2020

The Impact of Production Budgets on Theatrical vs. Non-Theatrical Revenues in the Movie Industry

Naveen Shastri

Recommended Citation

The Impact of Production Budgets on Theatrical vs. Non-Theatrical

Revenues in the Movie Industry

Senior Thesis in Economics

Economics 180 Teachers: Professors Antecol and Finley

Thesis Advisor: Professor Filson

May 11, 2020

Table of Contents

Introduction

When studios or independent producers greenlight movies, they allocate a production budget. This budget helps pay for actors' salaries, props in various movie scenes, screenplays and other aspects of the movie production process. To guide production and marketing decisions, it would be useful to be able to predict how producing a high vs. low budget film alters the relative importance of different revenue streams. I investigated this question using data on movies from 2006 to 2016. Specifically, the question this thesis answers is: How is the ratio DVD sales/total revenues expected to change for higher budget movies?

Previous literature related to this topic can be broken down into three categories: background information on the filmmaking process, factors that impact movie revenues, and determinants of the relationship between box office and DVD revenues. The Background section relies on magazines and other entertainment-related sources to describe the steps of producing a film. The Literature Review section discusses the latter two categories. Different authors have examined how metrics such as ratings, star presence and other factors are correlated with box office revenues (the most common metric utilized to assess a movie's financial success). Authors have also compared which movies are successful in the DVD vs. theatrical movie markets. A primary goal has been to determine whether there is a relationship between a film's box office and its DVD revenues.

Prior research does not directly address my research question, because the authors did not discuss DVD and theatrical revenues in proportion with each other (only in absolute terms).

Thus, this thesis contributes to the literature by analyzing the relationship between a movie's production budget and its DVD sales/total revenue.

I use an OLS regression model with production budget as my independent variable of interest and a movie's revenue ratio as the dependent variable. I include several standard controls such as movie ratings and genres. Most importantly, I include dummy variables to control for the year of release for a given movie. This is critical because as shown in Figure 1, movie DVD revenue ratios declined over time as alternative non-theatrical revenue streams (such as digital revenue streams) became more important.

When conducting the empirical analysis, I design three regressions based on the dependent variable discussed. The three dependent variables, all in natural log form, are: DVD/DBO (Regression 1), DVD/FBO (Regression 2) and FBO/DBO (Regression 3). DBO stands for domestic box office revenues, DVD stands for domestic DVD revenues, and FBO for foreign box office revenues. The results of these three regressions are provided in Table 3. The most important results lie in the Ln(Production Budget) coefficients. For each regression respectively, the coefficients were: 0.0370, -0.436 and 0.474. These effects reveal that the elasticities of the different revenue streams with respect to the production budget are significantly different. From greatest to least, ranking of elasticities is: foreign box office, domestic DVD revenues, and domestic box office revenues. This critical finding suggests that movies might generate more revenues in overseas markets. Our current globalized world could help make it a reality that audiences in different countries with similar preferences for a given movie (especially high-budget ones) view it no matter where it was made/produced. Directors of major franchise films, which are often produced with a high budget, expect that audiences in

various countries will like their films and desire to see more of them. For instance, fans around the world love Disney movies, Star Wars etc. In addition to these results, findings from other categories encompassing some non-budget variables in the regression equation (genre, theaters, sequel and foreign) are discussed in the paper.

I proceed as follows. First, the Background section describes how movies are made and the revenue streams. Then, the Literature Review section reveals how previous authors have investigated how movies generate revenues of various types (DVD and box office, in particular). It also details how this thesis will further these studies' findings. After this, the Data section describes the variables that are utilized in the regression equation. Specifically, it provides sources, definitions and summary statistics. Most importantly, the Empirical Strategy and Results section reveals findings from this thesis's data analysis of a cross-section of movies. This cross-section contains movies that have a variety of budget amounts in order to compare high with low-budget movies. Finally, the Conclusion section summarizes the key findings from the thesis and provides recommendations for future work on this topic.

Background

Since the 1980s, the film industry has been exposed to different distribution mediums. Two sources, Parker (2011) and Coplan (2006), discuss the history of film distribution starting from the 1990s. Before this time, video cassettes were a very popular means for consumers to access movies of their choice. The number of rental stores rose as VHSs became more popular (Knoji, 2012) . However, movie studios did not want to associate with these stores, so they developed a distribution strategy that involved marketing their videos to wholesale distributors. These large distributors would purchase the movies and in turn, sell them to video rental stores. Later on, studios decided to engage directly with the rental stores; this business model consisted of them selling movies to the stores, in exchange for part of the video stores' revenue from these titles (2012). Each transaction was conducted differently, as video stores and studios tried to maximize their own profits. Then, studios and consumers alike became aware of the DVD, a new disc medium. DVDs became adopted by major studios in the late 1990s, which altered their business strategies (Parker, 2011). DVDs are cheaper to produce than VHS cassettes (New York Times, 2004). Studios decided to sell a majority of their movie titles on DVD for under $30 (It Still Works, 2019). This increased their profits and decreased the influence rental stores had on movie distribution strategies. Now, consumers could have access to DVDs in retail stores. This phenomenon is defined as the "sell-through model," (Coplan, 2006). In turn, studios realized they could generate more revenues by pursuing a DVD-focused distribution strategy over a

VHS-focused one. In addition, DVDs allowed directors to customize their movie (inserting

behind-the-scenes segments etc.) and provide better graphics to consumers (Parker, 2011). On

the demand side, US consumers purchased an increasing amount of DVDs until 2005, when over

70% of American households possessed them (Coplan, 2006). This phenomenon was due to the

devices' technological appeal and DVD hardware prices consistently decreasing (Coplan, 2006).

The growth of DVD-induced movie sales was critical to studios' successes during this time.

However, as Coplan (2006) points out, DVD sales started to decline in 2005. More

importantly, he indicates that overall home video sales declined by 1% YoY during this year.

This trend indicates that consumers were deciding to buy less discs/VHSs and pursue other

viewing options. In particular, audiences desired to stream their favorite films on digital

platforms such as Netflix or Video on Demand (VOD). According to Nelson (2010), consumers

started to switch over to digital platforms around 2010.

This major phenomenon in the entertainment industry can be revealed best through the

business strategy of Netflix. The company was founded in 1997 by Reed Hastings and Marc

Rudolph when they created a DVD rental service. The Netflix founders always tried to visualize

the future market (Business Models Inc.). In their rental service, customers would choose which

DVDs they desired on an online interface, then have those titles delivered via post to their

homes. The founders adopted a fixed monthly pricing model (a subscription). This

subscription-based model made the price predictable for customers, while allowing access to all

of the company's titles. The company's popularity increased over time. In 2007, as DVD sales

started to decrease, Netflix decided to pivot its business model yet again to focus on two things:

providing streaming services on its platform and maximizing its customers' experiences (Business Models Inc.).

Nelson (2010) indicates that as studios realized a majority of their revenue would come from online viewing mediums, they decided to pivot their distribution strategies to maximize the number of options a consumer can choose from to view a specific film. One example highlighted in Nelson (2010) is a "connected viewing" strategy. This entails audiences being able to see films on different platforms (including online ones). For instance, a studio may choose to pursue displaying a film on Netflix with special behind-the-scenes footage to attract more consumers. This would draw audiences who may be too lazy to see the movie in theaters, but willing to pay a small price for watching the film in their own homes.

Most critically, Nelson (2010) asserts how the emergence of different digital viewing options has completely altered film windowing strategies. Studios can showcase films in different chronological steps, called windows. This helps draw consumers to watch the film in a variety of ways. However, as Nelson (2010) discusses, it also ensures that exhibitors (theater owners) and distributors (online/retail) can maximize their profits as well in the process. Due to lower box office sales and the easiness of pirating a film online, Nelson (2010) points out that the normal windowing timeline (theaters, DVD, and online platforms) is moving towards a simultaneous distribution strategy. Studios realized they had to adapt to this rapidly changing landscape within the film industry.

While studios' choice of distribution mediums have shifted over the past two decades, it is also critical to analyze how they produce films. Film production budgets usually include three

components: pre-production, production, and post-production (Moore, 2019). Pre-production

costs can involve persuading certain stars to join the film or securing any necessary rights to

make production occur. These are also called above-the-line costs in entertainment. Meanwhile,

production costs include salaries of actors, directors, screenwriters etc (Mueller, 2019). This

category is referred to as below-the-line costs (Moore, 2019). Besides these two major

components, a film budget usually contains any incurred financing/legal costs, producer fees,

and completion guarantees. Producer fees exist so that studios directly involved in producing the

movie will definitely receive income from it. On the other hand, completion guarantees are put in

place to help ensure that the film is produced and distributed as agreed upon by the according

parties (studios, financiers, and distributors) (Moore, 2019). These comprise the major

components of a film budget, although specific films might have additional categories as seen

relevant by the respective studios producing them.

Film production budgets vary extensively. For instance, James Cameron's Avatar has

been the most profitable film so far, and it cost $425 million to produce (PARLAY STUDIOS,

2017). However, independent (or smaller) film budgets have the possibility of being under $1m.

As this thesis will focus on analyzing larger films, here is an example of a large film (remake of

Annie) budget breakdown (*PARLAY STUDIOS | THE TAKE,* 2017) :

Category	Budget Amount (in millions of dollars)
Salaries of Cast, Producer and Directors	22

Rights and Writers	8
Other Production Costs (Set building etc.)	34
Post-Production Costs	9.5

Another reason that film budgets are important to determining a film's success is that distributors will pay movie studios a certain fraction of the production budget for the right to start marketing films to audiences (Moore, 2019). Producers choose to utilize measures such as producers fees to increase the supposed budget of a film (PARLAY STUDIOS, 2017). This clearly inflates budgets artificially, and often more funds are placed upfront from distributors. It should be noted as a topic for future research.

Marketing/distribution costs are not part of the production budget (Moore, 2019). While movies may be marketed through different mediums (DVDs, theaters, streaming etc.), the marketing cost for a movie will usually depend on the production budget. An article examining the financial impact of including movie stars in films discusses this idea. Ravid (1999), uses revenue/negative costs (studio-incurred costs) as a metric to gauge film profitability. However, it may be unclear how marketing costs factor into a film's financial success. Thus, the article decides to make two assumptions (Ravid, 1999). First, specific revenues (such as those going towards studios) are a fraction of the total revenue. Second, a movie's distribution/advertising costs are proportional to its production budget. This guideline provided by past researchers suggests that marketing costs can be linked to a movie's production budget. Therefore, one can

explore how a movie production budget may influence how much revenue it gains from certain marketing/distribution mediums.

Literature Review

Several movie companies invest in producing medium to large budget franchise films. While these entities take larger budgets to produce, they can sustain gathering income for multiple years. This phenomenon is due to possible sequels, adaptations, or merchandising/licensing opportunities that can arise from such franchises (VOX, 2015). Similarly, these producers might repeatedly seek out known celebrity names (Robert Downey Jr. as Iron Man etc.) to maximize their chance of attaining audiences. When producing such films, the producers must also consider how they market and distribute the motion pictures to various audiences (DVDs, video cassettes, streaming etc). In particular, the thesis will focus on discussing the following distribution mediums: movie theaters and DVD/Blu-ray sales.

Several authors discuss how movies earn revenue for studios, theater exhibitors and other parties involved. The majority use box office revenue/receipts as a dependent variable. The independent variables analyzed seem to differ based on the researcher's focus. For instance, Kim (2013) discusses whether having popular actors/actresses or directors within a particular movie correlates with an increase in its revenue. Kim utilized an OLS regression model to determine that variables such as actor salary were statistically significant for gauging high box-office grossing films. Sawhney and Eliashberg (1996) create a parsimonious model that estimates a movie's gross box office results from its initial ones. Specifically, they develop a stochastic framework that tracks factors which can help consumers decide whether to watch certain movies or not. This framework helped the authors construct the model with more "certainty"; the model utilizes the first three weeks of box office data to predict overall movie revenues. These articles

utilize different models and variables to gauge what will increase movies' box office revenue streams the most.

Prag and Casavant (1994) discuss certain criteria that will increase a film's box office revenue. These are quality, marketing expenditure, and whether it is a sequel or not. Besides this overall finding, this article is relevant to my thesis because it discusses the variables of marketing expenditures, production budgets and ratings. According to the article, a film's marketing spending is related to its production budget and collection of cast members (including how talented they are). Thus, the researchers found that when marketing expenditures are not accounted for, production budgets and whether stars receive certain awards become critical in the model they utilize. Since marketing spending is in fact determined to be a factor of the production budget (mentioned in the Background section), it would not be logical to include any marketing expenditure variable within my regression (where production budget is the independent variable). On the other hand, the article discusses how ratings can indeed correlate with movie revenues. I include movie ratings in my empirical analysis. Prag and Casavant use a linear regression of the following form: Revenue = B0 + B1 (Production Cost) + B2 (Film Quality) + B3 (Star Presence) + B4-10 (Other relevant factors). I use a similar regression with somewhat different independent and dependent variables. Overall, this article points out several key factors that could be useful in helping to determine the relationship between production budget and different distribution streams.

In addition, previous researchers have explored the relationship between box office and DVD revenue streams. For instance, Nelson and Rutherford (2010) investigated the phenomenon

of studios releasing a movie on DVD during its run in theaters. The authors reveal how studios decided to release movies on DVD earlier (25% of movies between 2001-5) for multiple reasons. Among these were: there were higher revenues to be gained from DVD releases than potential box office ones, and to capitalize on the trend that movies were most advertised in the early part of their overall release cycle. This caused weekly movie theater revenues to decrease by 46%, or 0.2% of their overall revenue. Walls (2010) discusses how there are different patterns with DVD and theater revenue streams. Among other findings, DVD revenue streams are more spread out between different titles, while theatrical ones possess a "winner-take-all" characteristic. Overall, the articles suggest that there could be a possible relationship between box office and DVD revenue streams.

Since previous research suggests that there might be a link between movie production budgets and different marketing revenues (box office, DVD/Blu-ray etc.), one can utilize this finding to figure out how studios/production companies should think about DVD distribution strategies. News sources such as The Guardian report how DVD and Blu-ray disc sales were surpassed by those from streaming and film downloads in 2016. However, despite studios' efforts to capitalize on the emergence of digital viewing mediums, it is difficult for them to make consistent profits from these platforms. Thus, as studios now decide to pursue films with larger budgets, they should at least consider whether a DVD distribution strategy is appropriate for them.

Furthermore, there are some general shortcomings within the articles that discuss factors that may make movies financially successful. First, there were none that compared the

proportion of a specific revenue stream. The articles discussed DVD revenue streams in comparison to theatrical ones only by absolute numbers, or total gross box office revenue streams (a widely used metric for such articles when discussing movie revenues). Thus, my thesis can add to the body of knowledge by implementing DVD revenues/total revenues as a dependent variable where I focus on the impact of the production budget. I also include control variables such as ratings, number of theaters and others (discussed in the Data section).

Hypothesis

My thesis will focus on analyzing the impact of production budget increases on the ratio of DVD sales/total revenues for a given set of movies (above $20M budget). My hypothesis is defined as:

Given an increase in production budget, the ratio of DVD sales/total revenues will decrease for a given movie. This hypothesis is based on the notion that larger budget film productions have more of a chance of becoming hits with audiences, while smaller budget films may not do so as much (Investopedia, 2019). Moreover, foreign films will have their ratio of DVD sales/total revenues decrease as a budget increases (as compared to domestic ones) because intuitively many directors will need to rely on box office showings in different countries to reach their respective audiences. Non-theatrical distribution mechanisms for streaming, DVD etc. might not be set up in some developing countries yet. This analysis will help gauge how differences in movie production budgets can impact theatrical vs. non-theatrical revenue sources. Most impactfully, this research might be able to be applied to new movie trends, such as the rising popularity of digital viewing mediums (including those used for streaming movies).

Interestingly, the regressions analyzed indicate that foreign box office elasticities actually have a relatively larger magnitude than the elasticities of either domestic revenue variable (DVD or box office). It goes against the original hypothesis about these elasticities discussed on the previous page; this finding could indicate that larger budget films are able to make more revenues successfully overseas. This logically makes some sense because audiences of similar tastes would see a movie, no matter where it was made in, across the world. For instance, the

same horror movie made in Canada or Hollywood would be enjoyed by equal audiences in Asia (assuming all other aspects of its production/distribution are controlled for). Another important metric to discuss are the regressions' R^2 values, which are around 0.4. This implies that this model explains around 40% of the variation in the dependent variable.

Data

The data originates from the Numbers.com, which is one of the most comprehensive movie databases. It contains information on how thousands of movies have been produced and distributed from 1977-the present date. I use a Numbers.com dataset of movies that meet the following criteria: budget is at least $20 million, movies are produced/released in US theaters, and a rating must exist. The data is collected from the years 2006-2016. Despite the informativeness of the dataset, there are some limitations to it. First, the data does not contain other revenue sources (such as streaming) or small-budget/independent films. This is because it is very difficult to obtain public data for these categories. Second, a movie's video (DVD/Blu-ray) revenue continues to grow over time as long as consumers keep buying the DVDs. This phenomenon should be kept in mind when conducting research utilizing this metric. Overall, the data contains the most accessible information for analyzing the effect of movie production budgets on theater/DVD revenues.

I use an OLS regression model. The outcome variable is DVD sales/box office revenue, and the main independent variable being tested is the production budget. To control for time-related and movie-specific effects in the analysis, these are among the list of controls that will be used: year, rating, genre, and # of theaters. Year, rating, and genre are specific aspects of movies that can affect how consumers view them. Thus, they should be included as controls. The number of theaters a movie has been scheduled to first release in can correlate with its total box office revenue. In addition, ratings are coded as binary variables. More information about control variables is discussed on the next page.

Each variable is defined in Table 1 with their respective summary statistics in Table 2. Dbo and dvideo represent domestic box office and domestic video (DVD/Blu-ray) revenue metrics, respectively. This data is aggregated on Numbers.com weekly for each movie. Interestingly, dbo has a higher standard deviation and mean than dvideo. This implies that dbo has a larger range of values, which could be related to the proportion of total revenues that come from theaters for a given movie (more chance for higher box office revenue values than video revenue ones). As discussed in the Background section, theater exhibitors focus on displaying larger-budget movies, even if studios also target alternative revenue streams. In this analysis, these variables are used to calculate the dependent variable d_videoprod, which is the fraction of DVD sales/total revenue for a given movie. This variable's mean is 0.31, which is important to note because it implies in this dataset that the average movie's video revenue is 31% of its total revenue. On a related note, Figure 1 points out that the average d_video_prod variable over a certain year's time (referenced as mean_dvideoprod_year in the graph) decreases over time. This means that DVD sales make up a less proportional part of a movie's budget. The next important variable to discuss is the actual budget variable (Budget), which specifically represents the production budget for a given movie. This variable's mean is $55,800,000, with a standard deviation almost as large. This implies that this movie dataset has a large range of production budgets. D_videoprod and budget are the two main variables to be considered in this empirical analysis.

In addition, this thesis will consider other control variables including: year, rating, Theaters, Genre, sequel, foreign, theater_low, ratings, and movie. Year is a dummy variable that is defined as the year a movie was released into theaters (total year dummy variable set spans 11

years). Meanwhile, rating is a dummy variable set that represents a movie's assigned rating by the Motion Picture Association of America (MPAA), which is traditionally used as a movie's rating in the US. Interestingly, 43% of the movies in this dataset are PG-13 rated movies (one might expect more rated R movies or equal distribution of movie ratings in the data). Sequel, foreign, and theater_low are all dummy variables created to control for specific events that could occur with movies being released (movie is a sequel, foreign made one, or released in a low number of theaters). Similarly, a set of dummy variables was created to account for movies being a specific genre (Adventure_Action is an example of this). On another note, there are no useful summary statistics available for movie (represents specific movie titles), as there is an infinite number of possible outcomes for this variable.

When finalizing the list of independent and control variables, three steps were taken. First, dummy variables that had small means were dropped from the original regression equation, as they would not apply to a large number of observations. Second, there were a few variables that were modified in order to better estimate the effects this regression measures. Specifically, the variables indicating the movie revenues ratio (dependent variable), production budget, and number of theaters a given movie is initially released in were converted to their natural log form. This action was taken to account for shocks in OLS regressions that can take on values ranging from negative to positive infinite. Third, most variables indicating some type of movie genre were combined with each other to increase their mean value (accounts for more observations) and increase their explanatory power in the regression. This resulted in the dummy variables being created for genre discussed in the previous paragraph.

Note: This data section utilized notes about the dataset created by thesis advisor Professor Darren Filson, CMC.

Empirical Strategy and Results

In order to estimate the effect of production budget on the elasticity of movie revenues, I estimate a model of the following form:

> *Ln((Movie Revenue Source X/Movie Revenue Source Y)) = B0 + B1*Ln(Prod. Budget) +*
>
> *B2*Adventure__Action + B3*Musical_Concert + B4*allthingsComedy +*
>
> *B5*Thriller_Horror + B6* Drama + B7*Ln(# of Theaters) + B8* theaters_low +*
>
> *B9*rate_G + B10*rate_PG + B11*rate_PG13 + B12* sequel + B13* foreign + yt + e*
>
> *where t = 2006...2016 and e is the error term.*

The dependent variable varies with the regression analyzed, as the elasticities of the three types of movie revenues are compared (foreign box office, domestic box office, and domestic DVD ones). Meanwhile, the primary independent variable is Ln(Production Budget) for a given movie.

As shown in Table 3, there are three regressions that differ only by the dependent variable. Regression 1 uses the dependent variable Ln(DVD/DBO), Regression 2 uses Ln(DVD/FBO) and Regression 3 uses Ln(FBO/DBO).

The key coefficient to analyze is Ln(Production Budget) in relation to these three regressions. Regression 1's coefficient is 0.0370 (significant at the 10% level). Meanwhile, Regression 2's and 3's coefficients respectively are -0.436 and 0.474 (significant at the 1% level). These coefficients can be thought of in the following way: as Ln(Production Budget) increases by 1, the corresponding dependent variable changes by the according number. Since Regression 1's coefficient is positive, it implies that the elasticity for domestic DVD sales is

relatively greater than the one representing domestic box office revenues when considering increases in production budget for the movies in the data. Intuitively, as a movie increases its production budget, it can distribute more widely on different mediums (theater, DVD etc.). While one could expect domestic box office sales to be greater, it seems to be novel that DVD sales would actually increase more when compared to domestic box office sales. Meanwhile, the second and third regression results indicate that foreign box office elasticities have a relatively larger magnitude than either domestic revenue variable (DVD or box office), which goes against the original hypothesis proposed. The implications of these results are discussed in the Hypothesis section of this paper.

Other results to discuss that are not related to the budget variable involve the following categories of control variables: genre, theaters, sequel and foreign. For the genre control variables, a notable pattern was that the majority of the dummy variables possessed negative coefficients for the first two regressions and a positive one for the third one. Specifically, the following genres have this pattern: Adventure_Action, Comedy, Horror, and Drama.

This suggests that these movie genres are more popular in foreign markets than domestic ones. It makes sense for some genres to be more popular, such as Adventure/Action ones due to audiences of all types being able to comprehend their plot lines. However, one would probably not expect comedies or dramas to be more popular in foreign markets, as they can be tailored to their home country's culture. Meanwhile, one dummy variable created accounted for movies with low initial numbers of theaters that they released in. It is interesting that the theater_low variable was negative in the first two regressions and positive in the third one. This means that this variable was more prominent in foreign markets vs. domestic ones. This could be perhaps

because studios may release a movie in a minimal number of foreign theaters initially to gauge

foreign audiences' reception of the production. Surprisingly, sequels follow a pattern of being

popular in foreign box office markets and domestic DVD markets (negative for the first two

regressions and positive for the third one). While franchise films are traditionally thought of as

having multiple versions played in theaters (including sequels and beyond), I speculate that

audiences could have preferred to buy them on DVD for convenience over the years. On a less

shocking note, movies that were foreign-made were more popular in overseas markets than

domestic ones (negative for the second regression but positive for the third one). This finding can

be explained for two reasons: there are over 100 countries in the world outside of the US, and

some foreign audiences would probably be able to relate to foreign movies more than domestic

ones.

Conclusion

The results of these three regressions are displayed in Table 3. The Ln (Production Budget) coefficients for each regression are the main metric of interest. For Regression 1, the coefficient is 0.0370 (significant at the 10% level). This indicates that as a movie's Ln (Production Budget) increases by 1, the DVD/DBO revenue ratio will increase by 0.0370. Another way to examine this result is that domestic DVD sale elasticities will be greater than domestic box office ones when relating them to movie production budgets. This could seem surprising, intuitively, because as studios can create movies with larger production budgets they would increase their ability to showcase their pictures in theaters. However, they would also increase their financial means to distribute their films on DVD. Thus, this finding can be seen as noteworthy. Meanwhile, the budget coefficients for the latter two regressions are -0.436 and 0.474 (significant at the 1% level). These results reveal that when comparing across production budgets, movie foreign box office elasticities are higher in magnitude than the domestic ones. This finding could suggest that larger budget films are able to make more revenues successfully overseas. Audiences that have similar movie preferences would view a film in their respective locations, no matter where the movie originated from.

Furthermore, results of other control variables were analyzed. The variable categories considered were: genre, theaters, sequel and foreign. Among other findings, a majority of movie genres seemed to have negative coefficients for the first two regressions and a positive one for the third one. The following genres fall into this trend: Adventure_Action, Comedy, Horror, and Drama. This result indicates that these movie genres are more popular in foreign markets than domestic ones. It makes sense for some genres to be more popular, such as Adventure/Action

ones due to audiences of all types being able to comprehend their plot lines. However it was interesting to see that comedies and dramas, which I think could be tailored to a country's home culture, were more popular in foreign markets. Another result was that sequels are popular in foreign box office markets and domestic DVD markets (negative for the first two regressions and positive for the third one), which is also referenced by Filson and Havlick (2018). While one might first think sequels would be played in theaters, it could be the case that audiences would have preferred to buy them on DVD for convenience over the years. This finding probably warrants further research.

While this research paper presents some interesting findings, a very important consideration to keep in mind is that DVD revenues have declined over the past ten years (as shown in Figure 1). This research paper controls for year-fixed effects, so the implications it derives above can be extended for future years or perhaps even other distribution mechanisms. Future researchers should consider investigating how a movie's production budget is related to revenues generated from alternate distribution avenues such as streaming, film festivals etc. Unfortunately, when conducting this analysis as a student, data related to a movie's streaming revenue stream was difficult and expensive to obtain. Thus, this thesis considered a narrow scope and solely compared revenue data generated from DVD/Blu-ray and box office viewings. In conclusion, producers can utilize this research to help gauge how movies with different production budgets can vary in terms of revenue proportions.

Tables and Figures

Table 1: Variable Dictionary

Variable	Definition
Movie	Title of movie to be analyzed
dbo	Cumulative domestic box office revenue for a given movie
dvideo	Cumulative domestic video (DVD/Blu-ray) revenue for a given movie
Budget	Production budget
Vyear	Year movie was released in theaters
MPAARating	MPAA rating given to movie
Genre	Genre of movie
Theaters	Number of theaters movie was first released in
d_videoprod	Fraction of Video revenues/Total revenues
rate_G	Binary variable for G-rated movies
rate_PG	Binary variable for PG-rated movies

rate_PG13	Binary variable for PG-13 rated movies
Ln_d_videoprod, ln_budget, ln_Theaters	Ln variations of the respective variables (described above in the table)
Adventure_Action, Musical_Concert, allthingsComedy, Thriller_Horror, Drama	Dummy variables relating to certain genre categories
theaters_low	Dummy variable that indicates whether a movie was released in a low number of theaters or not
sequel	Dummy variable that indicates whether a movie was a sequel
year_(Year number)	Dummy variable that indicates whether a movie was made in a specific year or not (accounts for time-related effects in the analysis)
Foreign	Dummy variable that indicates whether a movie was foreign-made

Table 2: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
dbo	1,453	7.27E+07	8.50E+07	4091	9.37E+08
dvideo	1,453	3.25E+07	4.50E+07	17738	3.98E+08
budget	1,453	5.58E+07	5.55E+07	100000	4.25E+08
vyear	1,453	2011.409	3.189747	2006	2017
Theaters	1,453	2506.067	1225.963	1	4468
d_videoprod	1,453	0.3062674	0.1424163	0.0021319	0.9804679
rate_G	1,453	0.017894	0.1326119	0	1
rate_PG	1,453	0.1686167	0.3745419	0	1
rate_PG13	1,453	0.4280798	0.4949708	0	1
ln_d_videoprod	1,453	-1.30564	.5440104	-6.150738	-.0197254

Ln_budget	1,453	17.36196	1.061905	11.51293	19.8676
Adventure_Action	1,453	.3248451	.4684782	0	1
Drama	1,453	.2188575	.4136141	0	1
Musical_Concert	1,453	.0137646	.1165526	0	1
allthingsComedy	1,453	.2278045	.4195602	0	1
Thriller_Horror	1,453	.2009635	.4008588	0	1
ln_Theaters	1,453	7.107782	2.097189	0	8.404696
theaters_low	1,453	.1403992	.3475203	0	1
sequel	1,453	.1679284	.3739314	0	1
foreign	1,453	.0371645	.1892298	0	1
year_2006	1,453	.1025465	.30347	0	1
year_2007	1,453	.0818995	.274306	0	1
year_2008	1,453	.0798348	.2711306	0	1
year_2009	1,453	.0963524	.2951755	0	1
year_2010	1,453	.0818995	.274306	0	1
year_2011	1,453	.0949759	.2932826	0	1
year_2012	1,453	.0915348	.2884674	0	1

year_2013	1,453	.0949759	.2932826	0	1
year_2014	1,453	.0935994	.2913709	0	1
year_2015	1,453	.0894701	.2855193	0	1
year_2016	1,453	.0929112	.2904079	0	1

Figure 1: How Movies' DVD Revenues Ratio Changes Over Time
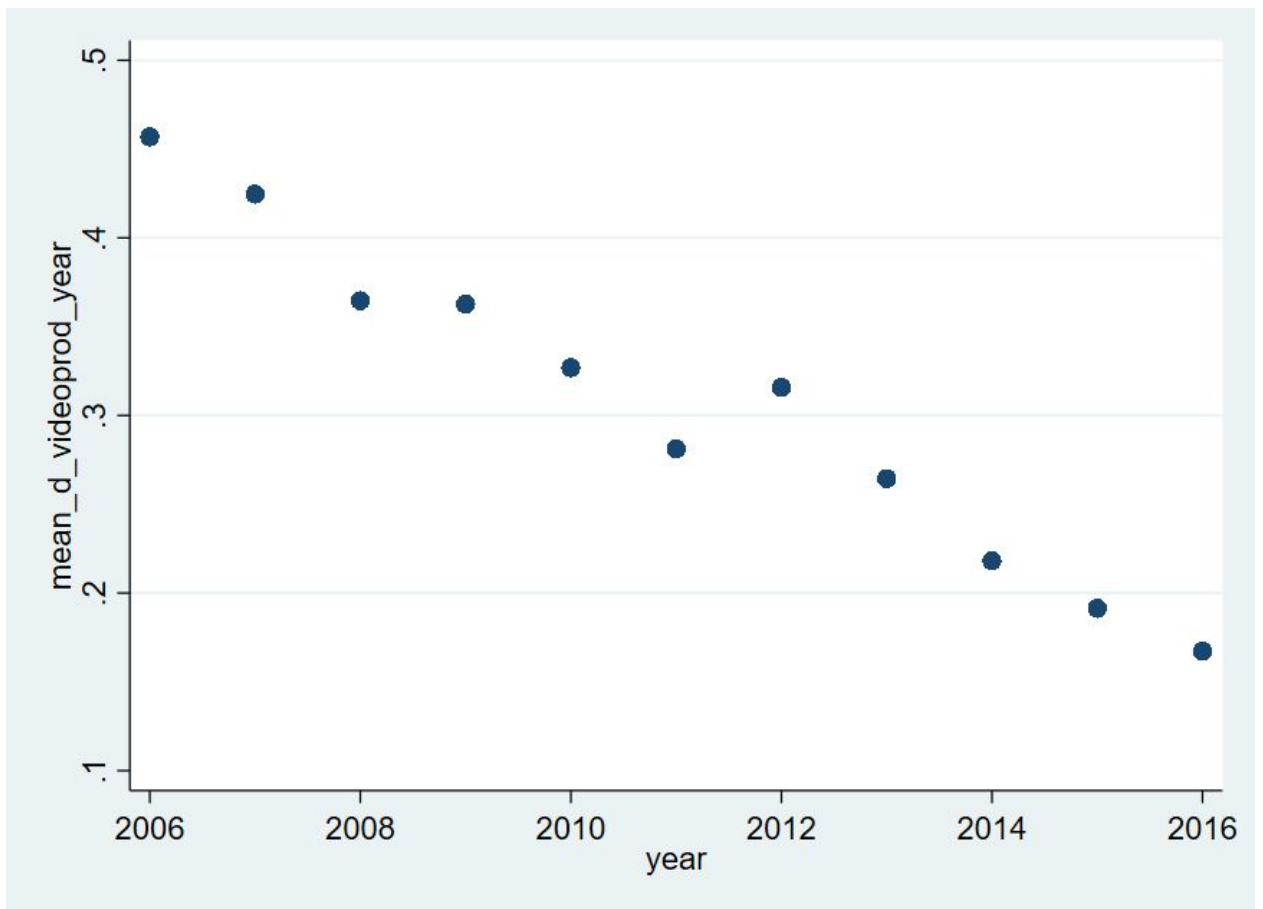
Table 3: Refined Regression Results

VARIABLES	(1) Regression 1	(2) Regression 2	(3) Regression 3
ln_budget	0.0370*	-0.436***	0.474***
	(0.0221)	(0.0492)	(0.0438)
Adventure__Action	-0.00227	-0.725***	0.719***
	(0.141)	(0.275)	(0.240)
Musical_Concert	-0.248	0.0476	-0.238
	(0.180)	(0.492)	(0.473)
allthingsComedy	-0.351**	-0.435	0.0721
	(0.140)	(0.274)	(0.242)
Thriller_Horror	-0.345**	-1.125***	0.773***
	(0.142)	(0.273)	(0.242)
Drama	-0.181	-0.244	0.0618
	(0.138)	(0.275)	(0.243)
ln_Theaters	0.0161	-0.0964	0.115

	(0.0626)	(0.0910)	(0.0942)
theaters_low	0.261	-1.844***	2.118***
	(0.376)	(0.533)	(0.556)
rate_G	0.0340	0.147	-0.118
	(0.0881)	(0.198)	(0.182)
rate_PG	-0.0764*	0.245**	-0.324***
	(0.0459)	(0.108)	(0.0988)
rate_PG13	-0.161***	0.0659	-0.233***
	(0.0354)	(0.0749)	(0.0709)
sequel	-0.124***	-0.249***	0.124
	(0.0354)	(0.0851)	(0.0798)
foreign	0.376***	-0.874***	1.252***
	(0.145)	(0.156)	(0.199)
year_2006	0.403***	0.470***	-0.0802
	(0.0601)	(0.154)	(0.144)
year_2007	0.243***	0.281*	-0.0381
	(0.0577)	(0.157)	(0.145)
o.year_2008	-	-	-

year_2009	-0.0308	0.0318	-0.0615
	(0.0580)	(0.146)	(0.135)
year_2010	-0.189***	-0.235	0.0457
	(0.0541)	(0.150)	(0.140)
year_2011	-0.400***	-0.655***	0.257**
	(0.0579)	(0.136)	(0.125)
year_2012	-0.239***	-0.577***	0.338**
	(0.0796)	(0.156)	(0.157)
year_2013	-0.550***	-0.746***	0.195
	(0.0803)	(0.142)	(0.132)
year_2014	-0.824***	-1.011***	0.189
	(0.0750)	(0.157)	(0.149)
year_2015	-0.978***	-1.279***	0.301**
	(0.0640)	(0.145)	(0.139)
year_2016	-1.143***	-1.350***	0.213
	(0.0649)	(0.154)	(0.144)
Constant	-1.082**	8.818***	-9.924***
	(0.527)	(1.045)	(0.961)

Observations	1,453	1,436	1,436
R-squared	0.436	0.360	0.338

*** p<0.01, ** p<0.05, * p<0.1

Works Cited

Coplan, Judson. "Diagnosing the DVD Disappointment ." *Glucksman Institute for Research in*

    Securities Markets , 2006.

Dargis, Manohla, and A. O. Scott. "Film Is Dead? Long Live Movies." *The New York Time*s.
    The New York Times, September 6, 2012.

"Feature Film Budget Breakdown - Average Cost of Films: Parlay Studios." *PARLAY STUDIOS*
    | THE TAKE, November 1, 2017.

Hennig-Thurau, Thorsten, Mark B. Houston, and Gianfranco Walsh. "Determinants of Motion
    Picture Box Office and Profitability: an Interrelationship Approach." *Review of*
    Managerial Science 1, no. 1 (2007): 65–92.

Jarvenpaa, Heini M., and Saku J. Makinen. "An Empirical Study of the Existence of the Hype

    Cycle: A Case of DVD Technology." 2008 IEEE International Engineering Management

    Conference, 2008.

Kim, Myeong Hwan. 2013. "Determinants of Revenues in the Motion Picture Industry." Applied
    Economics Letters 20 (10–12): 1071–75.
    doi:http://www-tandfonline-com.ccl.idm.oclc.org/loi/rael20.

Moore, Schuyler. "Why Film Budgets Are Important, Beyond The Cost Of Production." *Forbes.*
    Forbes Magazine, April 14, 2019.

Moore, Schuyler. "The Importance Of Completion Guarantees For Films." *Forbes.* Forbes
    Magazine, June 24, 2019.

Mueller, Annie. "Why Movies Cost So Much To Make." *Investopedia.* Investopedia, July 7,
    2019.

Nelson, Elissa, Jennifer Holt, and Kevin Sanson. "Windows into the Digital World: Distributor

    Strategies and Consumer Choice in an Era of Connected Viewing." In *Connected*

    Viewing, 17, n.d.

Nelson, Randy A., and Patrick Rutherford. "The Impact of Early DVD Release on Box Office

    Revenues." *Applied Economics Letters* 17, no. 7 (2010): 689–93.

"Netflix: How a DVD Rental Company Changed the Way We Spend Our Free Time - by BMI."

    Business Models Inc. Accessed October 31, 2019.

Parker, M. *Dvd and the Study of Film: the Attainable Text*. Palgrave Macmillan, 2016.

Paul, Johnathan. "The Ins and Outs of Hollywood Film Distribution." The Beat: A Blog by

    PremiumBeat, June 22, 2016.

Prag, J., Casavant, J. "An empirical study of the determinants of revenues and marketing

    expenditures in the motion picture industry." J Cult Econ 18, 217–235 (1994).

    https://doi-org.ccl.idm.oclc.org/10.1007/BF01080227

Ravid, S. Abraham. "Information, Blockbusters, and Stars: A Study of the Film Industry." *The*

    Journal of Business 72, no. 4 (1999): 463–92.

Red, James. "How Long Does It Take a DVD to Be Released to Stores?" *It Still Works*, January

    10, 2019.

Sawhney, Mohanbir S., and Jehoshua Eliashberg. 1996. "A Parsimonious Model for Forecasting

    Gross Box-Office Revenues of Motion Pictures." Marketing Science 15 (2): 113–31.

    doi:http://mktsci.journal.informs.org.ccl.idm.oclc.org/content/by/year.

Suderman, Peter. "How Star Wars Redefined the Notion of What a Movie Could Be." *VOX*,

    2015.

Sweney, Mark. "Falling DVD Sales Put Boot into Profits at Sony Pictures." *The Guardian*, 2017.

"The History Of The VHS Movie Industry." *Knoji*, February 28, 2012.

Walls, W. D. 2010. "Superstars and Heavy Tails in Recorded Entertainment: Empirical Analysis of the Market for DVDs." Journal of Cultural Economics 34 (4): 261–79. doi:https://link-springer-com.ccl.idm.oclc.org/journal/volumesAndIssues/10824.

Wayner, Peter. "In the Era of Cheap DVD's, Anyone Can Be a Producer." *The New York Times*. The New York Times, May 20, 2004.