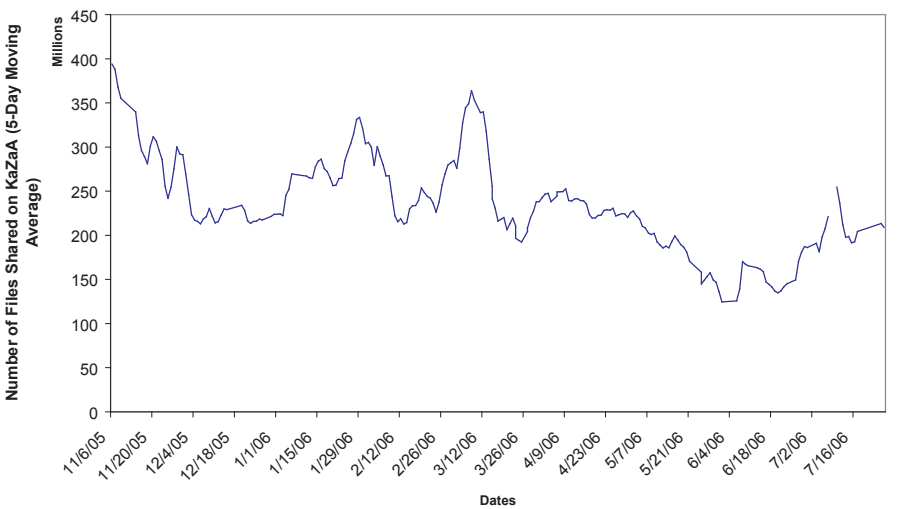


Figure 2. Number of files shared on KaZaA (5-day moving average) in millions



$$Max\ \{EW_1(\mathbf{v'}c_1,r_1),\ EW_2(\mathbf{v'}c_2,r_2)\}\ ;\mathbf{v'} = \{v_1, v_2, v_3, \ldots v_{n-1}\} \quad (10)$$

Subsequent decisions in later periods would follow the same rationale until the consumer obtains all individual songs he/she wants or purchases a subscription or a compilation of music in a physical format.

The total number of music files being shared (and thus downloaded) on peer-to-peer networks would therefore be derived from the decisions made by participants on the networks. Although the decisions made by file sharers depend on the values of parameters *v*, *p*, and *f* which vary greatly based on their financial resources, education, age, etc., we follow the approach taken by Becker (1968) to consider only the average values of these parameters.

DATA ANALYSIS

In this section, we develop an online data collection agent and conduct an empirical analysis to examine the actual impact that legal efforts by the music industry have had on the illegal file sharing activities. We characterize file sharers in terms of the variables in our economic model: valuation toward music (*v*), perceived risk of getting caught (*p*), and perception on the retail price of music. Our data collection agent tracked file-sharing activities on KaZaA between November 2005 and July 2006, during which many lawsuits were filed against alleged file sharers. Figures 1 and 2 show the number of file sharers and the number of files available for download on KaZaA between November 2005 and July 2006. Our preliminary results indicate that, while the lawsuits may have discouraged file sharers from engaging in online music piracy, the number of file sharers participating in peer-to-peer networks remain very high. The lawsuits were usually filed at the end or in the middle of each month (e.g., November 30, 2005, December 15, 2005, January 31, 2006, and February 28, 2006). As shown in Figures 1 and 2, file sharers tend not to participate on KaZA immediately after the industry's lawsuits. However, overall, the number of files being shared and the number of file sharers on KaZaA remain very high (i.e., on the day that we observed the lowest number of files shared on KaZaA, we found over 105 million files, and the lowest number of KaZaA users observed during our data collection period was 1.2 million).

In late July 2006 after our data collection was concluded, KaZaA received a court order to either shut down its operation or filter out all copyrighted materials from its network. In the past, when a popular file-sharing network was legally shut down (see, for example, the case of Napster), file sharers simply moved on to other networks and resume their online activities. At present, there are already other popular peer-to-peer networks such as Shareaza that allow file sharers to exchange copyrighted music files, filling the void left by KaZaA and thus undermining the legal efforts made by the music industry.

The second part of our analysis includes an opinion survey that looks at consumer's perception of the copyright law and its enforcement, the consequences of online piracy, and the retail price of music. Our data will be compared and supplemented by the data reported in previous studies. These empirical results will allow us to estimate the values of the parameters in our economic model presented above.

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