

Popcorn or Snack? Empirical Analysis of Movie Release Windows

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Working Paper – 05/04/2018

ABSTRACT

The distribution of motion pictures is going through a fundamental transformation. The primary channel has historically been the theater, and for the last few decades DVD distribution has been a profitable secondary channel. However, electronic sell-through (EST) and rental services like iTunes and Amazon Prime are increasingly playing a significant role in movie distribution, and a critical strategic decision content owners face is how to optimize revenues by coordinating movie release dates across these channels. We track movie releases in theaters in the 2012-2017 period, and then record the corresponding release dates and prices for DVD and three downloading services, otherwise known as electronic sell-through (EST) services: iTunes, Amazon, and YouTube. In most situations, EST is typically released simultaneously with digital rental, so our data is representative of both. We find evidence that, during this period, the length of the DVD window has been relatively stable at about three to four months, in line with empirical evidence and models that suggest there is an optimal DVD release window. We also find that the EST release window has been shrinking at a fast rate, converging towards the DVD window. This trend is evident even after controlling for other factors that may affect movie release timing, such as season, box office revenues, and accounting for fixed effects across studios and channels. Moreover, as of January 2017, we find that on average EST is released earlier than DVD, effectively becoming the first secondary channel after theater.

Keywords: Digital transformation, digital distribution, channel strategy

INTRODUCTION

The distribution of motion pictures is going through a fundamental transformation. The primary channel has historically been the theater, and for the last few decades DVD distribution has been a profitable secondary channel. However, with the advent of the Internet, today a consumer can easily download movies via services like iTunes and Amazon Prime, and watch them on an ever broadening range of media players and mobile devices.

Some argue that studios should embrace the transformation and distribute movies via Internet download (henceforth we use the industry term *electronic sell-through* or **EST**) and streaming subscription services. For example, Smith and Telang (2012) suggest that in order to avoid piracy, releases to DVD and digital channels should be done earlier. Another argument in favor of an earlier release for movie downloading is based on the notion that movie content is perishable (August et al., 2014), so studios may want to monetize secondary channels by releasing them as early as possible to maximize a movie's total life cycle revenues.

However, Internet distribution threatens the viability of established channels like theaters, DVDs, and cable TV pay-per-view services. The sooner movies are released for Internet download, the higher will be the cannibalization of revenues from these traditional channels. Therefore, studios and other content producers are faced with the dilemma of embracing distribution via the Internet and competing against piracy, while continuing to serve the interests of existing distributors and to protect revenues from traditional channels.

Because of the trade-offs to be considered when trying to decide when to release movies across different channels, there is substantial analytical work that models these trade-offs. The literature on this topic goes back a few decades under the umbrella of channel strategy and the timing and pricing of releases in primary and secondary channels. The fundamental managerial

problem modeled is when and at what price should a product be released in a secondary channel, to maximize revenues across the different channels (Prasad, 2004). There is also some empirical research that uncovers the existing timing of releases in secondary channels (Luan and Sudir, 2006; Hennig-Thirau et al., 2007), mostly in the context of DVDs as a secondary channel. But as far as we know, there is no empirical work that examines empirically how movies are being released in the trio of theater, DVD, and other digital channels.

In this paper, we track movie releases in theaters in the 2012 to early 2017 period, and then we record the corresponding release dates and prices for DVD and three EST services: iTunes, Amazon, and YouTube. In most situations, EST is typically released simultaneously with digital rental, so our data is representative of both. We find evidence that, during this period, the length of the DVD window has been stable at three to four months, in line with empirical evidence and models that suggest there is an optimal DVD release window. We also find that the EST release window has been shrinking at a relatively fast rate and it has converged towards the DVD window. This trend is evident even after controlling for other factors that may affect movie release timing, such as season, box office revenues, and accounting for fixed effects across studios and channels. Moreover, as of 2015, we find that on average EST was released earlier than DVD, effectively becoming the main secondary channel after theater.

Our study also investigates whether this trend is bound to continue, by testing both a linear model with steady rate of change in the EST release window, and a non-linear model with a decreasing rate of change in the EST window. The non-linear model has a better fit with the data, suggesting that pace at which the digital channel is encroaching in the theater window has slowed down.

Next we provide a review of the literature, followed by hypothesis formulation, empirical framework and model, results, discussion, and conclusions.

EXISTING THEORY AND RESEARCH ON RELEASE WINDOWS

The optimal release windows for movies is a topic generating controversial views in the literature, because of the inherent trade-offs involved. There are two major categories of factors that should affect the timing of a movie release in DVD and EST: cross-channel revenues and piracy.

Cross-channel Revenues. There is an optimal set of release dates for a movie across channels, based on the revenues generated by each channel and the cannibalization of revenues across channels. This problem has been studied in the broader context of the timing of product introductions (Prasad, 2004). If the secondary channel release is done too early, revenues from the primary channel will be cannibalized. If the release is too late, then revenues for the secondary channel will be affected, assuming that movies have entertainment value that decays over time. The faster the rate of decay, the less durable it is. If a movie has high durability, one would expect the release windows to come later than those with low durability. For example, Disney's movie Frozen was in more than 1,000 theaters in the U.S. for 4.5 months, an unusually long theater window, while the release in EST was four months after theater release. Interestingly, Frozen's revenue per theater had a sharp decline from \$2.5 million to \$1.9 million after it was released in EST, which suggests Frozen could have resisted an even longer period in the wide screens if EST had been further delayed. This example shows the potential for cannibalization of theater revenues by digital channels.

The trade-off between cannibalization of primary channel revenues and durability of a movie can be summarized as follows: the later a movie is released to DVD and EST, the less

cannibalization of theater revenues, but the losses for the secondary channels could be higher, because consumers' valuation of content decreases over time. There is a limited window of opportunity for sales in secondary channels, so the later the release in these channels, the lower will be the associated revenues.

There are also complementarity effects across channels that should be considered. Kumar, et al. (2014) found that there are spillover effects from pay-TV broadcast of movies into DVD sales. For the channels in our study, this means that exposure to movies in the theatres can have positive spill-over effects in secondary channels, and again, these effects may wane as the release in the secondary channel is delayed.

Based on these theoretical trade-offs, there is empirical evidence that suggests there is indeed an optimal release time in practice. Luan and Sudir (2006) and Hennig-Thirau et al. (2007) find empirically that the optimal release window is about 2.5 to 3 months. But the optimal release is moderated by the characteristics of the content, including durability, and the prices that are set across channels. August et al. 2014 modeled the trade-offs and found that strategic movie releases should vary depending on its durability. Ultimately, given these trade-offs, distribution executives at movie studios and others involved in content distribution face a very complex set of strategic decisions, related to the release date and price for a movie across traditional and digital channels.

Piracy. Smith and Telang (2012) and Danaher et al. (2010) suggest that in order to reduce the losses from piracy, the release windows of DVD and digital versions of movies should happen earlier. Implicit in this argument is that a sizeable share of consumers, given the option to pay a reasonable price for a non-pirated version of a movie, will be willing to do so. The problem is that, up until recently, before DVD/EST release there has been no legal option for consumers

to watch a movie in a digital channel, and the only alternative is to watch pirated versions. Until recently, major studios have preferred to respect the 3-month theater window to cater to theater owners and to protect theater revenues. That has left piracy of movies uncontested during the theater window, providing the pirates the opportunity to thrive and become increasingly sophisticated.

In contrast to the argument that DVD/EST release dates should come earlier to curb piracy, there is the possibility that piracy is a complement to legitimate content. The underlying rationale is that piracy and movie sales are complementary, because illegal viewing creates viral or promotional effects that lead to overall higher movie sales. If that is the case, then the traditional practice of delaying DVD/EST releases could be justified. But while there are a few studies that appear to support this argument (Martikainen, 2011; Smith and Telang, 2009), the overwhelming evidence in the literature suggests that piracy has a negative effect on movie sales (Smith and Telang, 2012).

One partial solution to the increasing piracy problem is to release legitimate digital copies of a movie earlier, within the 3-month theater window. There is evidence that suggests that this is a viable solution to curb piracy. Danaher and Waldfogel (2012) found that lags between U.S. and international release dates caused a 7% reduction in movie sales. Smith and Telang (2012) found that an increasing lag between the DVD dates and the first illegal DVD source reduced DVD sales by 2%. Therefore, earlier releases of legitimate digital copies of a movie are bound to reduce piracy.

Each secondary channel brings with it the possibility of pirate copies, but the economics significantly changed with the digital revolution. Before movies could be solid in digital format, it was more difficult for piracy to thrive, and many consumers had little choice but to wait for

movies to be released in video cassette, pay-per-view, or TV programming to enjoy them at home. Then pirated copies of DVDs emerged, and movie piracy increased. Now, with the possibility to distribute content via the Internet, movie piracy is rampant. Moreover, consumers are increasingly demanding content anywhere and anytime, and given the option for pirates to use the Internet to distribute illegal copies fast and inexpensively, the motion picture industry is under increasing pressure to re-consider the release windows of movies in DVD and EST.

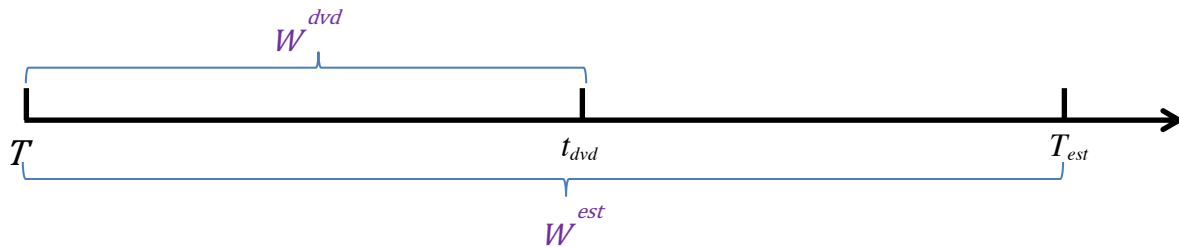
In this paper, we provide the results of four years of data collection and analysis on movie release windows in theater, DVD, and EST. This is a descriptive analysis that seeks to understand how studios are responding to the increasing pressures to bring DVD and EST release dates closer to the theater release date, while managing the trade-offs between cannibalization from earlier releases, and loss of revenues in the secondary channel and to piracy from later releases. Our econometric analysis provides specific measures to show how the EST release windows are fast encroaching on the DVD and theater windows.

MODEL SETUP AND HYPOTHESES

We define t_{dvd} and t_{est} as the release dates for DVD and EST respectively, relative to the theater release date T . Release windows for DVD and EST will then be as follows, and illustrated in Figure 1:

$$W^{dvd} = t_{dvd} - T \quad \text{and} \quad W^{est} = t_{est} - T.$$

Figure 1. Model Setup



Since the 1990s, the DVD release date has been converging towards the theater release date, resulting in a reduced DVD release window. In a span of 15 years, the DVD release window has shrunk almost in half, from an average of 200 days in 1998 to 115 days in 2014 (Tribbey, 2015). This trend suggests that the cannibalization of theater revenues is lower than losses due to a delayed DVD release. Moreover, consistent with the findings of Luan and Sudir (2006) and Hennig-Therau (2007) that an optimal DVD window is 2.5 to 3 months, there is still room for the DVD release date to converge towards theater release, resulting in a reduced DVD release window.

In addition, for the sample of movies we study, we found that 95% of the theater revenues are captured within the first two months, which adds to the expectation that over time, DVD releases will converge further towards the theater release. Therefore, we hypothesize:

Hypothesis 1: The DVD release window W^{dvd} shrinks over time; that is, over time t_{dvd} converges to the theater release date T .

The next question of interest concerns the release window for EST services like iTunes. There are three strong incentives for studios to release movies earlier for EST. First, given the proliferation of Internet-based distribution services for movies and the consequent competitive pressures across online distributors, there should be a supply-side trend for the EST window to converge towards the theater release date. Second, from the demand side, consumers

increasingly want content on-demand, which adds to the pressure for studios to release movies for EST earlier in the distribution window.

Finally, if you consider piracy as a low-cost competitor, and often the lone distribution channel late in the theater window, there is an incentive for studios to release movies for EST earlier in order to compete with pirates. The success of Netflix and other digital distributors can be partially explained by the fact that they provide content on-demand for a low fee, which effectively competes with piracy. Therefore, we hypothesize that the release date for EST services should converge towards the theater release date, resulting in a reduced EST release window.

Hypothesis 2a: The electronic sell-through window shrinks over time; that is over time t^{dig} converges towards the theater release date T .

Building on the tenet from modeling and empirical research that suggests there is an optimal EST release window, it is reasonable to assume that the EST window shrinks at a decreasing rate, asymptotically to the optimal release date. More specifically, as the risks of channel conflict and of cannibalization of theater revenues increase, convergence to an optimal release date is to be expected. Therefore, we hypothesize:

Hypothesis 2b: The electronic sell-through window shrinks at a decreasing rate.

Next, we develop the empirical model and describe the data collected for this study.

EMPIRICAL MODEL AND DATA

We collected data on 320 movies released in theaters during the period January, 2012 and March, 2017. The data includes release dates and prices for theaters, DVD, and the EST services

of Apple (iTunes), Amazon, and YouTube. In order to test the hypotheses, we first developed a model of the factors that affect the release date of movies into secondary channels. Based on the literature, we identified the following variables that affect release dates:

Price: The optimal time to release a product for sale in a secondary channel depends on its price. Even though the price is dependent on strategic decisions around product positioning, content quality, and other industry practices (e.g., negotiations between studios and distributors), release date in a channel and the respective price are simultaneous decisions, so there is a risk of endogeneity when including price as a predictor of the release date. That is, the expectations for revenue based on a set price for a given channel may influence the release date decision, but because these decisions are simultaneous, the release date decision may also influence the price at which the movie is released on that channel. We address this endogeneity problem by using instrumental variables for price, described below.

Season: The traction that movies get in the market during the summer and holiday season may increase the potential revenues during the theater window, leading to a later release in secondary channels like DVD and EST. Therefore, we control for summer and Christmas holiday seasons and hypothesize that movies released in theaters during these two seasons will be released relatively later in DVD and EST. We categorize May–August as summer months and December as end-of-year holiday.

Quality vector: We consider two movie quality variables, opening weekend box office as a signal of quality from the consumer side, and movie production budget as a proxy for the quality intended from the supply side.

Opening Weekend Box office: Box office revenues indicate the relative qualities across movies based on differences in box office revenues. Here, the literature is mixed in terms of how

opening weekend box office may influence release dates. First is the argument around cannibalization, that anticipation of high revenues in the theaters provide an incentive for studios to release late in secondary channels.

On the other hand, Lehman and Weinberg (2000) find that success in the first channel is a predictor of success in the secondary channel. More generally, Kumar et al. (2014) find that exposure to a movie in a channel can have spill-over effects in other channels as information and buzz about the movie is shared.

Therefore, box office revenues embed two countervailing effects on release dates: Release late to avoid cannibalization of box office revenues, or release early because box office revenues predict that secondary channel revenues will be higher. We use box office during opening weekend in our model since it is a very good predictor of the total box office often, but it is less correlated with the other variables.

Production budget: We use production budget as another possible predictor of movie quality. The budget includes the cost of making the movie and excludes marketing budget.

Based on the price and quality discussion, the model for the EST release window is:

$$W^{est} = \alpha T + \eta P + \delta Season + \gamma Q + \beta Studio + \sigma Dig + \epsilon, \quad (1)$$

where α , the coefficient of T , is the estimate of interest. In this model, T is the theater release date, indexed to a fixed date in the past (January 1, 2011). That is, we are interested in knowing whether over the period of the study, the length of the EST window is changing, after controlling for other factors that may affect the release date. P is the EST price, Q is the vector of quality variables (includes opening box office revenues and production budget), $Studio$ is a set of dummy variables for each major studio in the study (Sony, Paramount, Fox, Universal, Disney,

Warner, and Lionsgate). *Dig* is a set of dummy variables that represent the fixed effect of each EST service (i.e. iTunes, Amazon, YouTube), and ϵ is the error term.

The model for the DVD window is almost the same as the one for EST, except there are no EST service dummies.

$$W^{dvd} = \alpha T + \eta P + \delta Season + \gamma Q + \beta Studio + \epsilon \quad (2)$$

Endogeneity

The price of a movie in the different channels is typically set in relation to the release date chosen. Therefore, there is a simultaneity effect that makes this variable endogenous. Also, setting the price in a channel is determined by other variables that could also correlated with the release window length, yet not included in the model, which could bias the results. To address these potential endogeneity problems with P , we perform a 2SLS regression on the DVD and EST release windows, using the following variables as instrumental variables for P : theater release index T , *average rating* and *theater profit margin*.

The average rating is an indicator of the price that the market is willing to pay, based on consumer ratings of the content. We use a rating the combines IMDB and Rotten Tomatoes ratings. The profit margin of a movie, operationalized as box office revenues divided by production budget, is a proxy for cost factors that can influence the price at which the movie is released in the secondary channel.

Using the instrumental variables for price, we performed a Hausman test for endogeneity in the EST model. We do not find support for the hypothesis that endogeneity is present (Digital: $\chi^2(10) = 12.76, p=0.23$). We find face validity for this based on conversations with industry executives. Pricing of movies in secondary channels is still pretty non-scientific, and mostly

based on standard price setting across the industry. Therefore, it appears that pricing in secondary channels is often adopted as an exogenous variable.

Consistent with the endogeneity test, we find the main results to be consistent in both OLS and 2SLS estimations. Therefore, in the next section we simplify our exposition by presenting the results of the 2SLS runs.

RESULTS

We performed a test for heteroscedasticity in the EST and DVD release window models, using the Breusch-Pagan test for constant variance. We find support for the existence of heteroscedasticity in both models (Digital: $\chi^2(1) = 561.86, p < 0.001$;) DVD: $\chi^2(1) = 7.82, p=0.01$). Therefore, we report results with robust standard errors to account for the existence of heteroskedasticity.

There are no multicollinearity problems in our regressions because the lowest correlation between two regressors is 0.62, which was confirmed by the resulting Variance Inflation Factors of 1.67 and 1.66 for the EST and DVD models, respectively.

Interestingly, we find the DVD window did not change much during the period of our study. Table 1 presents the results of the estimation of the DVD window model. The DVD window has remained stable over the period of the study after controlling for other factors that affect the DVD release date. The coefficient for T is small but statistically significant ($-0.01, p = 0.002$), so while we cannot reject Hypothesis 1, the evidence shows that the DVD window has only mildly converged towards the theater window in the period 2012 to early 2017, at a rate short of three days per year.

Table 1. Regression Results for the DVD Window

Variable	Coef.	Robust SE	<i>t</i>
<i>T</i>	-0.008**	0.003	-3.13
<i>P</i>	-0.43*	0.23	-1.86
<i>Budget (\$MM)</i>	0.03	0.03	1.26
<i>Open Weekend Box Office (\$MM)</i>	0.10*	0.05	2.01
<i>Season</i>	-0.46	2.56	-0.18
<i>Sony</i>	-9.31*	4.46	-2.09
<i>Fox</i>	-2.69	3.78	-0.71
<i>Universal</i>	1.27	3.97	0.32
<i>Disney</i>	10.87*	5.00	2.17
<i>Warner Bros.</i>	-6.67	4.18	-1.59
<i>Lionsgate</i>	-3.94	4.58	-0.86
<i>Constant</i>	124.76***	5.91	21.11
R-squared	19.5%		

Note: * = $p < 0.1$, ** = $p < 0.01$, *** = $p < 0.001$

In contrast, we find evidence that the EST window has shrunk towards the theater release date (see Table 2). The coefficient estimate for *T*, our variable of interest, is -0.064 ($p < 0.001$). That is, the later in the study period that a movie was released, the shorter is its EST window, after controlling for other factors that could affect it. So we find support for Hypothesis 2. Over time, the EST release date has been converging towards theater release at an average rate of about 23 days per year during the period 2012 to early 2017.

Table 2. Results for Electronic Sell-Through Window – Linear Model

Variable	Coef.	Robust SE	<i>t</i>
<i>T</i>	-0.064***	0.003	-18.87
<i>P</i>	-4.01	5.11	-0.78
<i>Budget (\$MM)</i>	0.05	0.03	1.40
<i>Open Weekend BoxOffice (\$MM)</i>	0.17**	0.06	3.15
<i>Season</i>	12.55***	2.55	4.92
<i>Sony</i>	2.50	4.28	0.59
<i>Fox</i>	-7.64	6.32	-1.21
<i>Universal</i>	7.35	5.89	1.25
<i>Disney</i>	39.42**	19.06	2.07
<i>Warner</i>	7.29	12.17	0.60
<i>Lionsgate</i>	9.59	11.73	0.82

<i>Amazon</i>	0.05	2.92	0.10
<i>YouTube</i>	2.46	2.98	0.02
<i>Constant</i>	253.45***	79.24	0.82
R-squared	52.1%		

Note: * = p<0.1, ** = p<0.01, *** = p<0.001

One interesting finding is that the coefficient for Disney in the EST model is the only significant studio dummy in the 2SLS run (coefficient = 39.42, $p = 0.039$). It is also the only positive and significant coefficient in the 2SLS run for the DVD model (coefficient = 10.87, $p = 0.03$). This suggests that Disney can afford to delay its EST release by about 39 days on average relative to competition, and it can delay its DVD release by 10 days. We cover the implications of this finding in the Discussion section.

In order to test hypothesis 3, that the EST window is shrinking at a decreasing rate, we developed a log-linear version of the EST model, as follows:

$$\ln W^{dig} = \alpha \ln T + \eta \ln P + \delta Season' + \gamma \ln Q + \beta Studio' + \sigma Dig' + \epsilon. \quad (3)$$

Table 3. Results for Digital Sell-Through Window – Non-linear Model

Variable	Coef.	Robust SE	t
<i>T</i>	-0.58***	0.02	-30.48
<i>P</i>	-0.21	0.64	-0.33
<i>Budget (\$MM)</i>	0.02*	0.01	2.44
<i>Opening Weekend Box Office (\$MM)</i>	0.01*	0.01	2.01
<i>Season</i>	0.09	0.02	5.51
<i>Sony</i>	0.03*	0.03	0.91
<i>Fox</i>	-0.03	0.05	-0.65
<i>Universal</i>	0.07	0.04	1.60
<i>Disney</i>	0.29**	0.13	2.14
<i>Warner</i>	0.03	0.09	0.32
<i>Lionsgate</i>	0.54	0.10	0.52
<i>Amazon</i>	0.001	0.02	0.15
<i>YouTube</i>	0.02	0.02	0.07
<i>Constant</i>	9.24***	1.75	0.81
R-squared	57.3%		

Note: These results are for the log-linear model in Equation 3.

* = p<0.1, ** = p<0.01, *** = p<0.001

The result of the EST 2SLS log-linear regression provides a model fit of 57.3% R-squared, compared to 52.1% for the linear model. Therefore, we find modest support for the hypothesis that the EST window is shrinking at a decreasing rate, since the log-linear model has a better fit. As we will see in the next section, this moderate difference in model fit between the linear and non-linear models can be explained by the fact that a significant inflection of the slope of the EST window curve started in 2014. So while numerically it appears both the linear and non-linear models have a similar fit, the non-linear trend is more evident.

Notice that in both the non-linear model the same coefficients are significant (except for *Budget*, which has a small but moderately significant coefficient in the non-linear model but not in the linear model), namely the date of theater release, opening weekend box office, season, and the Disney dummy variable. This consistency across models suggests robustness of the design and choice of variables to explain the release window phenomena, and consistency in the trends, whether you model it linearly or non-linearly.

DISCUSSION

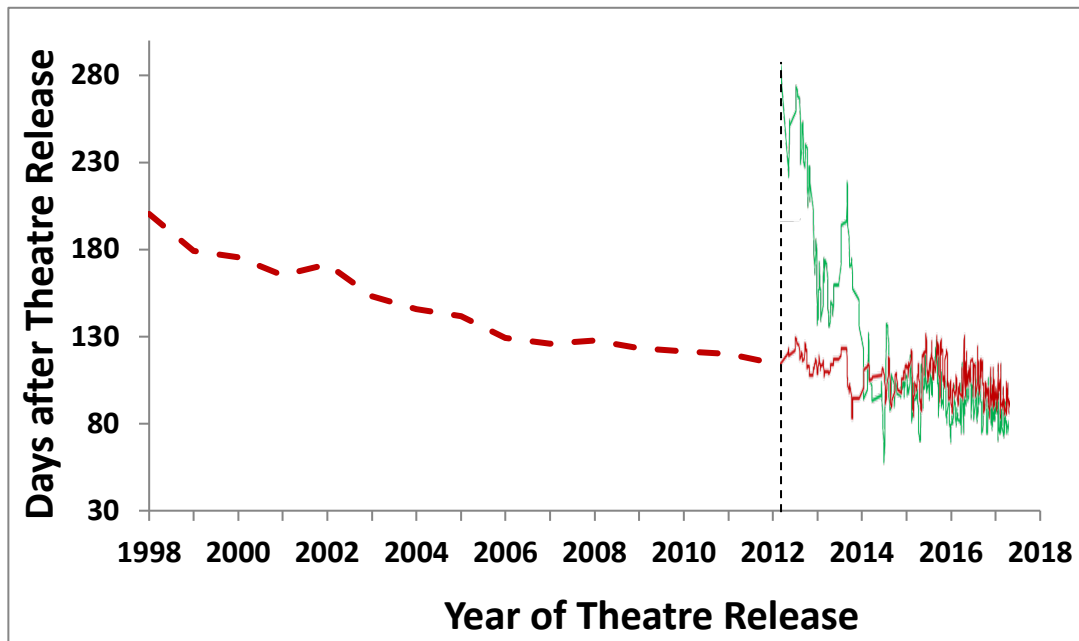
Our results provide support for the hypotheses on the convergence of the EST window to the DVD window, and the decreasing rate of convergence of the EST window. In this section we discuss these findings further, with more in-depth empirical regularities found in the data.

The Convergence of EST and DVD Releases

One of the surprising findings in our study is that the DVD release window has remained stable during the period of our study. Our results show that the DVD window has shrunk by about 3 days per year since 2012, controlling for other factors that may affect the DVD release

date, and accounting for studio fixed effects. This is in sharp contrast with the constant and significant shrinkage of the DVD window in prior years, as Figure 2 shows.

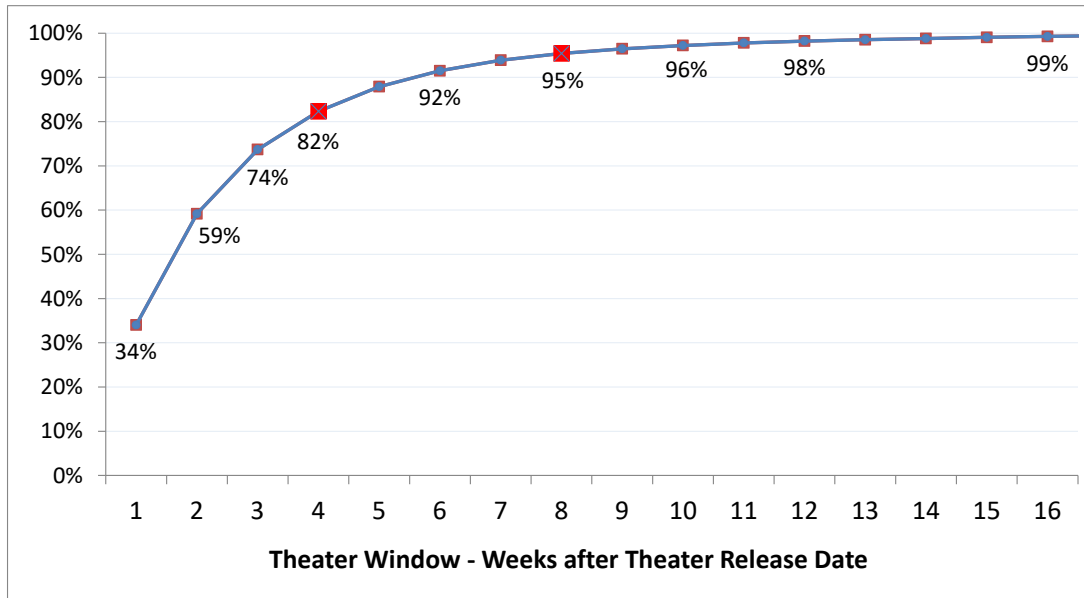
Figure 2. DVD and Electronic Sell-Through Release Windows (1998-2017)



Sources: 2012-2017 Fitted values of 2SLS regression in our study. 1998-2012: Tribbey (2014)

One possible explanation is that industry executives recognize that further shrinkage of the DVD window will come at the expense of box office revenue losses. For the movies in our sample, we tracked the cumulative theater box office revenues. Figure 3 shows that 99% of box office revenues were captured within four months after theater release, although 95% are captured at two months. For durable movies the window is even longer. Disney's *Frozen*, for example, accumulated 95% of its domestic box office revenues in 3.5 months. So studios and theater owners may prefer to protect all theater revenues from cannibalization by DVD distribution, by keeping the DVD window at about 3 months after theater release.

Figure 3. Cumulative Box Office Revenues



Note: Cumulative box office revenue curve (as a percent of total revenues for movies in our sample).

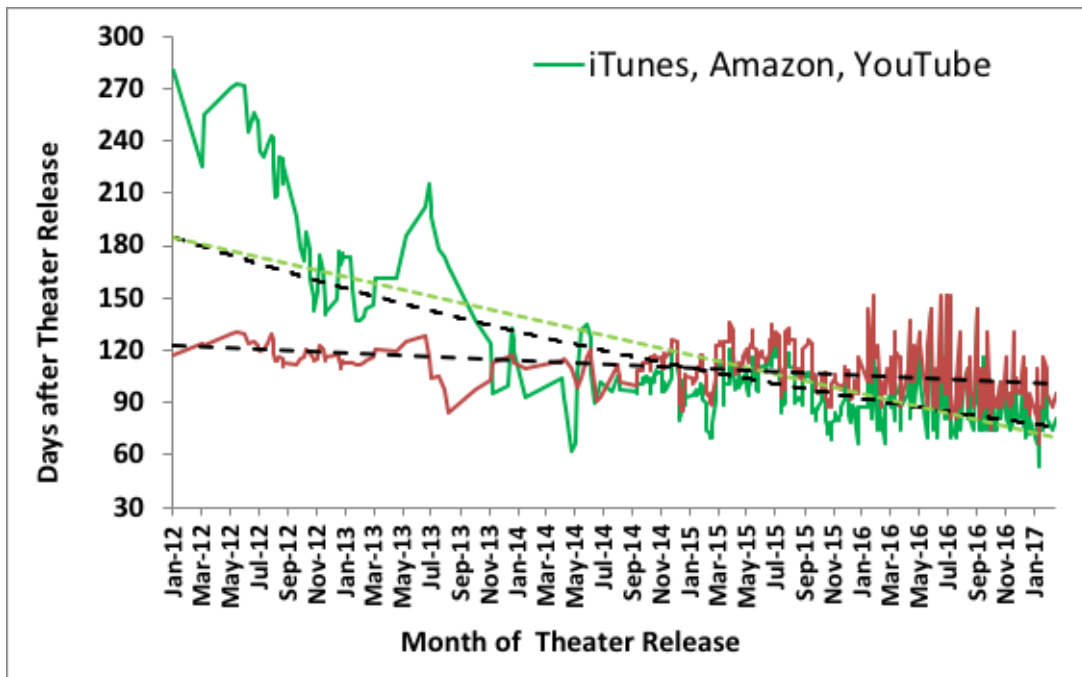
Another important finding is that, while the DVD release window has remained stable since 2012, the release date for EST (and rental) services via iTunes, Amazon, and YouTube has been converging towards the theater release date, at the expense of DVD revenues and possibly even theater revenues. In fact, as Figure 2 shows, for movies released in theater in the summer of 2014, the EST and DVD windows have converged.

However, as August et al. (2014) suggest, there is variability in this shrinkage of the EST window, depending in part on the durability of the content. Our empirical results show that Disney, with a slate focused on motion pictures for children, has an EST window 10 days longer for DVD and 39 days longer for EST, on average. Disney movies are known to have relatively high durability with a slate that targets children, who tend to be loyal to the brand. In addition, motion pictures for children creates cross-selling opportunities with other complementary products like merchandise and resort experiences. Our study provides empirical evidence that is consistent with the claim that Disney content is more durable than others.

Based on our results, the EST release date has been approaching the DVD release date at a steady and significant average rate of about 23 days per year. Within only two years, we have seen the average EST release window shrink by more than half, from 255 days in the 2nd quarter of 2012 to 114 days in the 2nd quarter of 2014. The EST window has pretty much reached the average 113 day DVD window in our sample. However, the pace of reduction of the EST window is in sharp contrast with the 15 years it has taken for the DVD window to shrink in half.

Looking at the trends for theater releases after summer of 2014, some movies were released simultaneously in both DVD and EST, and there are multiple cases where EST releases occur before DVD release. Figure 3 shows the results for the full period of our study. The graph contains smoothed fitted curves from our regressions, and trend lines based on the coefficient estimates. First, you can see the relatively flat trend of the DVD window, with a noticeable but very modest decrease in the last years, consistent with our findings.

Figure 3. DVD and Electronic Sell-Through Release Windows (Jan. 2012 – Jan. 2017)



In contrast, there is a sharp decline of the EST window. The graph shows how the convergence of the two curves happens around 2014. Then the trend continues for DVD and EST, so the EST window has continued to shrink past the DVD window, encroaching on the 3-month theater window. The average EST release window in early 2017 was 86, compared to 95 for the DVD window, which suggests after 2014, EST has effectively become the secondary distribution channel, debunking DVD.

The trend line of DVDs shows a slightly negative slope, consistent with our finding that $T = -0.008$ and it's significant. This suggests the DVD release date is being modestly dragged into the theater window as the EST window converges towards theater release. Therefore, the DVD window is also gradually starting to encroach into the 3-month theater window as EST leads the way.

EST Window Decrease at a Decreasing Rate

Figure 3 shows linear and non-linear trend lines for the EST window. The non-linear trendline has a slightly better fit, in line with our results. The graph provides face validity for our empirical findings supporting Hypothesis 3, that the EST window is shrinking at a declining rate. It appears the shrinkage of the EST window is coming to a halt, as it would be expected because of the potential channel conflict with theaters and risk of cannibalization. The studio-theater partnership for movie success is long-standing, so it may take time before EST encroaches further into the theater window.

Nevertheless, based on our analysis of the cumulative theater revenues, it is possible that the EST release window will settle somewhere between two and three months after theater release, in line with existing literature that has empirically determined this may be the optimal release time for a movie's secondary channel. This possible outcome dictates a move by DVD distributors to

advocate earlier releases in their channel, to compete with EST. Otherwise DVD channel distribution is bound to suffer a serious decline, as it gives in to EST's earlier and convenient delivery of content to consumers.

There is a precedent to be considered in order to understand why the pace of convergence of the EST release to the theater release is slowing down, and whether it will eventually come to a halt or restart. While studio incumbents need to continue adapting to disruptive innovation, a few startup companies have attempted to challenge the status quo by bridging the gap between digital and traditional distribution channels and windows. One emerging phenomenon is premium video-on-demand (PVOD), whereby studios and entrepreneurs are studying the possibility to release movies in digital channels within the 3-month period after theater release. By reviewing its developments, we can see how studios struggle with the potential channel conflict with theaters and with the risk of cannibalization of theater revenues, but at the same time try to introduce content within the traditional 3-month theater window.

In 2010, multiple studios announced they planned to test the waters for PVOD services that would release theatrical films through various services, such as DirecTV, In Demand and Time Warner Cable, around 30-60 days after initial theatrical release for approximately \$25-30 for a 2-day unlimited viewing rental for a limited number of titles. The rationale behind the plan was that DVD sales were plummeting, marketing spend and awareness could be optimized, and that theaters most of the time reap approximately 90% of a film's revenue in its first 30 days.

This initiative never rolled out on a wide scale, though a few attempts occurred with major pushback from theaters and low adoption from potential customers. One key issue is that post-theatrical fees from VOD, SVOD, Cable TV, etc., depend on box office performance, so cannibalizing theatrical revenue was not in the best interest of either exhibitor or studio. Even

today, opening weekend box office is commonly used in negotiations for fees and prices in secondary channels, which creates an artificial incentive for both studios and theaters to minimize cannibalization from digital channels.

Universal Studios planned a premium VOD release to Comcast subscribers in Atlanta and Portland of *Tower Heist* for \$59.99 just three weeks after its theatrical premiere on November 4, 2011. The plan caused major uproar from exhibitors, many of them refusing to show the film. Universal ultimately abandoned its plan in response to the negative backlash.

While one could argue that these PVOD offerings were not of titles with the highest viewing potential, i.e., blockbuster films, the titles also did not get full marketing support of either theaters or VOD channels compared to a typical theatrical release. These attempts were false starts at the PVOD concept. A popular view is that the \$30 price point for a film that is already two months old was too high for consumers.

Three recent initiatives suggest PVOD will gradually develop, as studios and theaters find comfort in releasing movies in other channels earlier than three months after theater release. One is Prima Cinema, which is backed by Best Buy, Universal, IMAX and other investors. For \$35,000, consumers can purchase a Prima Cinema's hardware system installed in their home theater. It uses a finger-print authenticating digital security system. Each title costs \$500, which can sit on a local server, or you can pay \$20,000 for unlimited titles annually, though Prima Cinema's film library does not carry all studio films. The market for this service is very limited, since before a potential customer even considers paying for Prima Cinema, they need to have an expensive home theater that could cost upwards of \$100,000.

Then, in March 2016, a new service called The Screening Room was announced. While it is in development and has yet to launch, it is headed by Napster co-founder and former Facebook

president Sean Parker and features an advisory board of former movie studio heads. The Screening Room model entails customers paying \$150 for a set-top box, then \$50 to rent each newly released theatrical title for 48 hours. In order to incentivize exhibitors, up to \$20 of that \$50 fee will be shared with a local theater of the customer's choice, and customers may also receive two free movie tickets. Film directors' opinions seem to be split on the legitimacy of The Screening Room, while studio and exhibitor executives are shying away from the concept.

Finally, in 2017 Paramount Studios launched the first virtual reality theater. A viewer can put on a VR headset and immerse into a virtual theater, as you would in a brick and mortar theater. These attempts at bringing PVOD to the market may eventually also pave the way for further reduction in EST and DVD windows. As a premium service, PVOD is more acceptable in the industry because it leads to less cannibalization and channel conflict, so it may resonate better with studios at an initial stage.

The other inhibitor of earlier digital releases is piracy. In one isolated case, Sony's *The Interview* was essentially forced into a day-and-date release because of rampant piracy of the title and death threats from cyber criminals that leaked the film and Sony's private emails to the public. Piracy continues to be an incentive for studios to release movies in digital channels earlier within the traditional theater window, despite the fear of cannibalization and channel conflict.

CONCLUSIONS

In this paper, we have shown how the EST release date for movies is converging towards the theater release date at a decreasing rate, using a sample of movies released within the period 2012 to early 2017. The pace at which this convergence has happened suggests that the story is not over, and that there will be plenty of fluctuation and movement in the structure of movie release windows. Future research can continue to monitor the trends, to see where the release windows

settle at equilibrium. Given that most of the theater revenues are captured within the first two months (and 80-90% is captured in the first month) and given that movie piracy shows no signs of slowing down, there will be increasing pressure for studios to release movies earlier in secondary channels to increase revenues coming from these channels. Premium VOD experiments may then pave the way for further encroaching of EST and DVD into the theater window.

Regarding opportunities for future research, it will be interesting to continue to track digital release window trends, perhaps with a larger sample. Also, this study did not include movie releases by digital distributors like Netflix and Amazon, which are shaking the industry with their bold moves. It will be interesting to track how these digital distributors release their original content. For example, Netflix experimented with day-and-date releasing *Crouching Tiger 2* in a few theaters as well as direct to video in February 2016. Using a different tactic, they financed a series of four Adam Sandler films that would skip theaters and be released exclusively on Netflix. The first of the series of films, *Ridiculous 6*, while receiving the lowest possible score of 0% on Rotten Tomatoes, managed to break viewing records on Netflix, which does not disclose specific viewing numbers.

Amazon takes a different tactic, maintaining exclusive theatrical windows with their original films, e.g., Spike Lee's *Chi-Raq* which was viewable on Amazon Prime one month after its theatrical release in December 2015. The \$15 Million budgeted film earned \$2.7 Million at the box office. Amazon is estimated to spend \$3.5 Billion on content in 2016 and expected to increase that budget by \$500 Million each year for the next several years.

This study also did not track releases in the pay-TV window, which happens about six months after theater release. Future research can track the extent to which major studios release their movies in the pay-TV window using distributors like Netflix and Amazon. For example, Disney

struck an exclusive deal with Netflix to distribute its 2016-2018 movies during the pay-TV window. The results from this study suggest that, given the durability of Disney movies, perhaps Disney is in a position to develop its own distribution and capitalize on the value of its slate.

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