

**Competing with Free:
The Impact of Movie Broadcasts on DVD Sales and Internet Piracy**

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1. Introduction

“They say without protection, high value content will not be made available on the broadcast medium. Given the circumstances and the potential harm to creators, it is appropriate to offer some baseline protection.”

Statement of FCC Commissioner Jonathan S. Adelstein, in Federal Communications Commission, Report and Order adopting Digital Broadcast Content Protection, November 4, 2003. (FCC 2003, page 69)

Since the advent of the first VCR, movie studios have believed that the ability of consumers to freely record television broadcasts will significantly harm the marketability of movies that are broadcast on television. The argument is intuitive. Once a consumer is able to make a copy of a movie shown on television, why would they ever consider purchasing a copy of that movie in a similar format? This concern has gained renewed interest recently with the development of high definition digital television (DTV), which will advance the integration between the television and the computer. Thus, while in the analog world of the VCR, consumers could make an imperfect, low resolution copy of the movie, HDTV allows consumers to make a perfect high resolution digital copy of the movie. While analog copies of movies were hard to duplicate and share, digital copies of movies can be easily copied and shared, raising the specter of rampant piracy of movies shown on television.

This is not an idle concern for movie studios where DVD sales represent the bulk of their revenues (close to 46% for \$14.9 billion; Epstein 2005, p. 20; PBS 2005). Indeed the DVD standard emerged as an enormous boon to the movie industry. For example, Time Warner’s library of movies appreciated by \$7 billion between the time the DVD was introduced in 1996 to 2004 (Epstein 2005). With this in mind, studios are also concerned about protecting future revenue streams from next generation high definition video standards such as Blu Ray and HD-DVD, and from emerging digital download services, such as Amazon Unbox and iTunes movie store.

In raising these concerns, some studio executives have gone so far as to argue that unless copy protection technology is included in over-the-air DTV standards, it will no longer be profitable for them to show their movies on (unprotected) over-the-air network broadcasts. That instead, they will choose to broadcast their content only on cable channels, which currently have basic copy protection for digital television content. The crux of this argument is that when movies are broadcast in DTV format, it will inevitably lead to increased piracy through Internet file sharing networks, which in turn, will lead to reduced sales of movies in retail channels.

However, in spite of these arguments, we believe that it is striking that nowhere does the public record contain any empirical evidence of whether DTV broadcasts actually stimulate piracy or reduce DVD sales in a way that might cause the movie studios to find it more profitable to show their content on cable systems versus over-the-air broadcasts.

With this in mind, the goal of this research is to analyze two main empirical questions. First, what impact do movie broadcasts have on DVD sales? And second, what impact do movie broadcasts have on the supply of and demand for pirated copies of movies? These questions are important because they parallel the arguments of the movie studios in advocating the broadcast flag. They also shed light on the incentives of the movie studios to broadcast their content in over-the-air versus cable venues. Finally, they shed light on the impact of movie broadcasts on the subsequent market for movies purchased on DVDs — which is one of four factors used in U.S. copyright law in determining whether a particular consumer use of copyrighted material should be considered an allowable “fair use.”

To do this we gather a new dataset including all movies shown on over-the-air television broadcast networks and the four most popular ad-supported cable networks from July 12, 2005 to March 3, 2006 (excluding the Christmas holiday season). For these movies we collect data on sales level at Amazon.com and piracy levels at two major BitTorrent tracker sites. We find that, movie broadcasts significantly stimulate DVD sales — leading to a 345-399% increase in sales immediately following broadcast. However, we also find that movie broadcasts result in a statistically significant increase in the demand for pirated copies of the movies. In particular, for movies shown over-the-air, the increase in piracy is about 150%. Most importantly for the studios, we find that broadcast movies that have a BitTorrent tracker available at the time of broadcast experience a smaller gain in sales than movies that do not have BitTorrent trackers available.

2. Broadcast Flag Policy Background

In the face of concerns about piracy from over-the-air high definition television broadcasts, the movie studios proposed a “broadcast flag” copy protection scheme to the Federal Communications Commission (FCC). The stated goal of the broadcast flag was “to prevent the indiscriminate redistribution of [over-the-air broadcast] content over the Internet or through similar means” (Welborn 2005, page 5). The broadcast flag is a 16-bit field inserted into the digital television bit-stream for over-the-air broadcasts. Broadcast flag compliant devices would listen for the flag, assume it to be set to protect if it was not found, maintain copy protection within the device, and only output the signal over protected outputs (e.g., High Definition Multimedia Interface (HDMI) standard for Digital Visual Interface (DVI) connections) or in a degraded form (approximately equal in resolution to current NTSC television broadcasts). The studios have argued that the broadcast flag copy protection scheme provides them with a similar level of piracy protection to existing copy protection schemes used in cable and satellite broadcasts.

In spite of this, consumer groups raised several concerns related to potential collateral impacts of the broadcast flag. First, consumer groups argued that the broadcast flag may limit some consumer “fair uses” of TV broadcasts currently allowed under copyright law. The U.S. Supreme Court’s 1984 decision allows consumers to record TV broadcasts to watch at a later time (a.k.a. time-shifting) or to transfer these TV broadcasts to another medium (a.k.a. space-shifting). Consumer groups argued that some time-shifting and space-shifting activities would be curtailed.

Consumer groups also argued that, for a variety of reasons, the broadcast flag is unlikely to significantly reduce piracy, the very problem it was designed to solve. Notably, the broadcast flag doesn't cover existing DTV decoders, which will continue to be able to receive content without copy restrictions. Furthermore, it is currently possible to decode DTV programming in software, and software distribution is significantly harder to control than hardware distribution (Burger 2005). Consumer groups also observed that the broadcast flag might stifle innovation by requiring hardware and software manufacturers to comply with restrictive standards. Notably, consumer groups argued that the increasing integration of the computer and the television may place the FCC in the difficult position of regulating computer hardware and software design).

3. Data

Our data were collected from July 12, 2005 through November 23, 2005 and from January 1, 2006 through March 3, 2006. We have eliminated all observations during the Christmas holiday season to avoid any potential holiday effects. Our data consist of information on all movies shown on over-the-air broadcast channels and major ad-supported cable channels. We sampled all movies shown in national broadcasts on ABC, CBS, NBC, FOX, UPN, and WB networks. We used only national broadcasts and we determined that a broadcast was national if it was shown in both the New York City and Los Angeles affiliates during the same time slot. We also collected data from the four most popular ad-supported cable networks: TBS, TNT, USA, and Lifetime.

We collected broadcast information — broadcast date and time, broadcast duration, movie name and description, and whether the movie was shown in high definition format — from TitanTV.com which provided a 14-day advance notice before a movie's broadcast date. We used the Internet Movie Database (imdb.com) to obtain information on the theatrical release date, rental revenue, gross revenue, gross budget, and IMDB user star rating for each of the movies. Finally, we collected information about DVD characteristics and sales (rank) for each version of the movie available at Amazon.com. For each of the DVD versions, we collected product characteristics including list price, amazon price, release date, number of discs, and sound quality. Our final sample contains 522 broadcast movies and 618 DVD titles.

Table 1: Sales Data Summary Statistics

<i>Variable</i>	<i>Obs.</i>	<i>Mean</i>	<i>St. Dev.</i>	<i>Min</i>	<i>Max</i>
Amazon Rank	144,612	10,447	9,880	38	64,610
List Price	144,612	15.56	5.55	4.98	79.92
Amazon Price	144,612	13.20	4.27	4.98	41.23
Amazon Star Rating	143,814	3.81	0.64	1	5
Broadcast Duration (Hours)	144,612	2.21	0.38	1.5	4
High Definition Format	144,612	0.07	0.26	0	1
Broadcast Network	144,612	0.14	0.34	0	1
Number of Discs in DVD	144,612	1.09	0.36	1	5
Ln(Gross Revenue (\$ Million))	125,755	17.42	1.19	10.53	19.69
IMDB User Votes	144,612	16,098	23,610	30	191,707
Minutes Edited from Broadcast	144,612	9.47	8.15	0	40

We use the DVD sales rank as a proxy for the number of products sold at Amazon. Amazon.com lists the rank of products sold in each product category, with 1 corresponding to the highest selling product, 2 to the second highest selling product, and so on. Following Brynjolfsson, Hu, and Smith (2003) and Chevalier and Goolsbee (2003) we assume that the relationship between sales and sales rank follows a Pareto distribution:

$$Quantity = \beta_1 Rank^{\beta_2} \tag{1}$$

We apply Chevalier and Goolsbee’s experimental technique, to estimate (β_2). We performed this experiment twice and found estimated β_2 parameters of -1.76 and -1.81 respectively. We use the average of the four β_2 estimates (-1.70) in our subsequent calculations.

Our piracy data comes from piratebay.org and mininova.org, two public tracker sites for the BitTorrent protocol. We selected BitTorrent for two reasons. First, BitTorrent is currently the most popular protocol for sharing large files, such as movie files. Second, the design of the BitTorrent protocol is such that all nodes participating in a file download report their status to the tracker every 20 seconds. We selected piratebay and mininova as data sources because they were among the most popular BitTorrent tracker sites during our study period, and these sites also list the current number of seeds, leechers, and downloads for each of their trackers.

For each of the movies in our dataset, we search for trackers matching the movie title and general description at both piratebay and mininova both before and after the broadcast date. For all matching trackers we collect the date the tracker was added to the respective tracker site, the file size and daily observations of the number of seeds, leechers, and cumulative downloads.

Table 2: Piracy Data Summary Statistics

<i>Variable</i>	<i>Obs.</i>	<i>Mean</i>	<i>St. Dev.</i>	<i>Min</i>	<i>Max</i>
Broadcast Network	3,847	0.13	0.34	0	1
Leechers	3,847	13.90	26.27	0	235
Seeds	3,847	3.47	8.15	0	68
Daily Downloads	3,554	3.81	10.77	0	189

It is important to note that DVDs are typically released 3-6 months after the end of the theatrical release (Epstein 2005) and first shown on television 18 months to 3 years after the DVD release. This will influence the number of daily downloads per trackers and will also suggest that our measured increase in piracy will be conservative.

4. Results

4.1. DVD Sales Results

To estimate the effect of movie broadcast on DVD sales, we create a set of time dummy variables that control for the sales levels before and after the broadcast. For notational simplicity, the dummy variable $D(a,b)$ will be equal to one for a to b days before or after the broadcast. Thus, $D(-2,-1)$ equals 1 for all time periods from 2 to 1 day before broadcast starts on the east coast.

We then estimate a model with DVD-level fixed effects to see how sales change before and after a movie is broadcast on over-the-air television or cable. An unfortunate characteristic of fixed effect estimation is that we cannot include any variables that are constant within DVD (and therefore collinear with the DVD fixed effect). We will relax this requirement using random effects models below. The fixed effect model we estimate is

$$\text{Ln}(\text{Rank}_{it}) = \zeta \text{Price}_{it} + \delta D_t + \varepsilon_{it} \quad (2)$$

where i indexes a movie and t indexes time. ζ and δ are the vectors of coefficients to be estimated, where δ captures the effect of movie broadcast on DVD sales. Our results (which are omitted due to space) indicate that, after a movie is shown, the sales coefficients are initially large and statistically significant, returning to the baseline sales level after two to four weeks. Comparing results across movie types and broadcast outlets we see that the gains for movies shown over-the-air in HD format are similar to, but generally higher than movies shown in lower resolution format — with the coefficients for both types of over-the-air broadcasts significantly higher than the coefficients from movies shown on cable channels.

In terms of numbers, movies shown in HD on an over-the-air channel experience, on average, a 345% increase in sales in the 24 hour period after the movie is shown, compared to an 88% increase in sales for movies shown on cable channels.

4.2. Piracy Results

In the second part of our analysis, we examine how TV broadcast affects the piracy of these movies on file-sharing network. The models we estimate are

$$\{\text{download}_{it}, \text{leechers}_{it}, \text{seeder}_{it}\} = \lambda D_t + \varepsilon_{it} \quad (3)$$

Preliminary results show show significant increase in piracy immediately after movies are broadcast (except for leechers). For example, our results suggest that in the day after a movie is broadcast there is a 150% increase in the day after broadcast and a 61% increase on the second day after broadcast.

We recently obtained data from Nielsen Media Research that will allow us to better identify the effect of piracy on DVD sales, and we hope to have all the results in time for WISE.

Reference

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