

## Enforcement and Control of Piracy, Copying, and Sharing in the Movie Industry

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**Abstract** We review strategies that movie distributors have used to cope with piracy, copying, and sharing of movies in the United States in four categories: “hard goods” commercial piracy, consumer theft of pay TV signals, consumer copying and sharing of videos and pay TV, and (mostly in prospect) Internet file sharing. In the past, distributors have mainly sought to raise costs of engaging in these activities by increasing legal jeopardy, advantaging anti-copy technology, and reducing original sources of supply. They appear to have effectively reduced or contained most piracy, copying, and sharing of movies in the U.S., at least with analog media. Movie distributors are following similar strategies with digital media, including Internet file sharing. Digital media raise the stakes because of lower costs of copying or sharing and higher quality of outputs. Digital outputs are not always as high quality as source originals, however, and digital rights management (DRM) technologies potentially improve distributor control. The movie studios now face technological, demand, and political uncertainties in the U.S., notably in maintaining or achieving technically compatible DRM systems to control file sharing and PPV/VOD copying. Implications for foreign markets and directions for research are discussed.

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Some sections of this article draw substantially on David Waterman (2005a). Hollywood’s road to riches (Cambridge, MA: Harvard University Press).

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## I Introduction

At a time when the Hollywood movie studios face a potentially devastating threat from Internet-based piracy, an assessment of strategies they have used in the past to fight piracy and otherwise to control the copying and sharing of movies may be useful. What have been the studios' objectives, and how successful have their efforts been? Does the industry's experience have useful lessons for our understanding of the current threat to movie distributors from illegal file sharing and other forms of digital piracy, copying, or sharing? In this article, we address these broad questions with an economic survey of the movie industry's experience with enforcement and control involving home video, pay television, and other movie exhibition media.

There is an expanding theoretical literature in industrial organization about market-based devices that owners of intellectual property might use to control piracy, copying, and sharing by consumers – or even to benefit from these practices by permitting or encouraging them. (For a survey, see [Peitz and Waelbroek 2006a](#)). There has also been a rapid growth in the flow of empirical studies and commentary by economists and others about the effects of file sharing on the music publishing industry ([Holm 2003](#); [Hui and Png 2003](#); [Liebowitz 2006a,b](#); [Rob and Waldfogel 2006a](#); [Zentner 2005](#); [Oberholzer-Gee and Stumpf 2007](#)). At this writing, movie file sharing is in a comparatively nascent period and has understandably attracted less academic attention and fewer empirical studies ([Bounie et al. 2006](#); [Rob and Waldfogel 2006b](#); [De Vany and Walls 2007](#)). In fact, apart from these articles and some commentary at the conclusion of Peitz and Waelbroek's theory review, movie piracy, copying, or sharing has itself been rarely considered in the economic literature. One objective of the present article is to provide an institutionally-based framework that may help guide an inevitable increase in the flow of empirical studies of the effects of movie file sharing.

We consider a broad range of movie piracy, copying and sharing activities: “hard goods” commercial piracy, consumer theft of pay TV signals, consumer copying and sharing of prerecorded videos and of pay TV programs, and – mostly in prospect – Internet file sharing. All of these activities are illegal, with the exception of pay TV copying, which has been permissible or within a gray area of law. Our focus, however, is only on these activities in the United States. That makes our analysis far from comprehensive, since about half of the Hollywood studios' revenues from distribution of theatrical features come from foreign markets, and the Motion Picture Association of America (MPAA) claims that these countries account for about four-fifths of their total piracy losses. Most of the information accessible to us comes from the U. S., however, and

hopefully that focus will give insight into the worse problems in other countries, especially in the Third World, where copyright law and its enforcement are often weak.

Another limitation of our study is that we stop short of welfare analysis. The question of how much control movie studios (and other copyright holders) ought to have over the ability of consumers to copy or share their products—or in other words, what should be the definition of “fair use” of movies and of other copyrighted products – is a subject of intense political debate. We primarily take an industrial organization perspective in this paper, focusing on the movie distributors and their profit motives. We abstract from—but hopefully inform—the important economic and social welfare issues raised by the fair use debate.

We begin in Section II below with background about how movies are released in the U.S., some data involving piracy and movie industry revenues, and an introduction to digital rights management (DRM) issues. In the bulk of the paper, Section III, we consider studio strategies in confronting the various forms of movie piracy, copying, and sharing in the U.S. A brief conclusion follows.

## II Economic Context

As with shoplifting and many other crimes against business, the burden of enforcement against commercial movie piracy and illegal copying or sharing activities rests heavily with industry initiative. For movies, enforcement is led by the MPAA, whose membership – currently the six major U.S. studios (Paramount Pictures Corporation, Sony Pictures Entertainment, Twentieth Century Fox Film Corporation, Universal City Studios, Warner Brothers Entertainment, and the Walt Disney Company) – has consistently accounted for 80 to 90% or more of all revenue from distribution of theatrical feature films in the U.S. market, at least since the early 1980s. These major distributors (which we refer to as “the studios”) also earn the great proportion of movie export revenues. Typically, the studios own the movie copyrights and U.S. law permits the MPAA, as a trade association, to coordinate the enforcement of anti-piracy law by reporting suspected illegal activity to authorities and by supporting prosecution efforts. The MPAA represents its membership before Congress and other legal and regulatory bodies, such as the Federal Communications Commission (FCC). The MPAA and individual studios also participate in negotiation and licensing of technical standards that affect piracy and copying, such as the development of DRM systems.

Each copyright industry has its own peculiar characteristics. Enforcement and control strategies of movie studios are best understood in the context of two main economic features of the film industry and its environment: the inter-temporal system of releasing theatrical movies, and the hardware-software compatibility requirements for electronic anti-piracy and copy control mechanisms to function.

**Table 1** The Typical Theatrical Release Sequence: Timing, Pricing, and Revenue Data: U.S. Domestic Market, 2002–2005

(1) Media	(2) Approx. Window	(3) Retail Price per Transac- tion (2002)	(4) Realized Retail Price per Viewing** (2002)	(5) Proportion of Total Distributor Revenues by Media (2002)	(6) Proportion of Total Distributor Revenues by Media (2005)
Theaters		\$5.81	\$5.81	24.8%	22.2%
Hotel PPV/ airline	2-3 months after theater			0.4%	0.4%
Video sales	4-5 months after theater	\$14.77	\$3.69	43.0%	47.2%
Video rentals	4-5 months after theater	\$2.84	\$1.13	11.0%	5.9%
Home PPV/VOD	30-45 days after video	\$3.50-\$4.00	\$1.50	1.9%	2.0%
Subscription pay TV	1 year after theater	\$7.64/mo	\$0.76	7.0%	7.3%
Basic cable TV	2-3 years after theater	\$34.52/mo	\$0.46	8.4%	10.8%
Broadcast TV	2-3 years after theater	–	–	3.6%	3.1%

\*\* based on survey data indicating the average or median numbers of users per transaction, as follows: video sales: 4; video rentals: 2.5; PPV/VOD: 2.5; subscription pay TV and basic cable: see [Waterman \(2005a\)](#), Appendix D

Source: [Waterman \(2005a\)](#), p. 71 & 87); [Kagan Research \(2006a\)](#), p. 3 & [2006b](#), p. 12)

## A. The Inter-temporal Movie Release Model

The system by which major studios usually release theatrical features over time, first to theaters, then home video, pay-per-view (PPV) and video-on-demand (VOD),<sup>1</sup> etc., is generally familiar. [Table 1](#) summarizes the typical sequence and some key economic features of it in the early to mid-2000s.

Average realized prices (Column 4) tend to fall for media that come later in the sequence. In addition to the inter-temporal element, average quality of the movie viewing experience tends to be lower for later media. Theaters offer the most rewarding experience in terms of visual impact, followed by video sales and rentals, which have a high degree of viewing control by consumers; then bundled subscription pay TV; followed by commercial-cluttered exhibitions on basic cable and broadcast channels.

The falling prices and varying quality of media suggest that movie distributors use the sequence as a device for market segmentation in order to price discriminate ([Owen and Wildman 1992](#)).<sup>2</sup> In addition, theater exhibitions are heavily advertised and the fact of a movie's theater release, as well as the degree

<sup>1</sup> The term VOD generally refers to "true" video-on-demand systems in which consumers interact with a server to order a specific program they want at an exact time they specify, while pay-per-view (PPV) usually refers to a pay-by-the-program system in which consumers select among a dedicated set of television channels that offer a menu of alternative programs having set exhibition times.

<sup>2</sup> Falling prices over time do not in themselves demonstrate price discrimination, but [Stokey \(1979\)](#) derives plausible conditions under which inter-temporal price discrimination is profitable. [Mussa and Rosen \(1978\)](#) demonstrate conditions under which quality discrimination is possible. See also [Varian \(1989\)](#) and [Mortimer \(2002\)](#).

of its box-office success, is widely believed to signal a movie's quality to users of subsequent media. The sequence has also been interpreted as an information collection device for studios, which thereby resolve uncertainty about a movie's future performance, and adjust prices and distribution plans accordingly (De Vany and Eckert 1991).

It is evident that demand among movie media is interdependent. Certain complementary effects may exist. For example, surveys have reported that a satisfying theater experience induces video purchase. Presumably, however, substitution effects dominate. One indication of substitution effects is the significant periods of time when distributors typically keep movies out of the market altogether, notably an "out-of-market gap" of several weeks or months between the end of film's theater run and its release to video (Nelson et al. 2007).

One consequence of interdependent demand is that the basic cost to the distributor of a piracy, copying, or sharing event – the net revenue the distributor would otherwise have received from the user of the pirated, copied or shared movie – is not necessarily for that medium, but possibly any other medium in the sequence. Obviously, the distributor's loss from some consumption events, notably DVD purchase or theater attendance, involves greater economic sacrifice than others; minimizing losses from the highest value viewers becomes the primary objective. It is evident from columns 5 and 6 of Table 1 that distributor revenues are heavily concentrated in the high value segments of theater and video exhibition – especially video sales. Thus the studios have a relatively intense concern with protecting the video and theater markets in their battles against piracy, copying and sharing.

Interdependent demand also affects distributors' coping strategies. As is well established in the economic literature, studios might be able to raise prices of movies exhibited on the copied or shared medium in order directly to appropriate value from those who both make and use the copied products, or indirectly from others who get them from the copiers (Liebowitz 1985; Besen 1986; Besen and Kirby 1989).<sup>3</sup> Or, sellers might engage in limit pricing—lowering prices of legitimate copies or originals in order to discourage copying or piracy. In either case, the pricing of one medium affects the pricing of others if intertemporal, quality or other market segmentation is to be preserved. Studios might also, however, manipulate the pecking order or the timing of media in the sequence to reduce piracy, copying, or sharing incentives. Of course, any such coping actions are at some net sacrifice to the seller. Usually, piracy, copying, and sharing tend to undermine segmentation. In the extreme, these activities could collapse the release sequence.

Under these constraints, each studio maximizes revenue for its slate of movies from all of these media. That does not necessarily mean stopping piracy, copying, or sharing for three basic reasons. First, of course, it is costly to do so. Second, consumer copying or sharing could in some circumstances increase seller prof-

<sup>3</sup> Hui and Png (2003) argue that music publishers have overestimated their losses from piracy to this extent.

its by offering opportunities (such as raising prices) to capture revenues from lower value consumers who would otherwise have been excluded from the market (Varian 2000, 2005).

A third reason is that even if such revenue capture is not possible, the copyright holders can achieve a revenue-equivalent outcome only by moving high value consumers who otherwise would have purchased tickets, bought videos, etc., back into the legitimate market. To the extent that the latter outcome is feasible, the studios' strategies in confronting piracy, copying, and sharing can be viewed as market segmentation. That is, a cost-raising strategy, such as increasing legal jeopardy of piracy or illegal copying, or a product quality reducing strategy, such as employing a technology that degrades a copy, need only affect higher value viewers. If, for example, high value movie consumers perceive a relatively high cost of file sharing, or if their valuations of movie quality are relatively high (a common assumption driving models of quality segmentation), then those left outside the legitimate market will disproportionately tend to be low value consumers, and thus can be ignored.

## B. Economic Effects of Piracy, Copying, and Sharing in Historical Perspective

MPAA estimates of harm from piracy based on a 2005 study, compared to estimates of total legitimate industry revenues from the distribution of theatrical features from all media, provide broad perspective. As Table 2 indicates, the majority of the MPAA's loss claims (a worldwide total of \$6.1 billion) in both the U.S. and foreign markets, involve hard goods piracy, but the effects of both that and "Internet piracy" are heavily skewed toward foreign markets, which accounted for 51% of total U.S. distributor revenues in that year.<sup>4</sup> The MPAA's methodology is incompletely described, and the estimates do not include, of course, any form of legal copying or sharing of movie products.<sup>5</sup>

Comparative historical data for piracy losses are not available,<sup>6</sup> but Figures 1 and 2 offer some historical perspective. As shown in Figure 1, U.S. consumer movie spending on theaters and video (the great majority of all U.S. movie spending), and with that, total U.S. movie distributor revenues, rose steadily from the 1980s to at least 2004. While the effects of file sharing on music industry revenues have been vigorously debated, at least the "smoking gun" of

<sup>4</sup> MPA and LEK (2006); this study was conducted by LEK for the Motion Picture Association (MPA), a branch of the MPAA that is involved with members' foreign markets. The study defines "hard goods piracy" as "obtaining movies by either purchasing or acquiring an illegally produced VHS/DVD/VCD through a commercial source, or making illegal copies for oneself or receiving from a personal source (friend or family) an illegal copy of a legitimate VHS/DVD/VCD"; "Internet piracy" is defined as "obtaining movies by either downloading them from the Internet without paying or acquiring hard copies of illegally downloaded movies from friends or family" (p. 5).

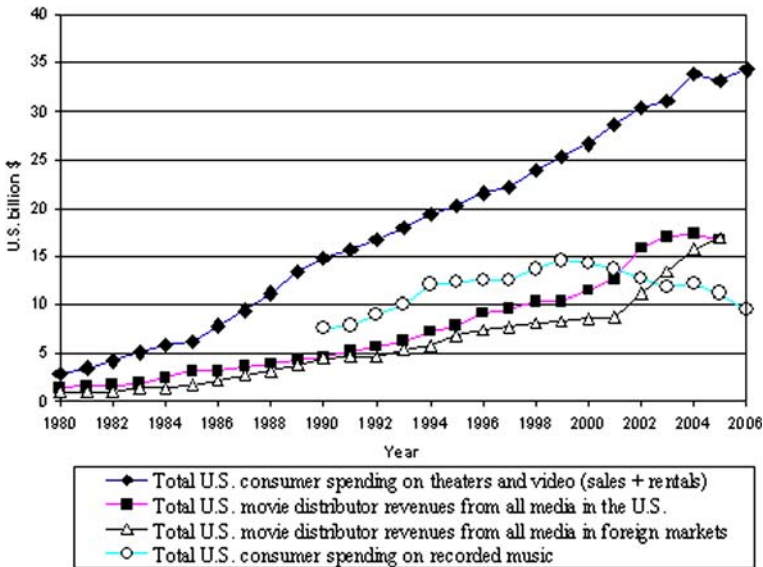
<sup>5</sup> International Intellectual Property Alliance (2007), Appendix B: Methodology.

<sup>6</sup> The MPAA has made piracy harm estimates since at least the 1980s, but there is no information about methodology prior to the 2005 study apart from a brief statement that the 2005 methodology is new (International Intellectual Property Alliance 2007, p. 3).

**Table 2** MPAA Estimated Losses to U.S. Distributors of Theatrical Feature Films from Piracy as a % of Legitimate Revenues from All Media (2005 \$ billions)

	U.S	Foreign countries	All countries
Hard goods	3.9%	13.0%	8.6%
Internet piracy	2.0 %	8.3%	5.2%
Totals	6.0%	21.2%	13.7%
<i>Base**(\$ billions)</i>	\$21.9	\$22.4	\$44.3

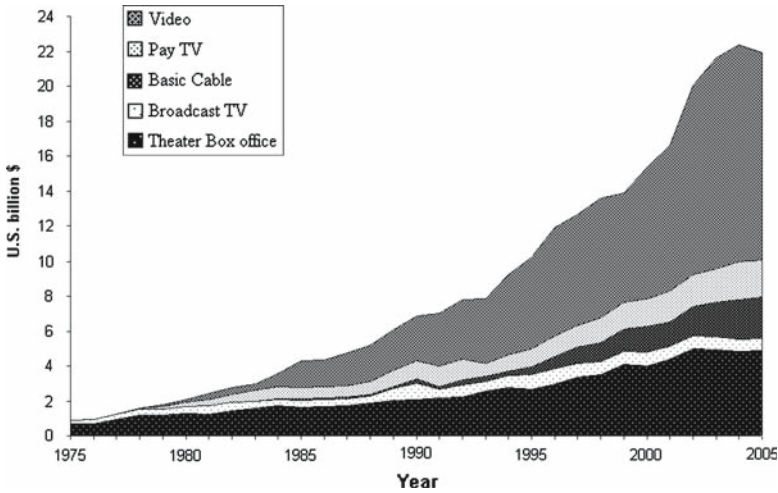
\*\* Total U.S. distributor revenues from the distribution of theatrical feature films to all media  
 Sources: Authors' calculations based on MPA & LEK (2006); Kagan Research (2006a, 2006b)



**Fig. 1** Trends in Movie Spending and Distributor Revenues, 1980–2006. Sources: Compiled from Waterman (2005a); Kagan Research (2006a, b, 2007); RIAA (n.d., 1997–2007); Hefflinger (2007)

declining music industry revenue since 1999 that has been concurrent with the advent of large scale music file sharing is not in evidence for the movie case. U.S. movie spending (and distributor revenues from it) has flattened since 2004, but that has been widely attributed to a spate of poor movies and a defection of movie consumers to video games and other electronic media. Also discouraging to the explanation that file sharing caused this decline in growth, Figure 1 shows that since the early 2000s studio revenues from all foreign distribution of theatrical features rose substantially relative to domestic revenues, while the MPAA attributes the effects of Internet file sharing to be in about the same proportion in U.S. and foreign markets.

Figure 2 shows that the proportions of studio revenues from various domestic media have greatly changed over time, beginning with the introduction of pay television and home video in the mid-1970s. The video revenue data include



**Fig. 2** U.S. Theatrical Distributor Revenue from Domestic Sources, 1975–2005. Sources: Waterman (2005a) Appendix C1; Kagan Research (2006a,b)

both rentals and sales, but the rise to dominance of video as a high value domestic revenue source has been accentuated by a strong shift toward sales. Rentals accounted for 74% of total video spending in 1986, but for only 32% in 2005. Studios also receive a much higher percentage of retail revenue from sales (about 85%) compared to that from the transactions-intensive rental business (about 25%). The most recent rise in video sales has been enhanced by the shift to the DVD format, which had less than a 1% market share of all studio video revenues in 1997, and 91% by 2005.<sup>7</sup>

None of these data, of course, imply that losses from piracy, copying and sharing of movies, legal or illegal, have not been high. They do suggest that the overall benefits to studios from the distribution to electronic media – and thus the VCR itself – have been dramatic. The movie industry has prospered; as a proportion of GDP, total domestic studio revenues from theatrical feature releases have increased from .05% in 1975 to .18% in 2005.

### C. Hardware/Software Compatibility Issues

Typically, authors of theoretical models of piracy or copying assume that content owners are free to make choices about the level of copyright enforcement. This is often not true. One fundamental aspect of electronically based distribution of intellectual property, notably movies, is that owner controls over piracy, copying, or sharing inherently require that there be some form of compatibility

<sup>7</sup> Authors' calculations in this and the following paragraph are based on Kagan Research data. The positive effects of video on foreign market revenues have been somewhat less than in the U.S.



with hardware devices, or in the case of PCs, with the computer software that plays the program.<sup>8</sup>

In movies, this general issue of hardware and software compatibility dates to videocassettes and pay TV systems in the late 1970s, but in the digital era, content control systems are generally labeled as DRM. DRM is quite technologically versatile. These systems can be used to deter or prevent copying and sharing, or to control the number of copies that can be made or shared, and to control which hardware devices can play or copy a particular movie. These systems do not work, however, unless the hardware (or computer software) recognizes and implements the content software coding.

A politically charged conflict between the content owning movie studios and exhibition hardware manufacturers and/or computer software makers has arisen.<sup>9</sup> In general, the studios desire the right of maximum control so that they can prevent or permit certain copying or sharing activity by varying DRM controls on the software at their will. Equipment manufacturers and software developers generally prefer more flexibility because the freedom to copy or share makes their products more useful to consumers. Also prominent in these DRM standard setting arenas are non-profit organizations (such as Public Knowledge and the Electronic Frontier Foundation), which oppose DRM before Congress and the FCC because they believe it will excessively limit the fair use of copy-righted products. Essentially, they attempt to use their political influence to disrupt the DRM standard setting process.

### III Economic Interpretations of Piracy and Enforcement Strategies

We turn now to sequential discussion of four categories of piracy, copying, and sharing issues in the U.S.:<sup>10</sup> hard goods commercial piracy; consumer theft of pay television signals; consumer copying and sharing of pay TV and home video movies; and Internet file sharing.

#### A. Hard Goods Commercial Piracy

Nearly all hard goods commercial piracy of movies has involved the manufacture and distribution of counterfeit videos—formerly videocassettes and now DVDs. Counterfeit videos have originated from several sources: before the theatrical release, leaks from the production process; during the theatrical release, from 35 mm prints that are stolen or “borrowed” from theaters, leaks

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<sup>8</sup> The movie hardware/software compatibility issue has interesting parallels in the music case that seem rarely mentioned in the economic literature. See Aldrich (2007) for a legal and technical history.

<sup>9</sup> These conflicts are discussed from a legal and technological perspective in Litman (2001), Williamson (2005), and Besek (2004). For economic discussion, see Park and Scotchmer (2006).

<sup>10</sup> The MPA website ([www.mpa.org](http://www.mpa.org)) has a detailed description of piracy methods. The categories used in this paper do not necessarily correspond to the MPAA's.

from the Academy Award reviewing process, and camcordings made off the screen by theater patrons; then after the video window begins, from commercial duplication of legitimate videos.

While it is possible that the availability of pirate videos has enhanced the diffusion of VHS or DVD players in the U.S., eventually leading to greater legitimate sales,<sup>11</sup> commercial video piracy is otherwise unambiguously bad for studios. The MPAA strategy has mainly focused on raising the costs of legal jeopardy to the pirates, restricting the supply of source materials to them, and restricting the supply of illegal copies to consumers, especially of higher quality products available early in the sequence. Although hard goods evidently remains more damaging than other forms of piracy or copying, and DVD technology offers new obstacles, the studios have made progress in fighting this practice in the U.S.<sup>12</sup>

In the early days of VCR diffusion, which began with the first commercially available machines in 1975 and reached 21% TV HH penetration by 1985, videocassette piracy was reportedly very widespread. Some studios would not release on video at all, although by 1979, nine of the 10 MPAA members released at least some films on cassette (Segrave 2003, p. 105).

The industry moved quickly to increase the legal risk to pirates by aggressive enforcement and by supporting changes in the legal environment. The MPAA formed a private investigation force in 1976 that has been very active in facilitating raids and supporting prosecutions. At first, for example, theater projectionists and others who stole theater prints – a major source of piracy that made relatively high quality illegal copies available early in the theatrical release – were lightly punished. On pressure from the MPAA, sentences were increased. Raids and prosecutions followed, and this source of bogus videos is apparently now rare. In 1982, much stiffer penalties were legislated for commercial video piracy, and the 1998 Digital Millennium Copyright Act (DMCA) further strengthened these penalties. In the 1990s, a number of states adopted laws increasing penalties or facilitating the trace of counterfeit video products to their original source (Verga 2004).

The MPAA actively investigated and sought prosecution of video retailers who marketed illegal copies. One source of these fake products was back-to-back copies made by video retailers, who then rented them to consumers. The MPAA's strategy in this effort involved the use of technology to reduce supply. In the 1980s, Macrovision Corp. introduced an analog encoding system for videocassettes that defeats or degrades copies. As discussed further below, that was mainly intended to prevent casual consumer copying of cassettes, but one effect was to reduce copying by the video store owners. Complaints from some store owners of suspiciously low rental prices at competing establishments also led to raids.

<sup>11</sup> The argument that piracy of copyrighted products can have such positive effects due to network effects is developed in other contexts by Liebowitz (1985), Hui and Png (2003), and others.

<sup>12</sup> Segrave (2003, ch. 5) chronicles much of the history in the following three paragraphs; see also sources cited in Waterman (2005a, ch. 4).

A related factor working against commercial video piracy has probably been trends in retailing. In early years, nearly all video stores were Mom and Pop operations; but by the mid-1990s, chains of publicly owned corporations such as Blockbuster and Hollywood Video had come to account for the majority of video rental transactions (VSDA 2000). As the importance of video sales grew in the 1990s, that trade came to be dominated by large discount chains like Target and Wal-Mart. A likely result of this greater transparency in retailing is to bring higher value, unsuspecting video renters or buyers back into the market, and concentrate the illegal trade to street corner markets, which presumably tend to attract lower value consumers.

Loss reports of the MPAA suggest a decline in video piracy over time, at least in the cassette case. One report attributed a claim to the MPAA of 1987 losses from video piracy in the U.S. of \$200-\$300 million (Belkin 1987), which amounted to about 10–15% of legitimate video revenues to the studios for that year.<sup>13</sup> The MPAA's financial loss claims remained in the same range until at least 2001, during which time total studio income from video release approximately quadrupled, suggesting a decline in the relative importance of video hard goods piracy over this period. By 2001, DVDs accounted for 34% of the video market. The only available evidence about the more recent impact of DVD piracy in the U.S. is the MPAA's 2005 estimates, indicating that losses from all video piracy amounted to approximately 7% of legitimate video revenues.

To confront commercial hard goods DVD pirates, the studios have used strategies comparable to those for VHS. On the supply side, they have moved to plug new supply sources, notably pre-theatrical release leaks from the production process and from the Academy Awards review process, with some apparent success. Raids of illegal DVD production or sales operations are frequently reported by the MPAA; stronger laws, especially the DMCA, have worked to the studios' advantage in these efforts. A continuing trend toward chain ownership of video sale and rental retailing has probably aided enforcement during the video window.

The challenge of fighting commercial hard goods piracy of DVDs is greater in important respects. The units are smaller, and duplication cheaper and more efficient. And as commonly noted, digital copies generally do not degrade in technical quality. While the net effects of digital technology on hard goods piracy may well be negative, some features of DVD technology work against commercial pirates. The use of digital "watermarks" or "fingerprints" on legitimate or working pre-release DVDs and on film prints themselves allow illegal copies to be traced to their specific original sources. While these technologies are still developing, they have reportedly aided some prosecution efforts.

<sup>13</sup> Percentage losses in this paragraph are authors' calculations based on Kagan Research (2002, 2005, 2006b) and MPA and LEK (2006).

Another limiting factor is that DVDs are relatively inexpensive, reducing commercial piracy incentives. Until the end of the 1990s, the great majority of videocassettes were priced for the rental market at wholesale levels ranging from \$60 to \$100 or more. One report indicated a \$10 retail street price for bogus cassettes in 1997–98 (Segrave 2003, p. 134). Since the late 1990s, DVDs have had uniform wholesale prices aimed mainly at the sales market, usually from \$10 to \$20, with most retail prices in the \$15 to \$25 range.

Because DVDs are a higher quality product than are VHS cassettes, their undermining effect on legitimate movie markets is potentially greater. It is not necessarily the case, as is usually assumed, however, that the quality of illegal DVDs matches that of legitimate DVDs. The MPAA reports that over 90% of “initially released pirated films” worldwide originate from in-theater camcording (MPA 2005, p. 1). Although these products are available before the video release, and thus may appeal to higher value movie consumers, they are generally of lower technical quality than VHS, tending to preserve quality segmentation in the legitimate market.

## **B. Consumer Theft of Pay Television**

Theatrical features account for the great majority of monthly subscription premium network viewing, and probably for the majority of PPV and VOD exhibition. Movies also account for about a quarter of all viewing of basic cable television network programming (e.g., on TNT and USA), which is relevant to our analysis because access to these networks requires a monthly subscription fee from subscribers. All of these pay TV services are available on local cable systems and via digital broadcast satellite (DBS).

Since at least the 1980s, the MPAA, along with cable and other multi-channel operators, has actively lobbied for stronger law to raise consumers’ costs of pirating pay TV. Studios have apparently encountered obstacles in stopping this practice, however, because multi-channel operators basically control enforcement and they have weaker economic incentives for enforcement. Available information suggests that in the end, pay TV piracy has substantially diminished due to cost-effective digital technology that multi-channel operators have integrated into their distribution systems, as well as stronger anti-piracy laws.

### **1. Historical Development**

After HBO and several other channels launched in the mid-to late 1970s, growth was rapid, but piracy was widely reported to be rampant.<sup>14</sup> In the legal arena, the MPAA supported stronger penalties for unauthorized reception of subscription pay TV signals. These were mild before 1980; in fact, the practice was not even clearly illegal. “Black boxes” that permitted basic subscribers to receive

<sup>14</sup> Among a number of press reports, see Taylor and Bock (1983).

the signals were openly advertised. Amendments to the 1934 Communications Act, followed by the 1984 Cable Act, specifically declared unauthorized cable and satellite reception to be illegal, and penalties were greatly increased.<sup>15</sup> The 1984 Act also made illegal the manufacture or alteration of decoder boxes for the purpose of stealing pay TV signals via cable or other wireless systems. These laws were further strengthened in 1998 by the DMCA, which increased penalties for making or selling black boxes and other circumvention equipment.<sup>16</sup>

On the technology front, HBO and other operators began encrypting their satellite signals in the early 1980s, and cable systems began converting to “addressable” technology that controls legitimate pay network access electronically from the headend, rather than by easily-removed mechanical traps on home premises. Addressable systems in conjunction with digital technology can also support “electronic bullets” to catch PPV pirates red-handed by identifying which consumers watching an exhibition are doing so illegally. In other cases, electronic bullets have been used to directly disable illegal boxes. These techniques for detecting illegal black boxes have steadily improved over time, making enforcement efforts more cost effective. Also, since the first services were offered in the mid-1990s, nearly all cable systems have upgraded to offer digital tiers, which are more difficult to steal. Many cable operators have now moved monthly subscription services to those tiers.

As late as 1999, based on a survey of its membership, the National Cable Television Association (NCTA) estimated that approximately 9.5% of homes passed (that is, all homes that have cable service available) were receiving premium networks illegally, and 11.5% were receiving basic service illegally; these findings were similar to those in a prior 1992 study (NCTA 1992). Then based on a 2004 survey it sponsored, the NCTA reported that the basic theft rate (of “analog expanded basic service”) had declined to 4.65%, and the analog based premium channel theft rate declined to 2.15% (Frank N. Magid Associates 2005). Digital tier service theft rates, on which nearly all PPV and VOD programming, as well as a number of premium services, are included, were reported to be less than 1%. In 2006, the NCTA officially disbanded its Office of Cable Signal Theft (a joint venture with the MPAA) and returned responsibility for fighting piracy to individual firms at the system level.

More sketchy data are available for DBS piracy, an all-digital service that has typically been pirated with hacked “smart cards” that subscribers use to access the programming. In one study, the Carmel Group estimated DBS pirates to be an average of 3.7% of legitimate subscribers over the 2000 to 2002 period.<sup>17</sup> Press reports suggest reduction in DBS piracy over time.<sup>18</sup>

<sup>15</sup> For a detailed survey of legal developments, see Gillespie et al. (1995). See also U.S. Congress (1991)

<sup>16</sup> See Title I, 17 U.S.C. §1201 (1999).

<sup>17</sup> Authors’ calculations for 2000-2002 based on Screen Digest (April 2003, p. 124). Some press reports claimed higher levels of DBS piracy in the early 2000s: e.g., Keough (2001) and Lieberman (2002).

<sup>18</sup> Davis (2005), for example, suggests recent declines due to smart card upgrades.

## 2. Obstacles to Enforcement: Asymmetric Incentives of Cable Operators

Although both the MPAA and the NCTA actively lobbied for strengthening of the legal framework that permits anti-piracy enforcement, it is the cable operators, as retailers with direct access to subscribers, that control the level of copyright enforcement. A variety of trade and general press reports suggest that at least in the past, cable operators were relatively lax in enforcement against premium channel theft.<sup>19</sup> In general, piracy enforcement is costly, and as cable industry reports have made explicit, that enforcement can only be expected to happen on a cost-effectiveness basis.<sup>20</sup>

A principal technology for discovering cable pirates is “tap audits,” which are labor intensive house-to-house efforts to compare records of legitimate subscribers against longer lists of households that the operator determines to be actually receiving the service. Sending electronic signals to detect pirates also requires use of the cable system’s hardware and software, as well as subscriber lists—resources that the operators presumably do not want to cede control of.

Under these circumstances, we can identify three reasons why cable operators may be less aggressive than the studio copyright owners would like. The first is interdependent demand in the release sequence. For subscription pay channels, that is probably of minor importance due to their one-year-plus position. For PPV/VOD, which currently occurs 30–45 days after video release for most movies, higher value demands are involved. Cable operators do not suffer directly, for example, if PPV theft reduces video sales.

A second factor is peculiar to electronically distributed intellectual property. A la carte movies or monthly subscription pay networks are sold at the retail level on a contingency basis. Contracts typically call for the programming network to receive some share of the retail price; the movie studios in turn receive a contingency payment depending on the number of actual subscribers. Unlike most retail goods, the pay network subscription does not exist until it is actually transmitted to the subscriber; if that transmission is an illegal one, neither the pay network nor the copyright holder receives anything. The cable operator therefore has an incentive only to invest economic resources in piracy enforcement up to the point that its marginal cost of the enforcement is equal to the marginal return from prevention – which is necessarily much less than the total net value added of the subscription.

A third source of asymmetric enforcement incentives is that cable operators might benefit from premium channel piracy as a price discrimination device. Legitimate basic cable subscribers who receive premium services illegally receive greater value from their basic subscriptions, and are less likely to disconnect or switch to other multi-channel services. For lax enforcement to be a profitable strategy for cable operators, however, the high and low value cable subscriber segments must be separated. If it is assumed that low value consumers

<sup>19</sup> For a series of press reports, see Waterman (2005b).

<sup>20</sup> See, for example, NCTA (1996b).

who are willing to buy basic but not premium service also perceive relatively low costs of pirating the premium service, then this form of price discrimination may be profitable.<sup>21</sup> Obviously in this case, however, such discrimination would be at the expense of studios.

These asymmetric incentives may explain the joint venture arrangement undertaken between the MPAA and the NCTA in the Office of Cable Signal Theft. Another anti-piracy organization, the Broadband and Internet Security Task Force (BISTF), was funded by a consortium of cable networks (which include movie studio owners), cable operators, and other corporate interests. Though apparently now disbanded as well, the BISTF collected complaints and published case studies of cable enforcement efforts.<sup>22</sup> Moral hazard issues probably remain in such joint ventures; if copyright owners reward cable operators based on their success in finding pirates, they risk tolerance or encouragement of piracy so that it may then be stopped.

To enforce against piracy, cable operators have often conducted “amnesty” campaigns, in which they offer “unauthorized” subscribers the opportunity to convert to paying customers without penalty. Multi-channel operators have more recently turned to strategies of demanding restitution payments up front from those caught red-handed. U.S. law permits private parties to sue pirates through the court system. Cable interests have also lobbied state legislators, with some success, to enact tougher piracy laws, including the right to seek restitution. Under these laws, cable or DBS operators can simply threaten the pirate with litigation through a letter, for example, in order to reach an out-of-court settlement. Press reports have indicated that some restitution demands by cable operators have been substantial, leading in one case to payments in the \$1,500 to \$3,000 range.<sup>23</sup> Consumer knowledge of restitution demands at these levels can obviously discourage pay TV piracy, although these procedures raise questions of economic efficiency.<sup>24</sup>

<sup>21</sup> For a model, see Waterman (2005b)

<sup>22</sup> <http://www.broadbandsecurity.bigstep.com/>, accessed October 28, 2003. This site is no longer in existence.

<sup>23</sup> Berkowitz (2002) reports that Cablevision, a major cable operator, identified 5,000 households that it alleged were illegally receiving premium cable service, and that 2,000 households among them paid between \$1,500 and \$3,000 each in response to a letter demanding such payments as an alternative to court prosecution. In one industry case study, Time Warner of South Carolina claimed that it collected \$377,000 in settlements from 357 illegal pay cable receivers that it confronted with the alternative of prosecution. <http://www.broadbandsecurity.bigstep.com/>, accessed October 28, 2003 (available from the authors). See also Mook (2007, May 28) and C&R Research (2004).

<sup>24</sup> Section 553 of the U.S. code specifies that restitution payments can be up to the estimated losses of the cable operator due to the piracy event: § 553(c)(3)(A)(i). It is unclear how those amounts are determined. Ideally, such an estimate would be the marginal, rather than the average value of a cable subscriber, and would be reduced by a factor accounting for an estimated proportion of low value subscribers who would not otherwise purchase the service. Further, efficiency suggests that the proceeds should be shared with the copyright holders upstream.

### 3. Losses to Movie Studios

Although the rates of cable piracy reported in the 2004 NCTA study are much reduced, the actual losses to studios (and cable operators) are mitigated by the proportion of low value cable pirates who would otherwise not subscribe. Case studies of amnesty campaigns conducted by cable operators in the 1990s provide natural experiments that suggest a majority of cable thieves are in that category. In one industry study of amnesty campaign effectiveness, for example, a series of seven annual tap audits by Time-Warner Syracuse over the 1995–2001 period resulted overall in a 26.7% “conversion rate” of unauthorized basic service users to paying subscribers ([Time Warner Cable 2003](#)). Various press and industry reports indicate typical illegal-to-legal basic cable conversion rates in the 25 to 40% range.<sup>25</sup> Separate conversion rates for premium services were not available, but if they are similar to those of basic subscriber conversion, the reported amnesty studies suggest that many of those who steal premium movie services would otherwise not have purchased them.

It is notable that temporary tolerance of cable TV piracy may also benefit both cable operators and copyright owners by serving as a marketing device. Typically, tap audits are conducted periodically at discrete intervals (e.g., several months or years), rather than continuously. Illegal subscribers thus accumulate during the intervals, and after the audit, the offer to become a legitimate subscriber is made. This procedure might be interpreted as a market penetration strategy in which cable or DBS operators offer basic service, or offer certain premium networks to basic subscribers, at no charge for the first one or two months before payment is demanded. Revenue from some high value consumers who perceive low costs of theft is inevitably lost, and cable operators have marketing alternatives, such as introductory free offers, over which they may have better control. Such tolerance of piracy may, however, be an example of a “sampling effect,” by which copyright holders can potentially profit from piracy.<sup>26</sup>

Another factor in determining actual pay TV piracy losses to studios—media placement in the release sequence—is much more difficult to quantify. The lapse of 30 to 45 days after video release before PPV release, which was formerly up to 90 days, has been attributed to widespread PPV piracy, presumably reducing video sales and rentals. (e.g., [Umstead 1993](#)). We consider PPV media placement further in discussing the copying and sharing of pay TV programs.

### C. Consumers Copying and Sharing of Video and Pay TV Movies

The studios have confronted these related problems with an array of legal, economic, and technological devices.

<sup>25</sup> See especially [Television Digest \(2001\)](#); [NCTA \(1996a,b\)](#).

<sup>26</sup> For discussion, see [Klein et al. \(2002\)](#), [Liebowitz \(2006b\)](#), [Peitz and Waelbroek \(2006b\)](#), and [Gopal et al. \(2006\)](#).



## 1. Duplication of Prerecorded Videos

DVD duplication can be accomplished with a standalone DVD burner or with a DVD-RW drive on a personal computer. DVDs can also be copied to VHS, or vice versa, with a DVD-VHS recorder. The precursor to these activities, though surely disappearing with the demise of the format, is back-to-back (B2B) copying of VHS tapes with two VCRs in tandem or with a dual deck VCR. Any duplication of copyrighted prerecorded movies by consumers using these or other means is specifically illegal.

Because home video is a large, high value market positioned near another important high value market, theater release, copying of videos has been of central concern to copyright holders. The studios have mostly attempted to raise consumer costs of copying by legal enforcement, public information campaigns, and support of anti-copying technology. Parallel to the hard goods commercial piracy case, digital technologies have raised the stakes but also provided new enforcement opportunities and the long term potential to enhance price discrimination via DRM.

Although the MPAA includes consumer video duplication and sharing in its claim of industry losses from hard goods piracy, it seems certain that the commercial component is the greater part of that. There is little other current data, but the industry's experience with at least VHS copying and sharing suggests that the extent of those consumer activities remained at relatively minor levels until the VHS format's demise in the mid-2000s.

### a. Back-to-back Videocassette Copying

It is well known that individuals may under-report in surveys the extent to which they are involved in an illegal activity. A series of VCR owner surveys about B2B copying in the U.S. conducted between 1989 and 1999 offer, however, a general picture of its distribution and effects within the video user population. An Office of Technology Assessment (OTA) national survey of about 1,500 adults over 10 years of age conducted in 1989 mainly covered music but had a series of questions about video use (U.S. OTA 1989). Four generally comparable telephone surveys of approximately 1,000 individual VCR owners over the age of 15, sponsored by Macrovision Corp., were conducted at three-year intervals between 1990 and 1999.<sup>27</sup>

One consistent pattern in these surveys is that a relatively small percentage of VCR owners were indicated to be responsible for all copying (the great majority of which was of theatrical movies). In the OTA survey, conducted

<sup>27</sup> Macrovision (1990, 1993, 1996b, 2000). As a seller of anti-copy protection devices for video and pay TV, Macrovision generally has an economic incentive to present problems video copying as severe, and to indicate that back-to-back video copying of videocassettes or DVDs not protected by Macrovision's anti-copy technology is high. Macrovision's objectives, however, were to influence movie studio decision-making, and it used a relatively sophisticated and transparent telephone survey methodology. These studies or their executive summaries were obtained from Macrovision and are available from the authors. In addition, a recent trade press article reports some limited data from comparable surveys conducted by Macrovision during 2002 (Frankel 2003).

when VCR HH penetration in the U.S. was about 70%, reported that 3.9% of owners had successfully made copies of prerecorded videos in the past year. The four Macrovision surveys reported that between 3.5% (in 1999) and 6.6% (in 1990) of VCR owners successfully copied prerecorded cassettes during the past year.

A second feature of the survey results was that the copiers affected a substantially wider range of individuals through sharing activity both before and after the fact. In the OTA survey, 70% of the copiers reported that they made them for their own use. But 42% of all originals had been obtained from friends, versus only 23% from stores.<sup>28</sup> The Macrovision studies having comparable data suggest a similar pattern. In the 1993 and 1996 surveys, 41% and 42%, respectively, said they had been “involved” during the past year either by making, receiving, or providing prerecorded copies. Between 32% and 41% said that they had copies of prerecording videos in their collections. The 1993 survey also found that 17.6% of respondents – compared to 6.5% who made copies – said that others had made copies for them. Thus, the relatively small proportion of copiers within the population had a disproportionate effect on copy availability and use.

In spite of this wider distribution of copies beyond the copiers themselves, studio losses due to the reported levels of videocassette copying and sharing appear to be relatively minor. After accounting for estimated proportions of the copiers who would otherwise have dropped out of the market, the Macrovision reports made estimates of displaced retail sales and rentals due to B2B video copying that amounted to between 1% and 3% of total legitimate retail video sales and rentals for the relevant years.<sup>29</sup>

Although the magnitudes would not seem to be great, at least some appropriation of the value of copies by sellers may also have been possible in the cassette rental market. Those who copy videos for themselves are willing to pay higher prices for originals, and those who make copies to distribute to others presumably receive some value from doing so. It has been pointed out that if such individuals are a sufficiently small minority of total consumers, then content owners cannot raise prices because they are unable to price discriminate; that is, too many non-copiers drop out of the market (Liebowitz 1985; Liebowitz 2006b). The Macrovision surveys of videocassette use do in fact indicate a relatively narrow group of active copiers. However, while the inframarginal consumers must indeed represent a sacrifice to the seller, the possibility of making copies or supplying an original to someone for that purpose can be considered as a product attribute like any other (for example, a safety feature on a car), which some consumers may appreciate and others not. To that extent, the ability to copy thus shifts the demand curve outward, and brings new marginal consumers into the market. While some outward demand shift thus seems reasonable, the direction of optimal prices in the presence of

<sup>28</sup> U.S. Office of Technology Assessment (1989, p. 162).

<sup>29</sup> Authors' calculations based on Kagan Research estimates of total retail video rentals and sales.

copying is nevertheless not determinant. Consumer copies also compete with legitimate “originals” for high value demand, which can induce the owner to reduce prices to maintain intertemporal or quality segmentation (Harbaugh and Khemka 2001; Johnson and Waldman 2005; Takeyama 1997).

One reason for the limited effect of B2B cassette copying may just be low demand due to the time and trouble of hooking up two VCRs, or the technical quality of copied videos, which somewhat degrade when copied. More than half of U.S. TV households owned multiple VCRs by 1999, but according to the Macrovision survey (2000), only 11% said they had connected their machines to enable video copying. Dual deck machines also became available in the late 1980s, but they never reached significant penetration.

Studio attempts to raise the cost of B2B copying probably contributed to low demand. The MPAA’s public information campaign, led by the familiar “FBI” warnings at the front of every pre-recorded movie, have continuously reminded viewers that it is illegal to copy them. A more substantive constraint on VHS duplication by consumers was copy control technology. The MPAA, along with some other private firms, played an active role in promoting compatible copy control standards for VCRs. In 1985, Macrovision Corp. introduced its first generation anti-copy system, which prevented or degraded video copies by interfering with the automatic gain control mechanism of VCRs (Harmetz 1985). Macrovision’s technology improved over time and in its evolved form (called “color striping”) became the de facto industry standard. This system could be easily defeated by technically savvy consumers, however, and some VCRs, along with other standalone devices, were manufactured to circumvent it. The MPAA also opposed the importation of dual deck VCRs into the U.S. until it obtained an agreement in 1988 from Go-Video, a small electronics firm that had patented such a system, that it conform to the Macrovision anti-copy system (The Record, 1989, March 12; Coco 1990).

The effectiveness of the Macrovision system was also limited because the studios, which were charged a royalty of a few cents per prerecorded unit by Macrovision, only chose to encode some movies. Eight years after it introduced its technology, Macrovision Corp (1993) reported that 40% of all video products and “over 50%” of theatrical film units in the market were copy protected. In spite of its limitations, anti-copy devices on videos appear to have reduced copying activity to some extent before the DMCA took effect. In the Macrovision surveys, roughly half as many people who successfully copied, reported failed attempts to do so in the past year.

In the end, the MPAA abandoned the market-based standard setting process over which it had limited control, and successfully lobbied for a provision of the 1998 DMCA that specifically requires that all VCRs conform to the Macrovision anti-copying system. Modification of VCRs to defeat the system, or standalone circumvention devices, are also in violation of the DMCA. In a familiar irony of government legislation, the VHS format soon after began its precipitous decline.

## b. Consumer Duplication of DVDs

In much the same way that it raises the stakes for commercial piracy, DVD technology escalates the risk to studios of consumer copying and sharing of videos. DVDs are generally easier and quicker for consumers to copy using a wider variety of available hardware devices, notably personal computers. Also, because the technical quality of digital copies can be indistinguishable from the original, quality segmentation tends to break down (Gayer and Shy 2005). Also parallel to the hard goods case, however, quality segmentation is not eliminated; a lack of packaging and the disutility of engaging in illegal activity reduce the value of the product for some subset of consumers. Digital technology also acts in favor of copy prevention in other respects. Digital anti-copy devices generally work better than do their analog counterparts, and they are more pervasive.<sup>30</sup>

From the time of the format's introduction in the mid-1990s, virtually all copyrighted DVD content has been encrypted by means of the Content Scrambling System (CSS). The DVD Copy Control Association, a consortium of entertainment and technology companies, including some movie studios, licenses the decryption code to all manufacturers of DVD capable hardware equipment, without which the prerecorded content cannot be played back. CSS also has an anti-copy component, preventing any user from duplicating an encrypted DVD. Notoriously, however, the CSS code was broken by a hacker in 1999 and published on the Internet. PC users with a DVD-RW drive can defeat CSS through readily accessible programs on the Internet, thus allowing the user to burn a copy of a CSS-encrypted DVD that will play on a standard DVD player.

Pre-recorded DVD movies can also be encoded with Macrovision anti-DVD copy protection. This system is more effective in preventing or degrading copies, and is harder to defeat than is its analog VHS counterpart. The Macrovision system has, however, handicaps that parallel, or are in some ways more formidable, than their VHS predecessor. In order to function, DVD player equipment (or in the PC case, DVD player software) must recognize the digital copy protection codes embedded in the DVD movie. Macrovision reported in 2003 that the majority of DVD player name-brands sold in the U.S. did not "properly process" the Macrovision codes, and that distributors only encoded about 75% of prerecorded DVD movie releases (Frankel 2003).

On the political front, the DMCA essentially pre-dated the commercial introduction of the DVD format, and in spite of subsequent efforts, the MPAA has been unable to persuade Congress to pass legislation mandating that all DVD player hardware or software recognize Macrovision's DVD anti-copy protection codes. Again, however, the DMCA's general provision rendering illegal the manufacture or use of hardware or software for the purpose of circumventing anti-copy devices defends against active consumer attempts to defeat Macrovision.

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<sup>30</sup> For a concise discussion of various DRM systems used for video and other movie media, see Dixon (2005).

Since the late 1990s, some members of the MPAA, along with equipment manufacturers and other industry players, have also sought to develop more sophisticated DRM systems for DVDs that allow the copyright holder to encode a disk to allow up to some particular number of copies (including no copies or unlimited copies), to be made. Potentially, such encoding can enhance a studio's ability to discriminate among consumers by pricing their products higher to copiers—thus overcoming the limits to direct and indirect appropriability that copying and sharing activity among a minority of users presents.<sup>31</sup>

Several such sophisticated DRM systems for digital copyrighted products have been proposed or developed since 1998, but the conflicting incentives of movie content owners, equipment manufacturers, software developers, and fair use advocates have led to uneven adoption and no common standard has emerged.<sup>32</sup> Secondly, new DRM systems may not work with the installed base of standalone DVD players because those players may not recognize the DRM codes. The potential of anti-copy coding for the standard DVD format thus has limited potential, and could only be realized over time for new generation copy control systems. Major developers of computer software that play DVDs have, however, adopted various digital copy control systems. Although they can be defeated, these systems can, unlike stand-alone DVD player hardware, be retroactively upgraded—as long as consumers have an Internet connection and accept the online updates.

Two high definition DVD formats, HD-DVD and Blu-Ray Disc, were introduced to the market in 2006, and so far have received little consumer acceptance. Both formats are protected by a sophisticated DRM technology called the Advanced Access Content System (AACS) that essentially serves as the next generation of CSS, while Blu-Ray Discs have an additional form of renewable protection called BD+ (Dell 2006). The AACS technology potentially allows sophisticated no-copy or limited copy controls at the will of content suppliers on a movie by movie basis. At this writing, however, final agreements on the adoption of a “managed copy” feature had apparently not been reached (Perenson 2007).

While sophisticated DRM copy control systems create interesting opportunities for movie sellers, empirical experience has raised questions about whether consumers will accept this form of price discrimination. In 1998, Circuit City introduced the DiVX format, which included a DVD player manufactured by Circuit City that would play any DVD, but DiVX software units would only play on DiVX machines. This technology integrated a DRM system that permitted “number-of-copy” controls on separate software units at the discretion of the releasing studio. DiVX, however, attracted few users, and the system was

<sup>31</sup> For a discussion of how DRM might be used for more efficient price discrimination in movie release (focusing on pay television), see Cowie and Kapur (2005).

<sup>32</sup> For discussion of these issues, see Williamson (2005), Besek (2004); Coral Consortium website from <http://www.coral-interop.org>; Digital Transmission Licensing Administrator website from <http://www.dtcp.com/>; Intel and DTCP: Intel. Protecting Premium Content and its Use in the Digital Home from [http://www.intel.com/standards/case/case\\_dtcp.htm](http://www.intel.com/standards/case/case_dtcp.htm).

abandoned by Circuit City in 1999. The format's demise has been attributed to several factors, but a prominent explanation has been that pay-per-use systems for prerecorded products, while potentially efficient for sellers, have less appeal than have flat rate subscription plans.<sup>33</sup>

In sum, there are few indications that consumer copying of DVDs has been of much more impact than the generally limited problem of B2B cassette copying. Apart from the brief DiVX experiment, the studios have to date only attempted to use DRM copy controls for DVD as a blunt instrument to stop copying altogether. While they have had limited success in doing so, they have at least built in the economic potential for more efficient price discrimination using DRM with high definition DVDs.

## 2. Consumer copying of PPV and subscription pay TV channels

Copying from pay television is easier than B2B video copying, requiring only a single VCR, or more recently, a DVD burner. Currently, copying for the purpose of time-shifting (recording for viewing at a more convenient time) from cable, DBS, or other television systems, including premium networks and PPV, is presumed legal fair use based on the 1984 "Sony Betamax" Supreme Court decision (*Sony Corp. of America v. Universal City Studios, Inc.*, 464 U.S. 417).

Because of its early position in the release sequence as an a la carte service, PPV or VOD copying is of special concern to the studios. The MPAA has devoted political and other efforts to gaining the right for studio copyright holders to use DRM to control copying of digital pay TV transmissions in the future. While these efforts have had limited success, and the long-term risks are high, the available evidence is that the effects on studio revenues of pay TV copying have to date been minor.

### a. The extent and effects of pay TV copying

As one might expect given its de facto legality and technological ease, indications are that U.S. consumer copying of PPV movies and monthly subscription channels (in the U.S.) has been much more prevalent among subscribers to those services than has been video duplication among prerecorded video users. Macrovision surveys of cable television subscribers reported that 25% of PPV users engaged in VCR taping of PPV movies during the past year in 1996, and that 34% did so in 1999 (Macrovision 1996a, 2000). No systematic information was available about copying from monthly subscription premium movie channels, but that has undoubtedly been a common event. The OTA and other surveys have shown that by far the most frequently copied type of television programming is movies. The most widely available source for commercial free films has been these subscription networks, which reached about a third of cable TV households by the early 1980s, with many subscribing to several networks.

<sup>33</sup> For one study of the DiVX experience, see Rothchild (2005).

No estimates of financial impact were offered in the Macrovision surveys, but they appear—at least to date—to have been small. First, the contributions of PPV and VOD to movie distributor revenues have been very low relative to their main a la carte substitute, video rentals and sales (Table 1). Consequently, even though copying has been relatively widespread among PPV users, the direct negative effects of copying on distributor revenues could not have been very great.<sup>34</sup> Second, the larger fraction of subscribers who copy PPV also suggests that the ability of PPV sellers to appropriate value from copiers may be greater than in the video case. An even larger percentage of respondents (61%), in fact, reported in the 1999 Macrovision survey that they valued the ability to copy PPV programs. Although a pattern of sharing PPV copies with potential video users surely has taken place (there was no direct information about sharing in these studies), the Macrovision surveys suggest that copying activity was mostly for personal use, including a large amount of time shifting.<sup>35</sup> As discussed below, cable television operators have opposed FCC or legislative adoption of any copy control mechanisms on PPV or VOD programming, a suggestion that they believe copying enhances demand for those services.<sup>36</sup>

On net, it seems very likely that movie distributors have lost revenue due to PPV copying because of video or possibly theater demand substitution. The most interesting possibility is that the full impact of PPV copying on movie studios could be much greater than the direct effects because the propensity for PPV copying (as well as piracy) has induced them to maintain the PPV window well after the video sales/rental window, thus limiting demand for PPV services.

While PPV copying and piracy has undoubtedly been a factor in these studio window decisions, a variety of evidence suggests that the effects of PPV copying have been minor to date. Consumer demand for PPV or VOD services via cable and multi-channel services has long fallen below expectations, and many have blamed clumsy technology and inadequate movie selection. Others have cited a consumer preference for bundled pricing offered by monthly subscription channels.<sup>37</sup> Finally, there have been hints of studio ambivalence to implementing PPV copy protection so far. Since the late 1990s, the great majority of legitimate set top boxes that cable subscribers use to order and decode PPV programs have been equipped with Macrovision digital copy protection technology, which is reportedly difficult to defeat, giving the studios a potentially high degree of control over PPV copying, especially in light of the DMCA's ban on circumvention devices. Reportedly as of at least 2003, however, no cable or DBS operators in the U.S. had enabled the Macrovision anti-copy encoding on

<sup>34</sup> The 1999 Macrovision survey (2000) stated that respondents who reported at least some copying copied an average of 7.5 movies. Based on an estimate in the study of the total number of PPV purchases in that year, about 15% of the purchases were taped.

<sup>35</sup> Forty five percent said that they generally recorded for temporary time-shifting purposes. Over half of those who taped (55%) reported that they never erased tapes or that they keep them until they “get tired on them.” (p. 13).

<sup>36</sup> See Umstead (1996).

<sup>37</sup> See Waterman (2005a, pp. 74–77) for a more detailed discussion.

the set top boxes, apparently due to a standoff between the studios and some large cable operators, who want a commitment that the PPV window will be moved forward in exchange for enabling the black boxes.<sup>38</sup>

With respect to subscription channels, significant negative effects of copying seem unlikely. In the 1980s, for example, some networks promoted copying in their advertising as a reason to subscribe, suggesting that it enhances demand.<sup>39</sup> Negative revenue effects of subscription network copying on studios would in any case seem minor due to their late position in the release sequence.

### **b. DRM and the Future of Pay Television Copying**

Many observers are optimistic about the long-term future of a la carte movie services, especially VOD. Again, digital technology raises the stakes, and the advent of HDTV enhances the risks.

In anticipation of future conditions that would make a PPV/VOD window coincident with, or in advance of home video profitable, the movie studios have since the mid-1990s, along with their DVD copy protection initiatives, actively pursued the development of DRM copy control technologies for multi-channel television systems and the legal authority to implement them. Although their success has been limited, the copy control model that they have pursued reflects the broader incentive that the studios have to preserve, and potentially to enhance, their inter-temporal price discrimination model by selective prevention or harnessing of home copying and sharing activity.

In 1996, the MPAA promoted the Digital Video Recording Act (DVRA), a bill in Congress that would have required consumer hardware sold in the U.S. to prohibit (at the discretion of the copyright holder) any copies of a digitally pre-recorded video or a digitally transmitted PPV program, to allow at minimum a single copy of a premium channel program, and to allow unlimited copies of broadcast or basic cable exhibitions. That bill died in Congress, and it was reported in 2001 that the MPAA was pursuing private efforts to induce five major equipment manufacturers (known as the “5C”) to incorporate technology in their hardware that would have these same anti-copy protocols.<sup>40</sup> That effort was unsuccessful, but the MPAA later renewed lobbying for legislation that would legally force all equipment manufacturers to include similar copy protection for all digital TV transmissions. That effort has also failed, but similar initiatives at the FCC were more fruitful. In 2003, the FCC adopted “Plug & Play Rules,” which primarily establish technical requirements for multi-channel consumer home premises equipment that are intended to facilitate the DTV transition (FCC 2003).<sup>41</sup> Those rules also specify ground rules for DRM by classifying certain multi-channel delivered digital TV transmissions according to whether consumers can copy them, and if so, how many times. At the

<sup>38</sup> Macrovision (2000); Harmon (2003).

<sup>39</sup> See Gendel (1986, March 12, p. 1). The demand for copying has probably declined with the rise of SVOD, which allows monthly subscribers to time shift subscription movies electronically.

<sup>40</sup> Healey (2001); Intel (n.d.).

<sup>41</sup> See FCC (2003).



discretion of copyright holders, the Plug & Play Rules mandate that copying of VOD or PPV content can be prohibited and that subscription pay TV transmissions can be restricted to only one copy in the most stringent condition, while basic cable and broadcast programming that is re-transmitted by multi-channel operators must be copy-protection free.

The MPAA proposals that have evolved into the Plug & Play Rules appear to make reasonable economic sense for the studios to enhance the efficiency of price discrimination within the release sequence. Any copies made from PPV, VOD or DVD, especially if the former window is moved up, would tend to appeal to the higher value viewers, thus undermining the sequence. It is reasonable to expect, though, that allowing a single copy of a subscription pay TV movie would increase the subscription's value to the buyer by more than it undermines other demands. Allowing unlimited copies of commercial-ridden basic cable or broadcast networks, while not ostensibly in the interest of the MPAA, would appear to be at most a low cost political concession to fair use advocates.

As adopted, the FCC's Plug & Play Rules codify essentially the same tiered copy-permission system that the MPAA advocated in the DVRA.<sup>42</sup> The Rules have been challenged, notably the PPV/VOD no-copy restriction, and multi-channel operators along with non-profit copyright fair use advocates have adamantly opposed them. There has reportedly been little adoption to date of the Plug & Play technology by consumers or cable operators.<sup>43</sup> Given the political environment, the studios' hold on pay TV copy protection remains tenuous.

We return to the DRM standards issue in our analysis of Internet file sharing to follow.

#### **D. Internet File Sharing**

File sharing of movies, music, or other copyrighted products can take place by means of a centralized server or by means of a decentralized system in which users have in common only a file-sharing software program. In either case, some individual users post digital files that other users may access anonymously. The file transfer itself takes place directly from one personal computer to another via the Internet. In all cases, these actions are illegal if they involve copyrighted products without the owner's permission, which, in the case of significant theatrical movies, is not granted.

File sharing is potentially very damaging to the studios because the repeated transfer of digital video files generally does not degrade their technical quality and because the cost to computer users of sharing and downloading movie files is potentially very low. The Internet also facilitates hard goods commercial

<sup>42</sup> Motavalli (2004) In particular, the MPAA has unsuccessfully lobbied for "copy-never" status for PPV, SVOD, and VOD services.

<sup>43</sup> "CableCard" technology was created to satisfy the Plug & Play Rules, but as of 2005, CableCards were in use by fewer than 3% of cable subscribers. Letter from Julie M. Kearney, Consumer Electronics Ass'n to FCC Secretary (March 14, 2005); Consumer Electronics Assn (2006, Jan. 20); See also Shim (2003), Kharif (2004), and FCC (2007).

piracy, notably by means of fast and cheap transfer of pirated files to locations where they can be commercially duplicated and sold.

### 1. The Effects of Movie File Sharing

There is limited data to assess the effects of peer-to-peer movie file sharing to date.<sup>44</sup> Three studies were available to us. Using a convenience sample of University of Pennsylvania students in 2004, [Rob and Waldfogel \(2006b\)](#) found that although relatively few individuals had participated in movie file sharing, the displacement effect in terms of legitimate video use was relatively high among that group. A 2005 online survey of French students ([Bounie et al. 2006](#)) reported substantial displacement effects of movie file sharing on video rentals and sales, but no effects on theater consumption. In the third paper, [De Vany and Walls \(2007\)](#) report that Internet downloading of one recent theatrical film release significantly diminished its theater box-office revenue path. Although the effects of file sharing are in an emerging period, these studies are foreboding to the industry.

As widely noted, movie data files are far larger than music files, even when digitally compressed to facilitate transfer, resulting in typical download times of 20 minutes to an hour or more on the fastest home premises broadband connections of the mid-2000s. Research conducted in the early 2000s indicated that successfully shared files were regarded by their users in the majority of cases as “DVD quality,” but the process often failed to work, or resulted in poor quality outputs ([Byers et al. 2004](#)). Just as widely noted, however, these constraints seem likely to fall away as broadband connections diffuse and improve, along with the forward march of other computer and network technology.

### 2. The Future of Illegal File sharing; Studio Strategies and Lessons from the Past

To combat Internet file sharing, the MPAA and individual movie studios have attempted to preserve their business model of inter-temporal and quality segmentation by following the same basic strategies that they have used in the past to confront piracy, copying, and sharing of movies. They have mainly pursued this objective by attempting to raise the cost to consumers of file sharing, and also by attempting to reduce the quality or value of shared files.

Among specific steps, the studios have attempted to increase search costs by reducing the supply of illegal files that can be shared. For example, they have moved to plug leaks of unprotected DVDs from the pre-production process, which tend to be especially damaging because those leaks can occur well in advance of theater release. Also in attempt to reduce supply, the MPAA has increased the policing of camcorder use in theaters, clearly a major source of shared movie files worldwide. In addition, to increase perceptions of risk

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<sup>44</sup> For a discussion of the general difficulties of assessing the effects of file sharing due to poor data in the music case, see [Liebowitz \(2006a,b\)](#).

and stigma, the MPAA has launched a public awareness campaign about the illegality of file sharing; and, following the example of record publishing companies, they have filed suit against a number of individuals whom they believe to be engaging in a high level of illegal file sharing activity. In the technology arena, the industry has helped to develop and employ watermarking and fingerprinting technologies that allow the tracing of a seized illegal movie to its original source. Finally, the studios have themselves posted empty or corrupted movie files to the Internet in an attempt to reduce demand for shared files.

In comparison to their past efforts with other media, the challenges to the studios of Internet file sharing are notoriously greater in several respects. First, while studios have clearly made progress in limiting supply by plugging leaks, they cannot all be prevented. With physical piracy, copying, or sharing, product availability is proportional to supply. Restricting supply for file sharing is much more difficult because the cost structure of the Internet makes even a small number of files effectively ubiquitous to all who search for them.

Another factor is that the absence of technical quality degradation even after repeated transfers raises the attractiveness of shared files to higher value users, certainly in comparison to analog media. So far, the high time cost and significant failure rate of movie file sharing has presumably provided a natural form of market segmentation—as long as a typically made assumption that higher willingness-to-pay movie consumers tend to have a relatively high valuation of their time – holds true. As downloading of movies becomes faster and more efficient, this element of segmentation will, other things equal, tend to break down, bringing a higher proportion of high value consumers into the illegal market.

A third factor working against the industry is that studio appropriation of value from consumers who benefit from copying or sharing activity seems to disappear in Internet file sharing, where anonymity makes feelings of obligation to copyright holders by those who post files unlikely.<sup>45</sup>

It further seems unlikely that consumers have much if any more compunction about pirating a movie file than they have demonstrated for music sharing. Much like music, the age group reported to engage most intensively in movie file sharing is said to be 16–24 years of age (MPA and LEK 2006), the same demographic group that is responsible for most theatrical admissions, and undoubtedly for a high percentage of video movie rentals and sales.

Some other compensating effects, or studio strategies, to combat music or software piracy, copying, and sharing seem to have limited value for the movie file sharing case. Theoretical research, with suggestive empirical support at least in the case of music, has indicated that consumer sampling of file shared music or the use of pirated computer software may benefit copyright owners because of network effects.<sup>46</sup> These possibilities seem weaker in the case of movies than for either music or software. Movies are generally seen only once, and the

<sup>45</sup> Liebowitz (2006b) makes this point in the music file sharing case.

<sup>46</sup> Notable among theoretical papers oriented to the software case are Takeyama (1994), Conner and Rumelt (1991), and King and Lampe (2003); for the music case: Peitz and Waelbroek (2000b)

studios regularly use other means to spread word-of-mouth that they can better control, including the advance release of clips from the movie or of deleted scenes to sharing sites such as YouTube.

As noted above, studios could also limit effects of Internet and other piracy by shortening the movie release sequence. The release sequence has generally compressed in the U.S. during the past several years, including a decline in the average video window from about five months to four months or less since 2000. It seems unlikely, however, that changes of this magnitude would have much, if any, limiting effect on piracy's impacts, since pirates are still left with months to work. The powerful incentive to preserve inter-temporal segmentation for the legitimate market would appear to trump piracy prevention strategies under these circumstances.

These various features of Internet file sharing are not encouraging to copyright holders, and experience of the recorded music industry seems an unhelpful model. Other characteristics of the Internet, however, will work in favor of the industry's efforts to preserve, or in some ways perhaps enhance its traditional business model.

First, the potential for quality segmentation of movie consumers does not entirely disappear, because like consumer-duplicated DVDs, shared files burned to rewritable DVDs have no packages, and to reduce download speeds file-shared movies are digitally compressed; these are features that presumably do not appeal to some subset of higher-value DVD or theater users. One should also be cautious in assuming that the average technical quality of illegally shared files will ever match that of DVDs or movies legally distributed on the Internet via movielink.com or other services

Second, it is evident that a large segment of the movie going-population prefers not to engage in an illegal activity, or to take legal risks. [Bhattacharjee et al. \(2006\)](#) reports that the well-publicized private lawsuit activity of the recording industry producers in the U.S. has been fairly effective in reducing music file sharing, especially among the higher volume users that are in most apparent legal jeopardy.

Third, there are technological forces working in favor of legitimate movie sales via the Internet. Beyond current bandwidth constraints, the Internet fundamentally offers a remarkably efficient mechanism for movie distribution, eliminating the cumbersome physical process of making, storing, retrieving, and returning physical videos (or transporting them among users). Cable or DBS system capacity constraints on movie variety are generally resolved by Internet architecture. Internet pricing, bundling, and billing systems, though often clumsy now, are steadily improving. These features of electronic commerce for copyrighted products can generally be expected to improve the attractiveness of legitimate Internet movie sales, such as movielink.com, at about the same rate that they improve illegal file sharing.<sup>47</sup>

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and [Gopal et al. \(2006\)](#). Empirical research by [Oberholzer-Gee and Stumpf \(2007\)](#) suggests that network effects in the music case must have been significant.

<sup>47</sup> [Lessig \(2004\)](#) makes a similar point.

A further advantage of the Internet – perhaps of most long-term importance – is that DRM systems offer the potential for movie sellers to limit illegal file sharing or possibly to take economic advantage of improved price discrimination.<sup>48</sup> Technologies to stop or to control retransmission of movie files are improving along with watermarking and fingerprinting. If consumers will accept “pay-per-use” systems in Internet distribution, there is technological potential for direct appropriation, for example, of the value of file-shared movies. Contracts could be written between file-sharing sites and movie distributors that activate an automatic payment to the copyright owner when a file is transferred via that site.<sup>49</sup> The studios themselves, in fact, could post movies to file-sharing sites. In theory, at least, such a system could be used to serve lower-value users at lower prices if we assume that those who are willing and able to use file-sharing sites perceive lower costs to do so.

While these more positive features of Internet distribution are reasons for optimism among movie copyright owners, a technological and legal fix for file sharing like the remedy that led to the decline of pay TV piracy seems less likely. Much computer hardware and software already detects and adheres to a variety of DRM systems, and the DMCA generally prohibits the circumvention of those systems. But hardware can be modified, and software can be hacked. Once a pirate figures out how to break the anti-copy or transfer codes on a DVD, the content becomes unprotected and, consequently, sharable online.

In the file-sharing case, the movie studios have not enjoyed as much legal and political support in fighting this practice as they garnered for past media. In 2005, an Appeals Court overturned the FCC’s Broadcast Flag regulations, which would have enabled content owners to employ a DRM system to control unauthorized retransmission of over-the-air digital broadcast signals. Studios have feared that Internet retransmission of high-definition programming, including movies, are particularly at risk (Labaton 2005). On a broader level, computers are used for many purposes other than illegal file sharing, and efficient as digital technologies may be to limit or stop file sharing at the home premises equipment level, the political obstacles to adopting and using those technologies have proven to be high. The public widely supports a definition of fair use beyond that preferred by the studios. Consumers have come to expect free copying for one’s own use or sharing among friends, and that will be a hard barrier to overcome.

Perhaps the best expectation for the studios is that they can achieve what they appear to have accomplished with most other media in the past: relegation of the practice to a relatively small group of consumers who do not perceive high costs of engaging in the activity but who may also have relatively low value demands in the legitimate market. Ironically, file sharing may at least prove

<sup>48</sup> For a discussion of DRM systems that can be used in movie distribution, see Currah (2006), who makes an argument that Hollywood studios should change their traditional business model to take advantage of file sharing.

<sup>49</sup> A similar system was proposed to music producers by SnoCap in the mid-1990s (The Economist 2004).

to be a more efficient way to consume movies illegally than hard goods or the physical duplication and sharing systems that have historically governed video and pay TV transmissions – thus reducing those activities.

## IV Conclusion

On a general level, the apparent success of movie studios in the United States in reducing or containing the impacts of commercial hard goods and pay TV piracy, and of the physical copying and sharing of movies on pre-recorded video or pay TV, is encouraging to their future profits. The forces of technology, the law, and active enforcement seem usually to have won out in the end for the studios, or perhaps at least, they have fought to a draw.

On a more specific level, however, digital technologies have raised the stakes in unpredictable ways, both as revenue threat and as prospect for control. While the overwhelming popular and academic interest has been Internet file sharing, the ability for studios to control the copying of PPV or VOD movie exhibitions could prove to be as significant. In both the PPV/VOD and file sharing cases, a political and technological maze awaits the industry.

In revenue importance, the greatest challenges to U.S movie distributors are international markets, where 80% of all piracy reportedly takes place. To compensate, some foreign theatrical release of major Hollywood films has been forced to earlier dates, although these changes in release patterns have reportedly been minor overall ([Screen Digest 2005](#)). In some other cases, however, rampant piracy has apparently even collapsed the release sequence. In China, for example, DVDs for some Hollywood films have been released on video months earlier at limit prices, or foreign theatrical release has been forgone altogether ([Arnold and Landreth 2006](#); [Video Business 2005](#)). Especially in Third World countries, it is obvious that weaker copyright laws, and weaker enforcement of those laws, possibly combined with less moral compunction against using Hollywood's products for free, are the main obstacles. Cross-country studies of computer software piracy have consistently shown that rising socio-economic status of the general population and stronger legal systems are correlated with low piracy rates ([Andrés 2006](#); [Banerjee et al. 2005](#); [Holm 2003](#)). As those economic developments take place, the effects that the studios' strategies of raising costs and reducing product quality have had in the United States may have some predictive value.

In terms of research needs, the several empirical studies of the effects of file sharing on legitimate music sales and computer software provide useful models for comparable studies about movies. We mention in conclusion three more specific sets of research questions for the movie case.

First, why are movie piracy rates higher in some countries than others? How might the determinants differ from those found for the case of computer software piracy? In particular for movies, how do pricing in the legitimate market, retail industry development, and government policy influence piracy? Is the

U.S. model of enforcement against the various forms of piracy, copying, and sharing in fact a prescient one for the rest of the world?

Second, what are the attributes of individuals who pirate or otherwise copy and share movies? Several studies have reported demographic or attitudinal characteristics of those who engage in music, computer software, or movie piracy, but few have gone beyond straightforward demonstrations that such individuals tend to be young, male, have low respect for the law, etc.<sup>50</sup> To understand the true costs of piracy, copying and sharing, an important unknown is whether those individuals tend to be high value or low value consumers. Answering that question requires survey design involving individuals' economic resources, inherent interest in movies, and other personal characteristics that independently predict legitimate movie demand. Given the high research costs of surveys and the difficulties in assessing results of studies sponsored by industry players, a publicly funded national survey of movie (and music) copiers and file sharers comparable to that conducted by the OTA in 1989 would make a valuable contribution.

A third subject involves hardware/software DRM compatibility issues. Among the many interesting questions: How well does the free market standard setting process work and what leads it to break down? How does industrial organization, notably vertical integration of hardware and software firms, affect the process? Should there be a government-imposed universal DRM standard for movies? Some interesting preliminary research in this area (Park and Scotchmer 2006; Bergemann et al. 2005) offers a provocative beginning.

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<sup>50</sup> Among numerous survey based studies about the characteristics and attitudes of computer software pirates are Sims et al. (1996), Woolley and Eining (2006), and Kini et al. (2000); for the case of music pirates, see Labaton (2005).

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