

THE RELATIONSHIP OF ONLINE NETFLIX USER REVIEWS TO DAYS TO SALE FOR NEW DVDS ON AMAZON

Baughner, Dan
Pace University

Ramos, Chris
Pace University

ABSTRACT

The study examines the relationship between Netflix user reviews of DVDs and their sale on Amazon. A seller account was setup on Amazon and 145 new DVDs were put up for sale between 10/15/2012 and 9/18/2013. The DVDs were a mix of nine DVD genres including TV. Of the 145 DVDs, 19% were Blu-ray and 17% were Criterion, a premier brand. Their average release date was 4/5/2005. DVDs were priced competitively, using a lower price strategy, with an average price of \$27.89. User ratings were collected from Netflix. The mean user rating or valence averaged 3.52 (SD = .38,) on a 1-5 point scale, and volume averaged 588,930 (SD = 1,447,820). All DVDs sold within 36 days, with average days to sale after the initial offering of 4.26, and 26.2% and 21.4% selling on the initial date or the first day after, respectively. Valence and volume had a correlation of .391 ($p \leq .001$) with better rated DVDs showing more ratings. Valence had a negative influence on days to sale with less well rated DVDs taking longer to sell. Valence showed a correlation of $-.383$ ($p \leq .001$) with days to sale and a negative standardized beta weight of $-.355$ ($p \leq .001$) in an OLS regression, after controlling for rating volume, initial price, Blu-ray, Criterion, and release date. Volume had no influence on days to sale in an OLS regression after controlling for valence though it showed a correlation of $-.193$ ($p \leq .05$) with days to sale.

INTRODUCTION

The substantial growth of the Internet has caused profound changes in the global economy. Research on its impact on national economies shows that Internet sales are beginning to make up a notable percent of GDP, especially in countries where consumers and corporations are heavy users (Hazan, et. al, 2011). It has also had a tremendous impact on consumer buying behavior and competition. Products that once were sold in a local competitive landscape now must compete globally as is readily seen for used and rare books (Raugust, April, 12, 1999). Rare books, for example, are no longer solely sold in small Antiquarian book stores. Buyers can now purchase rare books from such global sites as Biblio (<http://www.biblio.com>), AbeBooks (<https://www.abebooks.com>), and Alibris (<http://www.alibris.com/>).

The Internet has also impacted the sale of new books. While used college texts have, for example, always negatively impacted the sale of new texts, Internet sale and purchase of used books from students have increased this negative impact well beyond prior levels. No longer do new books of any kind have a long period of time before their sale is eroded by used books. As remarkable as it may seem, books are available as used books almost immediately after their release, with used editions appearing on Amazon often only one day after the new book goes on sale (Mutter, Milliot, and Holt, September 27, 2004).

The sale of DVDs has followed a similar course to that of books sold on the Internet with sales moving from local distribution by retailers to global regional sales linked to the ability of a DVD to play in given regions of the world, designated by their region codes (e.g., 1 = U.S. and Canada, 6 = China). As a digital product, the DVD film market has a short product life cycle; with considerable novelty value at the beginning, followed by a brief maturity phase and a rapid decline as new films supersede old ones. Studios have attempted to retain consumer interest through the release of Blu-rays and the release of popular films as special editions with some success, though the cost of restoration can be as high as \$1 million dollars (Schauer, 2012). Also, there are still things that can be obtained on a DVD that can't be found in streaming and may never be found on streaming because of the extra cost to streaming distributors, such as special features (e.g., interviews with directors and actors) (Weinman, 2012). Whether someone chooses to rent or own a DVD to get these features is a complex matter driven by price, convenience, and user preference.

However, a DVD is also capable of being a collectible and is not perishable. These are other similarities to books. So, even in a DVD's decline phase, there is always a residual market even for old DVDs (Cockrill and Goode, 2010). DVD collecting is still alive and well despite a significant decline in revenues since the peak of 2006. In the long run, digital distribution of DVDs may marginalize the collecting of physical videos, resulting in a niche market of collectors similar to that for vinyl records. This will likely result in an increase in prices and far less discounting (Schauer, 2012).

This short life cycle and the intense competition that takes place during it require a responsive and agile DVD inventory management process (Chung, Niu, and Sriskandarajah, 2012). One key component for the development of such a system is an understanding of how user views of DVD content relate to sales, especially online where many DVDs are now purchased.

REVIEW OF THE LITERATURE

The Internet influences price by providing information on competitive pricing (Baye, et al., 2007) and a vehicle for transactions (Ratchford, B., 2009). For DVDs, the Internet provides considerable information that can influence consumer and producer decisions. Movie maturity ratings, such as an R rating, are one form of information easily accessed. Maturity ratings have been shown to reduce box office revenues by 20% (Palsson, Price, and Shores, 2013). Research on the impact of maturity ratings on DVD sales has not yet been conducted, though it is likely they impact total revenue in a similar way.

For DVDs, the Internet also provides easy access to a number of movie quality rating sources, such as those provided on Amazon, Netflix, Yahoo Movies, and the IMDb website. It also provides written reviews from users and critics which vary in review quality on these sites (Yu, et al., 2012).

Prior studies on the predictive power of reviews have shown that volume of user reviews predicts the trend of product sales for DVDs (Gruhl, et al., 2005) and box office revenue (Duan, et al., 2008, Liu, Y., 2006). Average user ratings, sometimes referred to as valence, have also been found to have a positive impact on box office revenues as have positive critic ratings (Moon, Bergey, and Iacobucci, 2010). Technological change in DVDs, such as the release of the same movie in Blu-Ray, also impacts retail sales and pricing (Schauer, B., 2012).

Music CDs, DVDs, and books share many characteristics in common with food and while not actually metabolized are subject to discounting similar to commodities that can be directly consumed and are perishable (Charlton and Fantino, 2008). DVDs also show considerable price dispersion, defined as highest price minus the lowest price. While the average market price for a DVD goes down quickly over time due to intense price competition, price dispersion remains,

suggesting that dispersion is a persistent, rather than transitory phenomenon (Xing, X., 2008; Xing X., 2010).

The explosive growth of Internet retailing provides an excellent opportunity for determining factors which relate to consumer purchase of DVDs and the opportunity to see how such factors affect sales for a homogenous product. DVDs do not differ significantly except for the Blu-ray distinction. One notable exception is a Criterion DVD, where brand comes into the picture. Criterion DVDs command a higher price and are generally considered to be of the highest quality, especially for film restoration of more artistic films and high profile films of the past such as *Silence of the Lambs* (http://www.criterion.com/about_us).

Forecasting sales can be critical for the survival of companies that must deal with the very short life cycle of DVDs. However, it is not uncommon to find DVD products that do not follow typical sales patterns. This has fostered pessimism over the ability to develop reliable forecasting. With such disparate sales patterns, accurate sales forecasting is difficult (Chung et al, 2012). User ratings offer one possibility for predicting sales.

Three measures of online reviews have been considered. They include volume of reviews (Liu, 2006), the mean rating or valence of reviews (Duan, et al., 2008, Liu, 2006; Chevalier & Mayzlin, 2006) and variance in reviews (Godes and Mayzlin, 2004). Chevalier and Mayzlin (2006) emphasize the importance of valence in the case of books. Dellarocas and Zhang (2007) found that volume, valence, and dispersion of user ratings had a positive, significant impact on future national box office performance for movies.

Study of the relationship of review valence and volume with box office performance has yielded inconsistent results. Duan et al. (2008) studied 71 movies released between July 2003 and May 2004. They found no significant relationship between box office revenue and either the cumulative average ratings or the average daily ratings obtained from Yahoo!Movies and BoxOfficeMojo.com; box office sales were not directly influenced by time-series changes in the average ratings of consumers. However, they found that the daily volume of ratings had a significant relationship to revenue, with greater volume predicting more sales. They also found that valence related to volume, with more positive ratings related to greater volume suggesting that more positive buzz leads to more ratings.

In contrast, Chintagunta, et al., (2010) studied box office revenue for 148 movies released from November, 2003 to February, 2005 with user ratings collected from Yahoo!Movies website. They found the main driver of box office performance was valence and not volume of ratings or precision of ratings prior to a movie's release (a variation on rating variance). When they aggregated box office sales data across local geographic market releases, they found that volume and precision, not valence of ratings, related to box office sales. They argued that aggregating sales data across markets masked the true marginal impact of valence on regional box offices sales.

Likewise, Moon et al. (2010) did not find a consistent relationship between average ratings, critic and amateur, and movie revenues across the first two months of a movie's opening. They studied the relationship for 246 movies released from May 2003 to October 2005 in theaters and videos across six major genre categories: thriller, romance, action, drama, comedy and animation. Critic and amateur ratings did not relate to revenue except during the opening week for critics and the week following the opening week for amateur ratings. However, they did find that those who view movies after the opening week choose the movies because of previous amateur user ratings. When the interaction between ratings and advertising was considered, they found a significant effect for

all seven weeks following the opening week, suggesting that advertising is needed to enhance any buzz created by positive ratings.

Others have assessed the relationship between the content of reviews and future sales performance for movies. Yu et al. (2012) found that both sentiments expressed in the reviews and the quality of the reviews had a significant impact on future sales. For books, spikes in blog activity were found by Gruhl, et al. (2005) to relate to future spikes in sales rank though they also found that predicting whether tomorrow's sales rank for a particular book would be higher or lower than that of the preceding day was difficult. Their research suggests that users pay attention but they did not determine whether the blogs spikes were the result of negative or positive spikes in user views. Chevalier and Mayzlin (2006) found that negative reviews of books had a greater impact on sales than positive reviews while Shin et al. (2008) found that negative buzz led to price cuts for high ticket items on websites while positive buzz allowed price increases.

Online vendors may have considerable data on factors affecting the sale of DVDs but they do not ordinarily make this information public. While there can be issues with quirky raters and the possibility they may not adequately reflect the true popularity or reputation of a movie, especially when the number of raters are few (Zhou and Lange, 2009), user ratings of movies are public and available. Though the environment and the interplay of potential predictors is complex and, at times, frustrating to understand, it appears that user reviews may provide useful information for predicting DVD sales. The differences in the results found for the relationship of user rating valence and volume with movie revenue reflects the complex environment in which user ratings operate as "word of mouth" advertising on what to attend or watch.

PURPOSE OF THE STUDY

This study examines the association between user ratings and the number of days it takes for new DVDs to sell on Amazon.com. Two user rating measures are used: mean user rating (valence) and volume of ratings. The goal is to determine whether consumer ratings of a movie, TV series, or documentary impact DVD sales and, in particular, whether these two measures have the potential for predicting the time it takes for a new DVD to sell. The study also hopes to shed more light on the contradictory results found for the role of valence and volume of user ratings in predicting sales.

HYPOTHESES

Despite inconsistency in results for valence and volume of ratings in predicting sales revenue, with valence showing significant relationships in some studies and volume showing significant relationships in others, there appears to be little dispute that online ratings serve as word-of-mouth advertising for what to watch and buy. User ratings of movies and books have been shown to have a role in predicting their sales.

Sales forecasting models also anticipate the important role of user ratings. The Bass model for sales forecasting (Bass, 1969) assumes a single large potential adopter population with an instantaneous adoption rate influenced by two forces. The first force stems from intrinsic interest in a given product, independent of the number of previous adopters. The second force is due to a positive influence from previous adopters.

Goldenberg et al. (2004) suggest that the rate of product sales for new, innovative products (such as movies) relates to "localized sales density" where the "word of mouth" effect will become very strong as the density of product purchasers increases. When density is low, they suggest that there is less building momentum and product sales will diminish rapidly. Chung et al. (2012) posit three components for predicting DVD and game sales: (1) committed buyers whose purchase will be independent of the population, (2) potential buyers who are influenced by existing buyers and their

own intrinsic interest, and (3) potential buyers influenced by networking within a closely tied group of consumers, which is impacted by committed and potential buyers who cause this group to buy. One difference from the Bass model is the notion that those who influence DVD purchase in networking may not yet be previous adopters.

Two hypotheses were tested. For both hypotheses, the dependent variable was days to sale. In Hypothesis 1, we predicted that the influence of mean user ratings (valence) on days to sale for DVDs would be negative. It was our expectation that it would take longer to sell a DVD when user ratings were less positive. The mean rating of DVDs is readily available to users prior to their purchase and offers one measure of a DVD's popularity. Thus, it can serve as an important source of word-of-mouth views and fits into the Bass model as a potential positive influence from previous adopters.

In Hypothesis 2, we predicted that the influence of user rating volume on days to sale for DVDs would also be negative. It was our belief that it would take longer to sell a DVD when the volume of user ratings was lower. In the case of existing DVDs, it might be a proxy for market size and consumer awareness of a given title, including the inability or ability to remember a title to use in a search engine. Some research suggests that volume is influenced by movie attendance with box office revenue having an effect on volume (Duan et al., 2008) suggesting that volume builds as a result of prior sales success. Research by Gruhl et al. (2005) found that spikes in volume of blogs about a book related to spikes in purchases. Thus, there is potential for rating volume to serve as a predictor of DVD sales even though volume appears to operate in a somewhat more complex way than valence and likely lags valence.

The following formal hypotheses were tested:

H1: The influence of mean user ratings (valence) on days to sale is negative.

H1: The influence of user rating volume on days to sale is negative.

RESEARCH METHODOLOGY

Two sources of data comprised the study. First, it was necessary to sell DVDs online in order to determine the number of days sold for a mix of DVDs. Second, it was necessary to obtain user ratings of the DVDs sold.

DVD Sales. A seller account was established on Amazon.com in October, 2012, with a seller name of MyDVD/CD 4 U. A total of 145 new DVDs were put up for sale between 10/15/2012 and 9/18/2013. The DVDs selected for sale came from a personal DVD collection of close to 2000 titles. This collection was acquired over a 15 year period of time and included an array of new and used DVDs. To attenuate the possibility of seasonal variation, the DVDs were listed in six batches during this time period covering the fall, winter, spring, and summer selling seasons.

The DVDs were comprised of a very broad array of titles reflecting nine major categories: action/adventure, biography/documentary, comedy, drama, foreign film, horror/sci-fi, musical, mystery/thriller, and TV episode. The foreign DVDs included a mix of action/adventure, comedy, drama, and horror/sci-fi. TV included a mix of comedy and mystery/thriller. The drama titles included works derived from classic and modern literature including Ibsen, Joyce and Shakespeare.

The Amazon best sellers rank for each DVD was checked at the time of its initial listing. Amazon publishes sales rank information as a service to its customers. The Amazon best seller rank calculation is based on Amazon.com sales and is updated hourly to reflect recent and historical

sales of every item sold on Amazon.com (DVDs in this context). While this is a very dynamic measure, it provides an indication of sales potential for a title. The number increases when the sale of the DVD decreases, thus an inverse relationship. Each DVD on Amazon counts as a different DVD even if it is the same title in another format or package. About 425,000 new DVDs and another 38,000 Blu-ray DVDs, generally of the same title as a regular DVD, were offered during the time of the study.

The pricing strategy was essentially a low price strategy, though some DVDs were assigned a somewhat higher price to provide a range of pricing. The lowest price for each DVD was decided prior to offering it for sale by determining the lowest price offering for the DVD that existed prior to its listing.

However, pricing of DVDs was a highly dynamic process at Amazon. New vendors appeared, Amazon chose to discount unexpectedly, and some vendors pursued a computer-driven low pricing strategy which placed their product at a pre-determined low price point designed to make them the lowest price offering of the DVD. This low price point often was one cent lower than the next to lowest price though, at times, it was 30 cent and 61 cents, among other possibilities. Sometimes new start-up vendors, with no prior record of user ratings, would enter and discount their price by as much as 20% from the lowest price at the time of their initial offering. This combination of factors could lead to a downward spiral of prices for a period of time.

As a result, it was necessary to lower the price for some titles following the first sales date to maintain the pricing strategy set forth for each DVD. This was not done to maintain the somewhat artificial pricing strategy of other vendors to be a certain number of cents lower than the next to lowest DVD. Rather, the changes were designed to maintain the overall pricing strategy.

User Ratings. The mean user rating (valence) and number of user ratings (volume) ratings were obtained from Netflix.com (<http://movies.netflix.com/WiHome>). For box sets, it was necessary to find the average rating and average volume for the multiple movies or TV episodes on the DVD. Multiple TV episodes sometimes required estimation of valence and volume because episodes were not clearly separated in the Netflix ratings. This was the case for six TV box sets.

IMDb mean ratings were used instead of Netflix ratings for these box sets. The average IMDb valence for the episodes on the box set was determined. Then, the average IMDb valence for the box set was converted to a 1-5 scale by multiplying it by .5, allowing it to have comparability to the Netflix ratings.

Volume of user ratings was provided by IMDb for each episode within the six TV DVD box sets but we chose not to try and convert this volume to a comparable Netflix volume. Instead, the volume of ratings at Netflix for the aggregated ratings of the box sets was used as a measure of volume. For example, volume of ratings was available for all Simpson and Law and Order episodes carried by Netflix at 1,804,866 and 626,926, respectively. It was our belief that attempting to convert IMDb volume to Netflix volume would not result in a better estimate of volume for selected episodes than that provided at Netflix for all episodes.

Volumes of more than 1,000,000 were sometimes found. These were often movie blockbusters like *The Terminator*, *Shutter Island*, and *Pearl Harbor* or movies with a history of many successful years like *Casablanca* and *Citizen Kane*. For TV, high volume was associated with such series as *South Park* and the *Simpsons*. Low volumes were associated with less well known productions such as *The Merry Wives of Windsor*, *Mr. Arkadin* by Orson Welles, and *Hamlet at Elsinore*, which had the lowest volume of 375.

RESULTS

Table 1 provides summary data for the 145 DVD Data sample. The DVDs covered a very broad array of titles reflecting nine major categories. Drama dominated the mix followed by foreign films, musical, comedy and TV. A one-way-ANOVA showed no significant difference by type for days to sale ($F = 1.104$, $df = 8,136$, ns) or initial price ($F = 1.508$, $df = 8,136$, ns).

Of the 145 DVDs, 28 or 19% were in the high resolution Blu-ray format and 24 or 17% were a Criterion brand. Box sets of multiple titles or TV episodes comprised 24 of the DVDs or 17%. Typical of TV DVDs, all 11 of the TV titles were box sets.

The Amazon best seller ranking for the DVDs showed a broad range, from 1437 to 304,270, with a mean of 69,639 and standard deviation of 61,370. This measure is designed to be a measure or barometer of a DVD's sales by Amazon and was correlated with days to sale ($r = .439$, $p \leq .001$) with a higher value associated with more time to sell. DVD release date ranged from 4/28/1998 to 4/3/2012 and an average date of 4/5/2005..

The average valence for Netflix ratings was 3.54 with a standard deviation of .38 and range of 2.3 to 4.5. Volume averaged 588,940 with a standard deviation of 1,447,820 and range of 375 to 8,701,092. The median was 86,486, substantially lower than the mean, reflecting the impact of some very high volumes on the mean.

The average initial price for the DVDs was \$27.89 with a standard deviation of \$19.36. A price reduction was required for 26.2% of the DVDs for up to four times, depending on the DVD and competition. On average, the first price reduction took place 6.4 days after the first 24 hours (day 0) while the second and third price reductions took place on average at 12.9 and 21 days following day 0, respectively. The fourth price reduction took place on day 32 for two DVDs.

All DVDs sold within 36 days of their initial listing with 26.2% selling on the first day of their offering (day 0), in 24 hours or less, and another 21.4% selling on the next day (day 1). On average, DVDs took 4.26 days beyond the first day (day 0) to sell with a standard deviation of 6.29. While variability in days to sale differed across the six sales periods (Levene statistic = 5.349, $df = 5, 139$, $p \leq .001$), the Kruskal Wallis Test confirmed there was no significant difference in the time it took to sell the DVDs (days to sale) across the six periods (chi square = 6.907, $df = 5$, ns).

H1 and H2 were tested through an OLS regression. The dependent variable was days to sale where 0 is the first offering day, 1 is the first day after the initial offering day and 36 represents 36 days after the first offering day. The independent variables were valence and volume. Two analyses were conducted with only the control variables changing. In the first analysis, initial price was entered to serve as a control variable. In the second analysis, whether the DVD was Blu-ray or criterion and the DVD's release date were added as control variables.

Table 1
Summary of the 145 DVD Data Sample

Variable	Summary Statistics			
Nine DVD Types	Drama (57, 39%), Foreign (25, 17%), Musical (14, 10%) Comedy (11, 8%), TV (11, 8%), Mystery/Thriller (9, 6%), Horror/Sci-Fi (7, 5%), Bio/Documentary (6, 4%), Action/Adventure (5, 3%)			
Blu-Ray	No (117, 81%), Yes (28, 19%)			
Criterion	No (121, 83%), Yes (24, 17%)			
Box Set	No (121, 83%), Yes (24, 17%)			
Price Reduction Implemented	No (107, 74%), One (23, 16%), Two (8, 6%), Three (5, 3%), Four (2, 1%)			
	Mean	SD	Minimum	Maximum
Amazon Best Seller Rank	69,639	61,370	1437 Ben Hur	304,270 A Farewell to Arms (Gary Cooper)
Release Date	4/5/2005	na	4/28/1998 To Kill a Mockingbird	4/3/2012 Cleopatra New Blu-ray Version
Valence (Mean Rating)	3.52	.38	2.3 Sebastiane	4.5 Pearl Harbor Pride & Prejudice (Colin Firth)
Volume	588,930	1,447,820	375 Hamlet at Elsinore	8,701,092 The Terminator
Initial Price	\$27.89	\$19.36	\$4.60 Moulin Rouge (Jose Ferrer)	\$96.52 King Lear (Ian Holm)
Days to Sale	4.26	6.29	0 (26.2%)	36 Doktor Faustus

Table 2 shows the intercorrelations between the dependent variable, days to sale, and the six other variables. Valence and volume have a negative relationship with days to sale, showing that a high mean rating or valence and a high volume are associated with a shorter time to sell a product. This is in keeping with both H1 and H2. Initial price is positively correlated with days to sale, with a higher price resulting in longer time to sell.

Table 2
Intercorrelation Between Days to Sale and Independent Variables

Variable	Valence	Volume	Initial Price	Blu-ray	Criterion	Issue Date
Days to Sale	-.383***	-.193*	.490***	-.174*	-.039	-.003

* p < .05, ** p < .01, *** p < .001

The negative correlation for Blu-ray shows that Blu-ray DVDs sold faster. Additional analyses showed they were less variable in days to sale according to Levene's Test ($F=9.275, p \leq .01$) and, on average, sold 2.75 days faster ($t=3.495, df = 118.4, p \leq .001$) even though there was no significant difference in their price ($t=.823, df = 143, ns$).

Table 3 shows the standardized beta weights for the independent variables at each stage of the sequence of regression analyses with days to sale as the dependent variable. The first analysis shows the results when valence and volume were entered as independent variables. The second analysis shows the addition of initial price to the analysis. The third analysis shows the addition of Blu-ray and Criterion and the fourth analysis shows the addition of issue date. All regressions are statistically significant ($p \leq .001$).

Table 3
R, F-Value and Standardized Beta Coefficient for Four Regressions

Analysis	R	F-change	Standardized Beta Coefficient					
			Valence	Volume	Initial Price	Blu-ray	Criterion	Issue Date
Reg. 1	.386	12.450	-.364***	.050	-	-	-	-
Reg. 2	.585	24.473	-.333***	.029	.450***	-	-	-
Reg. 3	.588	14.675	-.316***	.031	.455***	-.029	-.054	-
Reg. 4	.619	14.272	-.355***	.062	.471***	-.158	-.033	.239**

* $p < .05$, ** $p < .01$, *** $p < .001$

Analysis of the bivariate correlations of the variables in Table 3 showed valence and volume had a positive correlation of .391 ($p \leq .001$), suggesting that movies with higher volume also receive higher average ratings. Initial price did not have a significant association with valence, Blu-ray, Criterion or issue date. However, it did have a significant correlation of -.204 with volume ($p \leq .05$), showing a tendency for higher volume DVDs to have lower pricing in the marketplace. Blu-ray showed a significant correlation ($p \leq .001$) of .427, .503 and .557 with valence, volume, and issued date, respectively, suggesting that movies offered in Blu-ray tended to be more liked and more watched with a greater volume of ratings (and more recent), suggesting that the decision to release a DVD in a Blu-ray format is impacted by both. Criterion showed no significant relationship with other variables.

In addition to a positive correlation with Blu-ray, issue date had a correlation of .344 ($p \leq .001$) and .23 ($p \leq .01$) with valence and volume, respectively, showing that more recent DVDs were more likely to have better ratings and more volume. None of the variables showed a variance inflation factor (VIF) of greater than 1.9, suggesting there was no multicollinearity problem (O'Brien, 2007).

The results show support for H1. Valence (or mean rating) had a significant negative influence on days to sale in all four regression analyses. The results do not support H2. Volume of ratings did not show an influence on days to sale in any of the regressions though it did have a modest negative correlation with days to sale.

The positive relationship between issue date and days to sale uncovered in the 4th regression was unexpected, in part, because issue date was not correlated with days to sale. Regression four suggests that more recent DVDs took longer to sell when the other variables were controlled. Also, the beta for valence increased. Additional analyses, not shown, indicate that this relationship emerged mainly due to the inclusion of valence. One possible explanation is that valence was cancelling out the true effect of issue date on days to sale. Perhaps, there was a degree of market saturation for more recent DVDs, causing them to take more time to sell, that could only be seen

when their reputation was held constant. Given that the change in R was not significant, another explanation is that the result is due to small sample size.

DISCUSSION

This study focused on determining whether the valence (mean rating) and volume of ratings for DVDs from Netflix relates to the time it takes to sell a new DVD on Amazon. While the huge providers of DVDs in the marketplace may already be aware of these and other variables related to DVD sales time, it is not something that has been subject to academic investigation. This study differs from other studies of the relationship of valence and volume of user ratings to sales by studying sales on Amazon and not the early box office sales of movie releases. By the time someone decided to purchase any of the DVDs in this study, it had been released for at least one year and, on average, for seven to eight years. Price affected days to sale in the expected direction with higher price slowing sales.

Research has been somewhat contradictory when it comes to the relationship between valence and volume and movie box office sales. This study supports valence as a useful indicator of the time it takes to sell a DVD, one important indicator of sales. Valence showed a negative influence on days to sell. This was true when volume, initial price, Blu-ray, Criterion, and release date were entered as controls. It may be that the valence of a DVD impacts sales due to its signal value. Once price is a constant, any additional delay to purchase may be due to thoughts that a DVD is not worth viewing, at any price, and it appears that valence provides this information, not volume. Per the Bass model (Bass, 1969), valence should influence purchase by reflecting the views of prior adopters. It is unlikely anyone rates a DVD without having seen it at least once.

One explanation offered for why valence does not always relate to box office revenue is that consumers often make an impulse decision to attend a movie without paying much attention to word of mouth content (Liu, 2006). Valence may have related to sales in this study because a DVD is less of an impulse decision than the decision to go to a movie, allowing more time to investigate and think about user ratings, or ask others what they thought of a DVD.

Gruhl et al. (2005) showed that spikes in online chatter corresponded to spikes in book sales but did not assess whether the chatter was negative or positive. Chung et al. (2012) studied 170 DVD rental titles and 98 DVD retail titles from Blockbuster retail operations but all were new releases and price was not considered. Also, their model did not include user ratings though it did suggest strong influences from networking of users (e.g., discussing the movie among friends). Both studies suggest that volume should relate to sales. However, volume was not found to influence sales in this study.

In their analysis of movie box office sales, Chintagunta, et al., (2010) also found volume to relate to sales, not valence, but they only found this when sales data was aggregated beyond regional areas. When data was no longer aggregated, they found valence, not volume, to predict sales. This study is more reflective of their aggregated study in that days to sale was not aggregated across different regions and, thus, inconsistent with their findings

The unexpected positive relationship between the time it took to sell a DVD and issue date (that is, more recent DVDs took longer to sell), when valence was controlled, was unexpected. Without further theory to guide and more data, it is not possible to be sure whether the suppressor effect on issue date by valence, as it related to days to sale, was sample specific, as can happen with suppressor variables (Thompson and Levine, 1997), though it is worth further study. It may be that there is a market saturation effect for newer DVDs that slows the speed of their purchase that might be more easily discovered if user valence for a DVD was controlled.

This study is limited by the mix of DVDs offered for sale. While a very diverse mix of DVDs was selected for sale, they were not a random selection of all the DVDs offered on Amazon. Also, it was not possible to study how changes in valence and volume over time affected the time it took for a DVD to sell, which is the common approach used to assess the impact of valence and volume on movie box office sales. All of the DVDs sold in a relatively short period of time making it impossible to study change in user ratings. Time series impacts were likely of minimal consequence in the short period of time considered.

It appears that those who sell DVDs on Amazon, who do not have the time, experience or resources to create a sophisticated sales forecasting system, can look to one variable to better understand the time it will take to sell a DVD that is competitively priced. There are a fair number of small volume users selling DVDs on Amazon who may fall into this category. That variable is the average rating of the DVD by users, or valence.

In this study, valence and volume came from Netflix. Netflix ratings are available for the vast majority of DVDs available for sale, though not all. Amazon ratings are available for all DVDs sold on Amazon, though they do not have nearly the same level of volume as those of Netflix. One avenue of future research is to study the relationship of Amazon ratings to the time it takes for a DVD to sell. Unlike Netflix ratings, Amazon ratings are immediately observable by a consumer. Study of sales across markets is another potential avenue for further research on valence and volume as predictors of DVD sales. It is now possible for a DVD vendor at Amazon to opt into selling their DVD in the world market outside the U.S.

As a predictive variable, valence appears to be an important word of mouth variable. Its potential impact is consistent with the notion that previous adopters have an influence on future adoption of a product, though the full nature of its impact on buyer behavior, including the timing of its impact, is yet to be fully understood. Experimental research on the impact of the valence and volume of user ratings on the sale of DVDs would be an interesting avenue of research as it might help sort out the conflicting results found to date for the impact of valence and volume on sales. In this study, valence was clearly the dominant factor, not volume.

REFERENCES

- Bass, F.M. (1969). "A new product growth model for consumer durables." *Management Science*, 15(5), 215-227.
- Baye, M.R., Gatti, J.R.J., Kattuman, P, and Morgan, J. (2007). "A dashboard for online pricing." *California Management Review*, 50(1), 202-216.
- Charlton, S.R., and Fantino, E. (2008). "Commodity specific rates of temporal discounting: Does metabolic function underlie differences in rates of discounting?" *Behavioral Processes*, 77(3), 334-342.
- Chevalier, J.A., and Mayzlin, D. (2006). "The effect of word of mouth on sales: Online book reviews." *Journal of Marketing Research*, 43(3), 500-518.
- Chintagunta, P., Gopinath, S. and Venkataraman, S. (2010). "The effects of online user reviews on movie box office performance: Accounting for sequential rollout and aggregation across local markets." *Marketing Science*, 29(5), 944-957.
- Chung, C., Niu, S., and Sriskandarajah, C. (2012). "A sales forecast model for short-life-cycle

- products: New releases at Blockbuster.” *Production and Operations Management*, 21(5), 851-873.
- Cockrill, A. and Goode, M.M.H. (2010). “Perceived price fairness and price decay in the DVD market.” *Journal of Product and Brand Management*, 19(5), 367-374.
- Dellarocas, C., and Zhang, X.M. (2007). “Exploring the value of online product reviews in forecasting sales: The case of motion pictures.” *Journal of Interactive Marketing*, 21(4), 23-45.
- Duan, W., Gu, B., & Whinston, A. B. (2008). “The dynamics of online word-of-mouth and product sales--an empirical investigation of the movie industry.” *Journal of Retailing*, 84(2), 233-242.
- Godes, D., and Mayzlin D. (2004). “Using online conversations to study word-of-mouth communication.” *Marketing Science*, 23(4), 545-560.
- Goldenberg, J., Garber, T., Muller, E. and Libai, M (2004). “From density to destiny: Using spatial dimension of sales data for early prediction of new product success.” *Marketing Science*, 23(3), 419-428.
- Gruhl, D., Guha R., Kumar, R., Novak, J. and Tomkins, A. (2005). “The predictive power of online chatter.” *Proceedings of the eleventh ACM SIGKDD international conference on Knowledge discovery in data mining*, 78-87.
- Hazan, E. and Manyika, J. and du Rausas, M.P. (2011). “Sizing the Internet’s economic impact.” *McKinsey Quarterly*, 5, 18-21.
- Liu, Y. (2006). “Word of mouth for movies: Its dynamics and impact on box office revenue.” *Journal of Marketing*, 70(3), 74-89.
- Moon, S., Bergey, P.K., and Iacobucci, D. (2010). “Dynamic effects among movie ratings, movie revenues, and viewer satisfaction.” *Journal of Marketing*, 74(1), 108-121.
- Mutter, J., Milliot, J. and Holt, K. (2004, September 27). “What price used books?” *Publishers Weekly*, 251(39), 31-33.
- O’Brien, R.M. (2007). “A caution regarding rules of thumb for variance inflation factors.” *Quality and Quantity*, 41(5), 673-690.
- Palsson, C., Price, J. and Shores, J. (2013). “Ratings and revenues: Evidence from movie ratings.” *Contemporary Economic Policy*, 31(1), 13-21.
- Ratchford, B. T. (2009). “Online pricing: Reviews and directions for research.” *Journal of Interactive Marketing*, 23(1), 82-90.
- Raugust, K. (1999, April 12). “Used and rare books go online.” *Publishers Weekly*, 245(15), 22-25.
- Schauer, B. (2012). “The warner archive and DVD collecting in the new home video market.”

Velvet Light Trap, (70), 35-48.

Shin, H.S., Hanssens, D.M., and Gajula, B. (2008). "The impact of positive vs. negative online buzz on retail prices." *Working paper, Anderson School of Management, University of California, Los Angeles, Los Angeles.*

Thompson, F.T., and Levine, D.U. (1997). "Examples of easily explainable suppressor variables in multiple regression research." *Multiple Linear Regression Viewpoints*, 24(1), 11-13.

Weinman, J. J. (2012, May 14). "Die hard, hardly dying." *Maclean's*, 125(18), 44.

Xing, X. (2008). "Does price converge on the internet? Evidence from the online DVD market." *Applied Economics Letters*, 15(1), 11-14.

Xing, X. (2010). "Can price dispersion be persistent in the Internet markets?" *Applied Economics*, 42(15), 1927-1940.

Yu, X., Yang, Liu, Y. Huang, X., and An, A. (2012). "Mining online reviews for predicting sales performance: A case study in the movie domain." *IEEE Transactions on Knowledge & Data Engineering*, 24(4), 720-734.

Zhou, H. and Lange, K. (2009). "Rating movies and rating the raters who rate them." *American Statistician*, 63(4), 297-307.