

THE NETFLIX EFFECT: PRODUCT AVAILABILITY AND  
PIRACY IN THE FILM INDUSTRY

by

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(Under the Direction of Ronald Warren)

ABSTRACT

With the rapid growth of the Internet and peer-to-peer technology, digital piracy has become a serious problem. Many studies have focused on negative or neutral effects that piracy has had on the music industry, but the role that piracy plays in the film industry is still relatively unclear. Companies have spent millions of dollars in lawsuits that have yielded very little in return. By making their content more convenient to access, these companies might be able to lure pirates away from file sharing and into a more socially acceptable form of enjoying these digital goods. Using a basic difference-in-difference model and data collected from two of the largest illegal file sharing websites, I find that introducing a blockbuster movie onto Netflix, the leader in digital video streaming with over 27 million subscribers, decreases the rate at which it is pirated.

INDEX WORDS: Piracy, Digital Piracy, Netflix, Film, Entertainment

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Dedicated to Mom.

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# Chapter 1

## Introduction

Over the last ten years there has been a significant change in the way that movies are watched, music is listened to, and television programs are delivered. Netflix, an online DVD rental company, added 3.1 million net subscribers in the last quarter of 2010, bringing its total membership to over 27 million. Netflix claimed 61 percent of the digital video market, with revenues of approximately \$2.2 billion for 2010. In March 2010, Hulu streamed approximately 380 million videos to its clients. Its unique viewership has risen to over 41.5 million people, making it the second largest digital television provider in the U.S.

As legitimate video download businesses are growing, so are illegal movie downloads through technologies like BitTorrent. This leaves film studios struggling to cope with the same problem that music studios tried in vain to address more than a decade ago. In 2010, Voltage Pictures, an independent production company, filed a copyright complaint against 5,000 anonymous users in Federal Court. Attorneys for Voltage wrote in the complaint that unless the court stopped people who were pirating the film *The Hurt Locker*, Voltage would suffer “great and irreparable injury that cannot fully be compensated or measured in money” (Huffington Post 2011). But is taking such strong legal action the best solution to fighting piracy? Beckerman (2010) found that the actual damages paid from Recording Industry

Association of America (RIAA) lawsuits were far below the legal expenses of the trials. Between 2006 and 2008, over \$64 million was spent tracking pirates. While the amount of piracy deterred by these lawsuits is unknown, these lawsuits extracted only \$1.36 million in successful settlements.

In mid-2011, Fox News Network delayed the airdates of their shows on Hulu.com from twelve hours after their cable television debut to eight days, and experienced an increase in the piracy rate of its shows from 200 to 400 percent. Valve, a video game developer and winner of over one hundred Game of the Year awards, believes the problem is only a matter of convenience. By offering their most popular PC game, *Team Fortress 2*, as a free-to-play game supported by in-game transactions, Valve has reduced the piracy rate of this game by 30 percent while increasing its profits (Morely 2011).

Using data I collected from two of the world's largest BitTorrent servers, I examine piracy trends of blockbuster films before and after their debut on Netflix. With these data and using a basic difference-in-difference model that also controls for genre, release year and box-office success, I test the hypothesis that piracy is driven by product availability and consumer impatience. I find that my "treatment" movie, *Rango*, which grossed 123.5 million dollars in theaters, experienced an eleven percent decrease in its piracy rate only two weeks after its Netflix debut. This finding suggests that production companies should allow their content to be more readily available so that consumers are not tempted by more convenient, yet illegal, ways of watching movies.

# Chapter 2

## Literature Review

Because piracy is still a relatively new topic and its evolution has been rapid, reliable piracy data are difficult to find. Most data on piracy are offered through survey companies often sponsored by the recording industry. The data offered by the International Federation of the Phonographic Industry (IFPI) suggest that individuals who engage in piracy purchase fewer albums compared to those who do not (IFPI 2010). While this may be true, the IFPI does not account for selection bias. As Strumpf and Oberholzer-Gee (2007) and, more recently, the Swiss Government (2011) point out, file sharing is attractive to those who are time-rich but cash-poor, and these individuals would purchase fewer albums even in the absence of file sharing.

Oberholzer-Gee and Strumpf (2007)(hereafter O-S) study the effects that file sharing has on album sales in the U.S. By capturing output-log files generated by OpenNap servers, they are able to track peer-to-peer (p2p) file transfers. O-S observed over 1.75 million downloads, or about .01% of all downloads worldwide, in a span of seventeen weeks. After restricting their findings to U.S. I.P. addresses and music downloads, O-S find that their data are statistically representative of all music downloads on p2p networks in their timeframe. Using these data, along with weekly U.S. album sales in the latter half of 2002 provided

by SoundScan, O-S find that file sharing has no significant effect on record sales. While their paper is the most cited work on piracy, it has generated considerable controversy. Haring (2008) points out that, although their work was published in the *Journal of Political Economy* (JPE), O-S have denied access to their data to anyone seeking to replicate their results. Handelsblatt (2008) notes that if empirical results cannot be reproduced, then they should not be regarded as fact.

Waldfoegel (2006) studies the survey responses of a sample of U.S. college students. He finds that downloading five albums replaces the sale of one CD. However, when he restricts the data to albums which sold over 2 million copies since 1999, Waldfoegel finds no significant correlation between downloads and sales. He concludes that, although piracy does not affect popular artists, it may have a negative effect on lesser-known artists.

Leung (2012) finds that music piracy decreases music sales by between 24% and 42% but also has a positive effect on music accessory sales. He attributes a 12% increase in iPod sales to piracy, which translated to an additional \$1.1 billion in 2008 revenue for Apple. By combining data collected from Waldfoegel's survey with a Bayesian discrete-demand model, Leung finds that when students pirated 10% more music through p2p websites, they bought 0.7% fewer iTunes songs and 0.4% fewer CDs.

Bhattacharjee, Lertwachara, Marsden and Teland (2007) study the effects Napster has had on album survival life on Billboard's top charts. By comparing length of time spent on Billboard's top-ranked charts from pre- and post-Napster decades, they find significantly reduced chart survival time post-Napster except for those albums that debut high on the charts. These results, along with Waldfoegel's study, suggest that piracy via p2p networking leads to a greater risk of loss in sales and popularity for all but the most popular of artists.

This paper extends the research on the effect of piracy on the entertainment industry. While previous studies show the effect piracy has had on music, there are few papers that show the effect piracy has had on film. Research that uses piracy data is even less common.

Other papers have utilized survey methodology, whereas this study is the first to track downloads of specific illegal files. My approach differs from the existing literature in that I examine how the availability of streaming options affects the rate at which a movie is pirated. I propose that that piracy will be high when the movie is not on Netflix and that piracy will decrease when it is released to Netflix and the movie is made more readily available.

# Chapter 3

## Mechanics of File Sharing

To understand the data and my method of collecting it, a brief overview of how file sharing by BitTorrent works is necessary. BitTorrenting is a practice that allows for fast downloading of large files using minimum Internet bandwidth at marginal costs that are almost zero. Unlike other downloading methods, BitTorrent maximizes transfer speed by gathering pieces of the desired file and downloading them simultaneously from people who already have these pieces. This process makes a large file, such as a video, much easier to download than the same file on other p2p networks. The speed of transfer is affected by several variables, including the amount of traffic on the server and the number of other computers that are downloading the file. This means that if the file is large and popular, then the demands on the server are great and the download will be slow.

Unlike other p2p downloading methods, BitTorrent unloads some of the file transferring work to a central server (called a tracker). Most trackers use a “tit-for-tat” strategy when determining download speeds. In other words, in order to download files you have to upload some too. This solves the problem of free-riding in the BitTorrent community. With BitTorrent, the more files you share with others, the faster your downloads are.

The process for BitTorrenting is as follows: You open a Web page and click on a link for the file that you want. Your BitTorrent client software communicates with the Web page, which acts as a tracker, to find other computers running any BitTorrent clients that have the complete file (the “seed” computers) and those with a portion of the file (peers that are usually in the process of downloading the file, too). The tracker identifies this network of computers as the “swarm.” The tracker helps the client software trade pieces of the file you want with other computers in the swarm. Your computer receives multiple pieces of the file simultaneously. If you continue to run the BitTorrent client software after your download is complete, others can receive torrent files from your computer; your future download rates improve because you are ranked higher in the “tit-for-tat” system. Because the Web page acts as a tracker, it is able to keep a real-time count of current uploaders and downloaders. Downloading pieces of the file at the same time helps solve a common problem with other p2p download methods: Peers upload at a much slower rate than they download. The more computers that are involved in the swarm, the faster the file transfer occurs because there are more sources for each piece of the file.

# Chapter 4

## Data

The movies chosen for inclusion in the data set were based on their box office success and release date on Netflix. Netflix does not announce upcoming releases to its consumers directly so a movie’s debut comes to them as a surprise. *Feedfiks.com*, however, shows its visitors what movies will be released onto Netflix in the upcoming month, along with the movie’s write-up and its critic score on *IMDB.com*. I use this information as a proxy to decide which movies to track and when to start. The movies are tracked for one week prior to and a minimum of two weeks after their Netflix debut. I pair each “treatment” movie with a “control” counterpart of the same genre, similar relative success, and release date. The control movie is one that has not been released onto Netflix.

From January until May 2012 only one movie, *Rango*, was released onto Netflix that grossed over \$100 million, making it the only popular box-office success in this timeframe. *Rango* is an animated children’s movie that was released by Paramount Pictures during the end of February 2011 and grossed approximately \$124 million in US theaters. During the same spring movie season, Paramount Pictures also released *Kung Fu Panda 2*. Like *Rango*, *Kung Fu Panda 2* is an animated children’s movie; it opened early in May 2011 and grossed approximately \$163 million from US audiences at the box office. While both movies were



completed in the same box-office season, Paramount postponed the release of *Kung Fu Panda 2* so as not to compete for the same target audience as *Rango*. Both movies were nominated for Best Animated Feature Film in the 2011 Academy Awards, and *Rango* was the recipient of the award. Both movies had DVD release dates during the fall 2011.

The data were collected directly from two of the world’s largest BitTorrent websites, *thePirateBay.org* and *Demonoid.me*. Their servers keep a real-time count of the total number of downloads for all of their torrent files. Using a software plugin for the web browser Google Chrome called iMacros, I was able to query the number of downloads for a specific file every six hours. Along with total downloads, I kept track of the total number of uploaders and downloaders at that specific moment. iMacros takes this information, compiles it, and saves it as a csv file to a hard drive. Using several of these macros, I tracked the ten most popular torrents from each website for each movie in the data set.

Over the three-week timeframe, I observed a total of 6,795 downloads for *Rango*, with a daily average of 338 downloaders. For *Kung Fu Panda 2*, I observed 975 total downloads with a daily average of 73.5 downloaders. Each period is defined as every six hours, starting with noon on March 25. The number of total downloads was as follows:

Figure 4.1: Total *Rango* Downloads

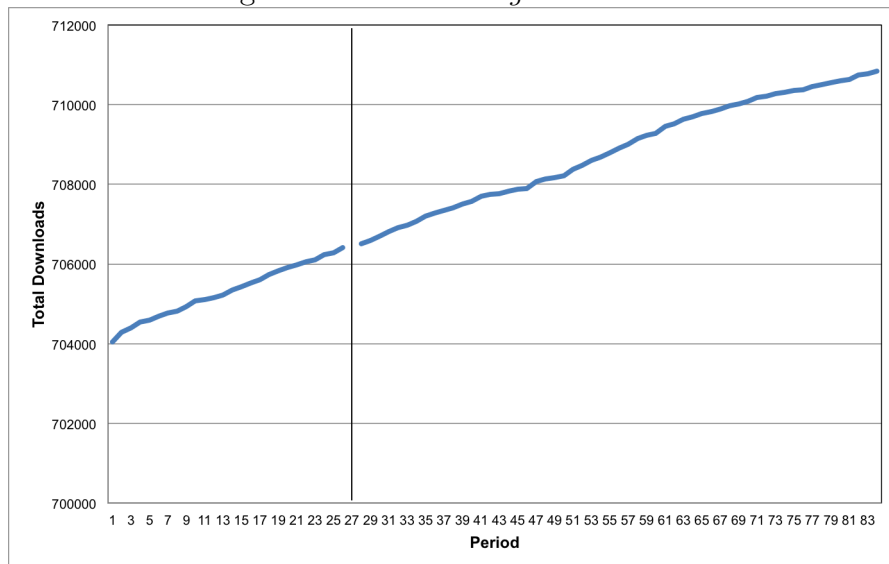
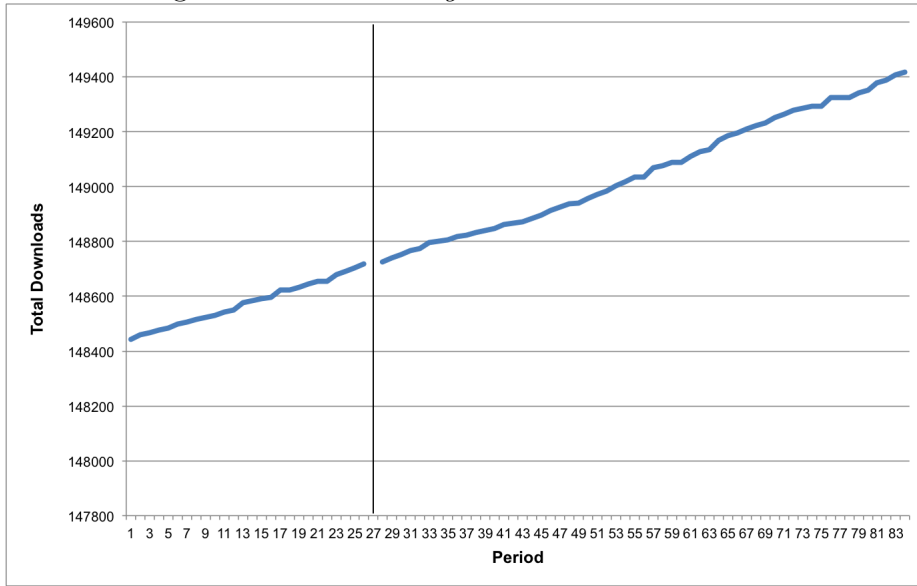
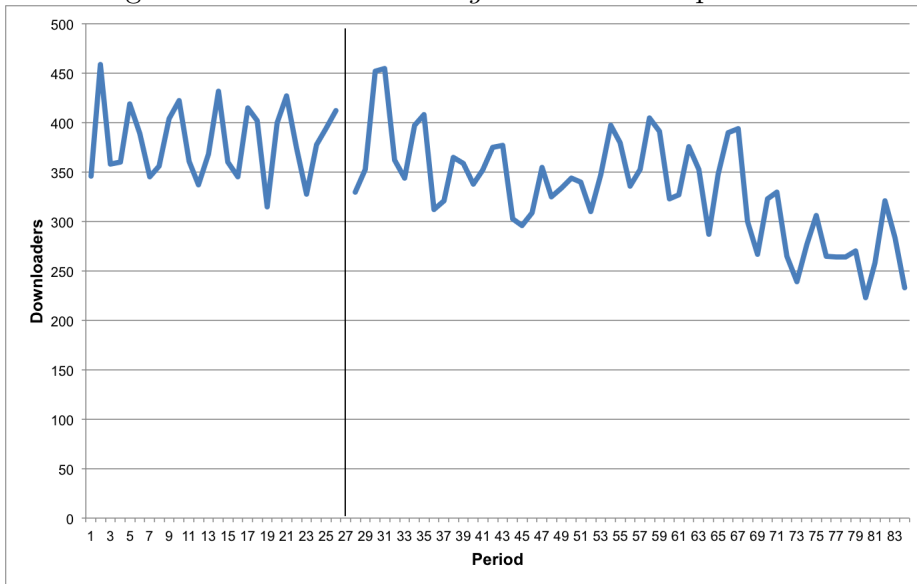


Figure 4.2: Total *Kung Fu Panda 2* Downloads



While the trends in the two total downloads rates look similar, one interesting feature is the break in trend in the number of daily downloaders before and after the Netflix release:

Figure 4.3: Number of *Rango* Downloaders per Period



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The break indicates the release period of *Rango* onto Netflix

Figure 4.4: Number of *Kung Fu Panda 2* Downloaders per Period

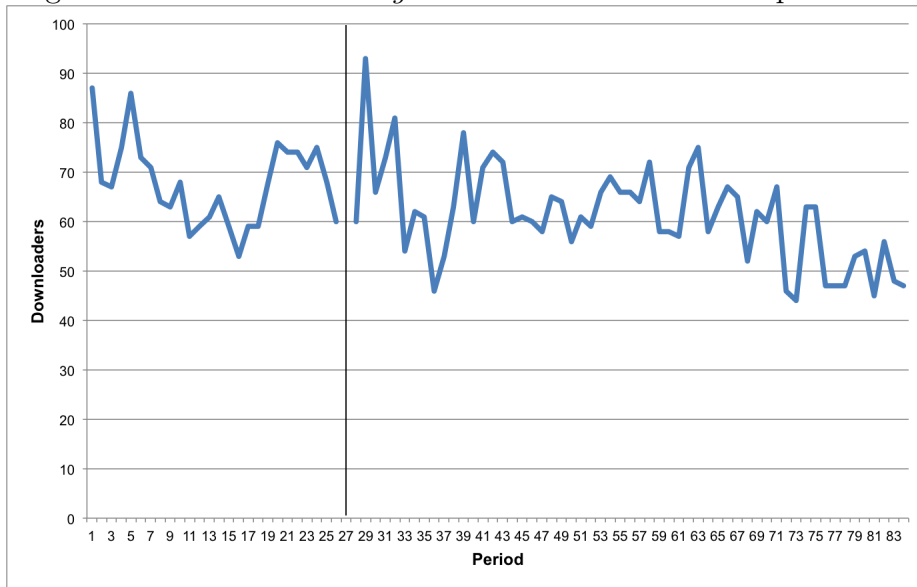


Figure 4.5: *Rango* Downloaders Pre-Release

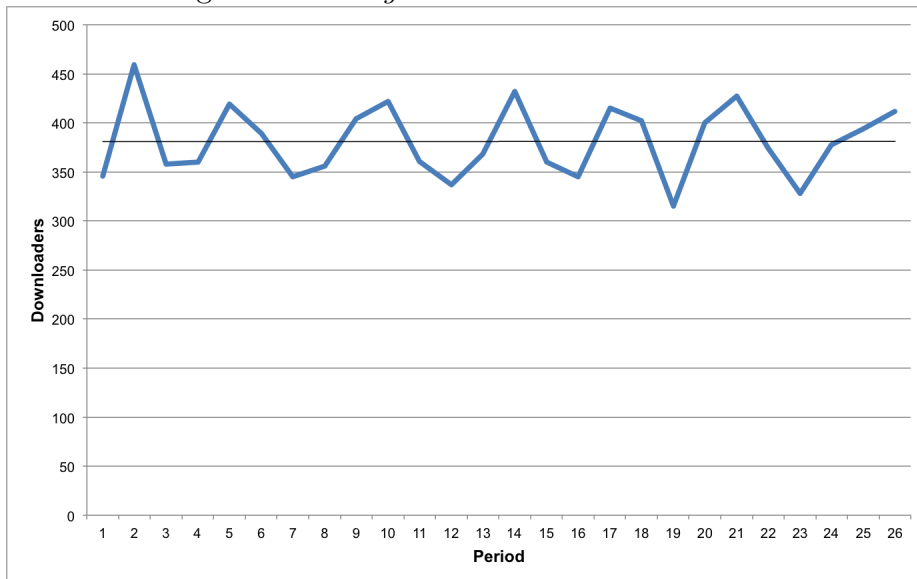


Figure 4.6: *Kung Fu Panda 2* Downloaders Pre-Release

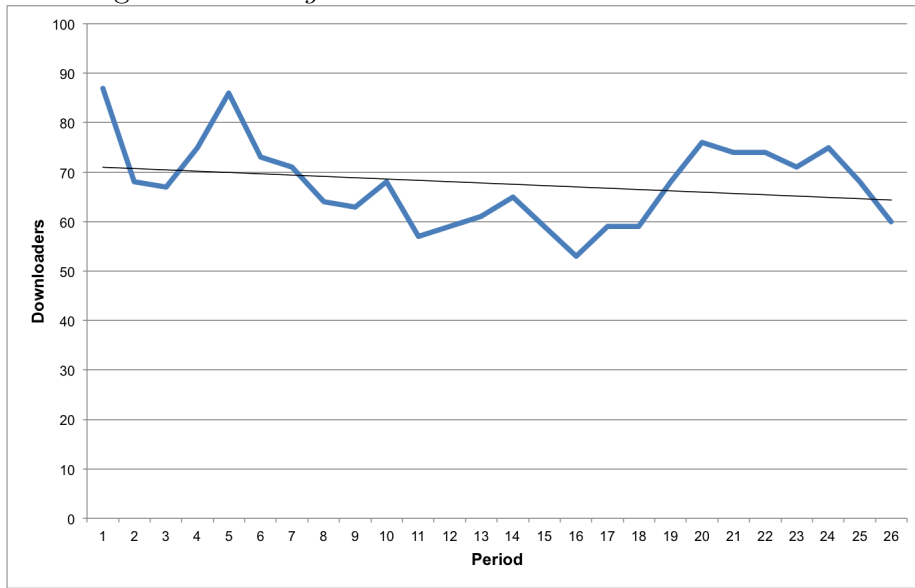


Figure 4.5 shows that the pre-Netflix release trend-line for the number of *Rango* downloaders neither increases nor decreases. However, the pre-Netflix release trend-line for *Kung Fu Panda 2* has a negative slope.

Figure 4.7: *Rango* Downloaders Post-Release

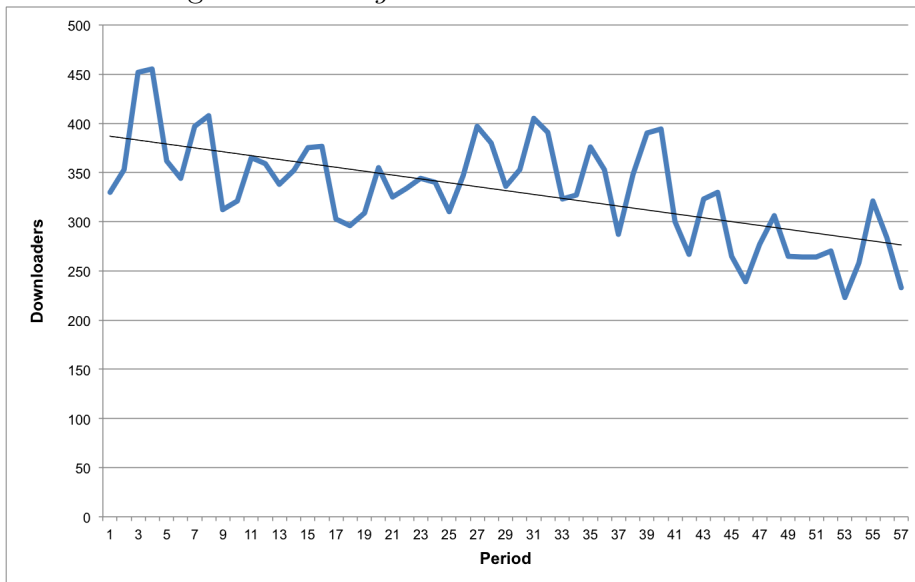
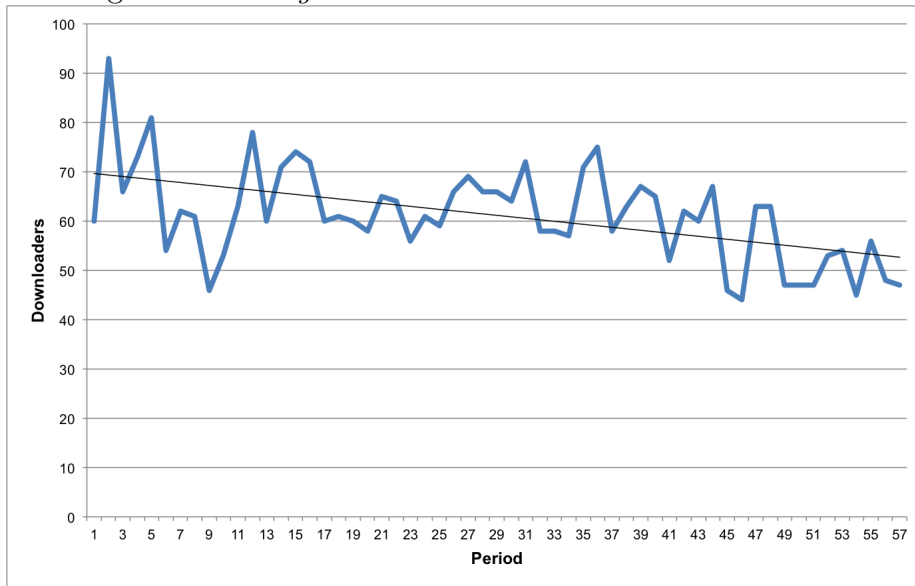


Figure 4.8: *Kung Fu Panda 2* Downloaders Post-Release



The slope of the post-Netflix release trend-line for the number of *Rango* downloaders decreases significantly, while the trend-line for the number of *Kung Fu Panda 2* downloaders remains relatively unchanged from pre- to post-Netflix release.

Table 9.1 gives a side-by-side comparison of the total number of downloads and downloaders pre- and post-Netflix release. Table 9.2 compares the slopes of the regression lines throughout each of these timeframes.

# Chapter 5

## Econometric Approach

A useful framework for analyzing data where outcomes are observed for two groups for two time periods is the difference-in-difference model. The movie released onto Netflix is designated the treatment movie and is paired with a movie of similar genre and box-office success that has not been released onto Netflix; this complement will be denoted the control movie. To estimate the effect on the piracy rate of a Netflix release, the average increase in the number of downloads for the control movie is subtracted from the average increase in the number of downloads for the treatment movie. This removes biases in post-release comparisons between the treatment and control movies that could be the result of pre-release differences between those movies. It also removes biases from comparisons over time between the treatment and control movies that could be the result of common trends.

Define  $\mu_{it}$  as the mean of the download outcome for movie  $i$  at time  $t$ . Let  $i = 0$  for the control movie and  $i = 1$  for the treatment movie. Also, let  $t = 0$  denote the pre-Netflix release period and  $t = 1$  denote the post-Netflix release period. We can write the difference-in-difference estimator as

$$\Delta = (\mu_{11} - \mu_{01}) - (\mu_{10} - \mu_{00}) \tag{5.1}$$

where the first term is the change in the piracy rate for the treatment movie and the second term is the change in the piracy rate for the control movie.

With repeated cross sections, we can use an alternative regression-based estimator written as:

$$y_{it} = \beta_0 + \beta_1 X_i + \beta_2 T_t + \beta_3 X_i T_t + \epsilon_{it} \quad (5.2)$$

where  $y_{it}$  is the change in the piracy rate for movie  $i$  at time  $t$ ,  $X_i$  is a dummy variable that takes the value 1 if the movie is in the treatment group and 0 otherwise, and  $T_t$  is a dummy variable that takes the value 1 if the observation is in the post-Netflix release period and 0 if it is in the pre-Netflix release period. The difference-in-difference estimator is the OLS estimator of  $\beta_3$ , the coefficient on the interaction between  $X_i$  and  $T_t$ ; that is,

$$\hat{\beta}_3 = (\mu_{11} - \mu_{01}) - (\mu_{10} - \mu_{00}) = \Delta . \quad (5.3)$$

Inference based on even small sample sizes in each of the groups is straightforward, and is easily made robust to different group or time-period variances. As Manning (2012) notes, the validity of the differences-in-differences estimator is based on the assumption that the underlying trends in the outcome variable are the same for both treatment and control groups. This assumption is never testable, and with only two groups one can never be certain if it is plausible. However, with more than two observations we can get some idea of its plausibility.

# Chapter 6

## Results

Table 9.3 gives the results for the estimation of equation 5.4, with total downloads and the number of downloaders as alternative measures of the piracy rate. The number of uploaders is ignored because, once a movie is finished downloading, an uploader continues to seed only to increase his or her tit-for-tat ratio and pays no attention to exogenous releases of the film. The results presented in the table are consistent with the notion that pirates reduce these illegal activities when their movie of choice becomes more readily available.

The estimated “Netflix effect” is a decrease of about 40 movie downloads per day for *Rango*, or roughly an 11% decrease in the piracy rate. Although this drop is less than for Valve’s *Team Fortress 2*, it should be noted that *Rango* was released onto a medium where many substitutes were available, unlike computer games. When comparing the number of simultaneous downloaders, estimates in the table reveal a decrease in the number of downloaders of about 6.66 per day. While there was a drop in the number of *Rango* downloaders, there was also a drop in *Kung Fu Panda 2* downloaders. Over a longer period of time, this should have an effect on the total number of daily downloads that is not observed in the current data. Together, these results suggest that piracy might simply be a matter of convenience for those who are time-rich but cash-poor.



# Chapter 7

## Conclusion

These results are intriguing but come with some rather obvious limitations. The conclusions are based on a specific data set containing only two popular movies. For these results to be reliable, they should be able to be replicated across multiple movies of various genres and degrees of success. With a longer time frame, I would track piracy rates on more movies with longer before and after release periods. To estimate more accurately the effect of a Netflix release on piracy, one could also use data on DVD sales, Redbox rentals, Direct TV sales, and the number of rentals on a slew of online movie rental sites. The findings and methodology used to collect the data in this paper should be viewed only as a benchmark for future studies.

An interesting question is whether or not piracy is really a matter of convenience and impatience. If the Netflix effect is significant, it implies that pirates might reduce their illegal downloading because they find it easier to watch a movie on a service they are already paying for than to find it online and download it. The average Netflix user consumes 40 hours of video a month. That is about 20 movies and, at a \$10 per month fee, approximately \$0.50 a movie. Most other companies like Redbox or iTunes charge upwards of \$2 to rent a movie, so why haven't these companies been squeezed out of the market?

If piracy is not a problem of convenience, then it might be a philosophical question of morals. Do pirates view their acts as legitimate theft? Are pirates more likely to disassociate a good from its monetary price? Surely, most of these pirates would not steal \$20 from a production company's cash register. If disassociation is the cause, then pirates could be more inclined to support a third-party movie service, such as Netflix, than large movie studios backed heavily by the MPAA. Piracy has greatly evolved over the last millennium and, as Friedrich Nietzsche (1919) eloquently states, "Merchant and pirate were for a long period one and the same person. Even today, mercantile morality is really nothing but a refinement of piratical morality."

# Chapter 8

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# Chapter 9

## Tables

Table 9.1: Data Summary

	<i>Rango</i>	<i>Kung Fu Panda 2</i>
Total Downloads	6795	975
Avg Daily Downloads Pre-Release	339.14	39.43
Avg Daily Downloads Post-Release	308.86	49.5
Avg Daily Downloaders	338	73.5
Avg Daily Downloaders Pre-Release	353.79	62.88
Avg Daily Downloaders Post-Release	337.71	62.27

Table 9.2: OLS Estimation Results

	<i>Rango</i>	<i>Kung Fu Panda 2</i>
Download Trend Pre-Release	88.075 *** (1.22)	10.739 *** (.148)
Download Trend Post-Release	80.009 *** (.983)	12.609 *** (.131)
Downloader Trend Pre-Release	-.0075 ** (.972)	-.2667 * (.219)
Downloader Trend Post-Release	-1.976 *** (.323)	-.3035 *** (.068)

Standard Errors in parenthesis

\* $p < .2$ , \*\* $p < .01$ , \*\*\* $p < .001$

Table 9.3: Empirical Results

	<i>Rango</i>		<i>Kung Fu Panda 2</i>		Difference	Difference-in-Difference
	Before Release (1)	After Release (2)	Before Release (3)	After Release (4)	[(2)-(1)] (5)	[(5)-(6)]
Download Trend	88.075	80.009	10.739	12.609	-8.066	1.87
Downloader Trend	-0.0075	-1.976	-0.266	-0.3035	-1.9685	-0.0375
						-9.936
						-1.665