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Dan Baugher

Pace University, Lubin School of Business, dmbaugher@aol.com

Chris Ramos

Pace University, Lubin School of Business, cdcramos@aol.com

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User Reviews and Their Relationship to the Online Sale of Used DVDs

Dan Baugher, Pace University, dmbaugher@aol.com

Chris Ramos, Pace University, cdcramos@aol.com

Abstract — Except for books, research on factors impacting the sale of low-priced used products is uncommon. This study examines the relationship between Netflix user reviews of DVDs and their sale on Amazon as used products. An Amazon account was created by the authors, and a broad mix of 121 used DVDs were sold between 10/15/2012 and 11/20/2015. Using a low-price strategy, all sold within 57 days of posting on the site with 17.4% selling on the first day. DVDs with lower user ratings (valence) ($p < .001$) and lower rating volume ($p < .05$) took longer to sell. Valence and volume were not correlated ($p > .05$). In an OLS regression that included valence, volume, price, and release date, valence showed the highest beta ($-.507$, $p < .001$) for days to sale, followed by price ($.237$, $p < .01$), and release date ($.168$, $p < .05$). For Blu-rays which were well-liked blockbusters, volume predicted sales and valence didn't. Valence appears to be an important word of mouth variable affecting sale of used products when the range of quality is broad.

Keywords — Word of Mouth Advertising, Sale of Used Products, Online Product Ratings, eWOM

Introduction

The substantial growth of the Internet has resulted in a tremendous impact on consumer buying behavior and competition (Hazan et. al. 2011). 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 increased the sale of used books. 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 & Holt 2004 September 27).

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). Like books, DVDs are also capable of being a collectable and often sold as used products on such sites as Amazon and eBay. Even in a DVD's decline phase, there is always a residual market for older DVDs (Cockrill & Goode 2010).

Indeed, DVD collecting is alive and well despite a significant decline in revenues since their

peak sales in 2006. In the long run, digital distribution of DVDs may marginalize the collection of physical discs, but it seems probable they will continue to be sold to collectors and those who wish to maintain a library of DVDs much as vinyl records and CDs are sold. This will likely result in price increases and far less discounting (Schauer 2012) and cause used DVDs to be more attractive to buyers seeking lower prices.

Whether it be the sale of new or used, the short life cycle of DVDs and the intense competition that takes place during it require a responsive and agile DVD inventory management process (Chung, Niu & Sriskandarajah 2012). One key component to the development of such a system is understanding how user views affect the sale of used DVDs online, where most are now sold.

Literature Review

For buyers, the Internet serves as a vehicle for transactions (Ratchford 2009) and quickly provides information on the pricing of competitors (Baye et al. 2007). In the case of DVDs, much information is available on the Internet that can influence consumer purchase decisions (Palsson, Price & Shores 2013). The Internet also provides easy access to a number of movie quality rating sources that can play a role in the purchase of a DVD whether new or used, such as those provided on Amazon, Netflix, Yahoo Movies, and the IMDb websites. Some sites also provide written reviews from users and critics though they vary considerably in quality (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 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 & Iacobucci 2010). Technological change in DVDs, such as the release of the same movie in the Blu-ray format, also impacts retail sales and pricing (Schauer 2012).

While not at first obvious, music CDs, DVDs, and books share some characteristics in common with food. Though not actually metabolized, they are commodities that can be directly and immediately “consumed” and are thus with faster consumption by the market are discounted quickly (Charlton & 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 a wide range of prices is a persistent, rather than transitory phenomenon (Xing 2008; Xing 2010).

Three measures of online reviews have been considered which may be useful in predicting the sale of used DVDs. 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 & Mayzlin 2004). Chevalier and Mayzlin (2006) emphasize the importance of valence in the case of books.

Yet, studies of the relationship of review valence and volume with box office performance have yielded inconsistent results. Dellarocas and Zhang (2007) found volume, valence, and dispersion of user ratings had a positive, significant impact on future national box office performance. Duan et al. (2008) studied 71 movies released between July 2003 and May 2004 but

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 also not directly influenced by time-series changes in the average ratings of consumers.

However, Duan et al. (2008) found daily rating volume related to revenue, with greater volume predicting more sales. They also found valence related to volume, with more positive ratings associated with greater volume suggesting 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 and found the main driver of box office performance was valence prior to a movie's release in a specific market, not volume of ratings. But, when they aggregated box office sales data across local geographic market releases, they found volume of ratings, not valence, related to box office sales.

Concerned about valence no longer showing a relationship, Chintagunta et al. (2010) further analyzed their results and argued that aggregating sales data across markets masked the true marginal impact of valence on regional box offices sales and remained important. Others have found previous ratings by non-critics, the typical viewer, impact movie attendance after the opening week (Moon et al. 2010) and higher quality written reviews can likewise impact future movie attendance (Yu et al. 2012) Similarly, Baugher and Ramos (2017) established a business on Amazon and sold new DVDs and found valence, not volume, was a predictor of days to sale.

For books, Gruhl et al. (2005) found spikes in blog activity related to future spikes in sales rank though predicting sales rank day to day from such online activity was difficult. Similarly, Chevalier and Mayzlin (2006) found negative reviews of books had a greater impact on sales than positive reviews while Shin et al. (2008) found negative buzz led to price cuts for high ticket items on websites while positive buzz fostered price increases.

This difference in the results found for the relationship of user rating valence and volume with movie revenue reflects the complex environment in which user ratings serve as "word of mouth" advertising on what to attend or watch. It may be that factors affecting the sale of DVDs, used or new, are known by online vendors but this information is rarely made public. In contrast, 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 is few (Zhou & Lange 2009), user ratings of movies are public and readily available.

While there is some research on movies, there is little research on DVD sales (Baugher and Ramos 2017) and none for the used DVD market despite concerns that the used market is a serious problem for those selling books, CDs/DVDs, and video games (Ishihara & Ching 2012). Ultimately, competition from used goods can significantly lower profits and the incentive to develop new products (Tedeschi 2004). In some places, such as Japan for video games, those selling used goods have been sued because of this concern (Hirayama 2006) though ironically Ishihara and Ching (2012) found sale of used video games in Japan actually increased the demand for new games.

For second-hand markets, research has generally shown that price is a factor in the purchase

of used goods. For such relatively expensive durable goods like a car, price relates to sales and is significantly discounted relative to new cars (Engers 2009; Esteban & Shum 2007). Though most durable goods follow a model similar to cars, there are exceptions. The market for art, like paintings and sculpture, can work in an opposite manner with higher prices achieved in the second hand market (Scitovsky 1994). There are also times when the second-hand market can be priced out of existence via a low price for the new good (Anderson & Ginsburgh 1994).

While the focus of this study is on Internet word-of-mouth and not price, we believe the used DVD market behaves much like that of the used car market with price impacting sales and buyers expecting used DVDs to have a lower price than the corresponding new DVD. However, when a DVD becomes scarce due to it going out of production, we believe consumers understand used DVD prices will increase considerably much as is the case for some used cars like Pontiac GTOs from the 1960s (Cargurus.com 2021)

Purpose of the Study

This study examines the association between user ratings and the number of days it takes for a used DVD to sell on Amazon.com. Two types of user 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 used DVD sales and, in particular, whether these two measures have the potential for predicting the time it takes for a used DVD to sell. The study also hopes to shed more light on the contradictory results found in prior studies for the role of valence and volume of user ratings in predicting DVD sales.

There appears to be little dispute that online ratings serve as word-of-mouth advertising for what to watch and buy despite the inconsistency in results for valence and volume in predicting movie sales revenue, with valence showing significant relationships in some studies and volume showing significant relationships in others. Likewise, user ratings of books have been shown to have a similar 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.

For predicting DVD and games sales, Chung et al. (2012) posit three components that might apply equally well to used DVDs: (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 here from the Bass model is the notion that those who influence DVD purchase in networking may not yet be previous adopters..

Hypotheses

Two hypotheses were tested. For both hypotheses, the dependent variable was days to sale.

For Hypothesis 1, we predicted the correlation between mean user ratings (valence) and days to sale for used DVDs would be negative, with less positive ratings associated with a longer time to sell a used DVD. Valence is readily available online prior to their purchase and offers one measure of content quality for DVDs thereby serving as an important source of word-of-mouth views, fitting the Bass model as a potential influence from previous adopters or viewers.

For Hypothesis 2, we predicted rating volume would correlate negatively with days to sale for used DVDs, with lower volume of ratings associated with a longer time to sell a DVD. For used DVDs, volume might be a useful 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 volume builds as a result of prior sales success in a complex interplay between sales, time, and movie success (Duan et al. 2008). Thus, rating volume might serve as a predictor of used DVD sales though volume likely lags valence in its impact.

The following formal hypotheses were tested:

Hypothesis 1: User ratings (valence) will have a negative relationship with days to sell such that a higher average valence will be associated with fewer days to sell.

Hypothesis 2: User rating volume will have a negative relationship with days to sell such that a higher volume will be associated with fewer days to sell.

Research Methodology

Two data sources comprised the study. First, it was necessary to sell used DVDs online in order to determine the number of days it took to sell a mix of DVDs. Second, it was necessary to obtain user ratings (valence) and volume of ratings for the used 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 121 used DVDs were put up for sale between 10/15/2012 and 11/20/2015. 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 used DVDs. To attenuate the possibility of seasonal variation, the DVDs were sold across the fall, winter, spring, and summer sales seasons over the three-year timeframe.

The DVDs comprised a very broad array of titles reflecting ten genre categories: action/adventure, biography/documentary, comedy, drama, foreign film, gay-lesbian, horror/sci-fi, musical, mystery/thriller, and TV episode. TV included a mix of comedy and mystery/thriller like the British mystery series, *Midsomer Murders* and *Poirot*. The drama titles included works derived from literature including that of O’Neil, Shakespeare, and Tennessee Williams as well as somewhat less literary titles.

The Amazon best sellers rank for each DVD was checked at the time of each DVD's initial sale to gauge buyer interest and to assure a full range of used DVDs was put up for sale. This rank is updated hourly and based on Amazon.com sales and reflects the historical sale of every item sold on Amazon (in this case for the United States platform). While this measure changes often, it provided an indication of the sales potential for each used DVD sold. As the sale of a DVD decreases, the number increases.

Specifically, a high best sellers rank reflects slow selling DVDs while a low rank shows fast selling DVDs. Consideration of The Amazon best sellers rank assured the selection of a full range of used DVDs for sale. While Amazon did not separate new and used DVDs in this measure, it is likely a high selling new DVD would also be a high selling used DVD and vice versa.

Also, each DVD on Amazon counts as a different DVD even if it is the same title in another format or package though fortunately sales ranks do not change much across formats. Thus, the sales rank for the ISBN number of each used DVD selected was utilized to check its rank and assure a full range of DVDs was sold. During the time of the study, about 370,000 used DVDs and another 20,000 used Blu-ray DVDs, typically accompanied by a regular DVD of the same title, were offered on Amazon.

All used DVDs in this study had a new version of the DVD competing with it and both typically selling for less than list price. When price exceptions occurred, they were due to scarcity resulting from a title going out of production. In this situation, both the new and used DVDs could be priced higher than list but the used DVD continued to be discounted relative to the new DVD. For example, the only new copy of Godzilla 50th Anniversary 9 Movie Collection available on Amazon at the time of this study was offered at a price of \$387.50. Its list price was \$117.95, and we offered our used version of it for \$119.00.

Thus, the pricing strategy in this study was essentially that of low price, though some used DVDs were assigned a somewhat higher price to provide a range of pricing. The price for each DVD was decided prior to offering it for sale by determining the lowest price offered by others selling the used DVD before its listing. Only in rare cases as noted above where no used DVD was available was it necessary to decide price based on the price of new DVDs.

Still, pricing of used DVDs was a highly dynamic process at Amazon. New vendors appeared, Amazon chose to discount new DVDs 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 their DVD the lowest price offering. This low price point often was one cent lower than the next to lowest price though, at times, it was 30 cent or 61 cents lower, among other possibilities, each available as Amazon IT pricing options to vendors. Likewise, 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, for a short time, lead to a downward spiral of prices.

As a result, it was necessary to lower the price for some used titles following the initial 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 whose goal was 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 of low price.

User Ratings

While there are various sources of mean user ratings online for movies, documentaries and TV shows, valence was obtained from Netflix. At the time of the study, it was one of the biggest sites providing such information. Number of user ratings (volume) was also obtained from Netflix. When the study was implemented, there were about 35 million Netflix users in the United States (Sadeh 2019), a sizable proportion of the population of movie goers.

For box sets, it was necessary to find the average rating and average volume for the multiple movies or TV episodes comprising the set. Multiple TV episodes sometimes required estimation of valence because episodes were not clearly separated in the Netflix ratings. Specifically, this was the case for three TV box sets, *A Touch of Frost*, *Keeping Up Appearances*, and *Peter Gunn*. This did not occur for movie box sets. For these, it was always possible to find the valence and volume for each movie in the set and create an average valence and volume.

IMDb mean ratings were used instead of Netflix ratings for these box sets as it provided valence ratings for each episode allowing the average IMDb valence for the episodes in the box set to be determined. Because these ratings could range from 1 to 10, the average IMDb valence for these box sets was converted to a 1-5 scale by multiplying it by .5, allowing comparability to the Netflix 5-point ratings. It is understood that this made it possible for a rating to be less than 1 (e.g. $1 \times .5 = .5$) but no IMDb ratings were this low in the study and this allowed for simplicity. For Volume, it was possible to use Netflix volumes for the episodes in these three box sets.

Across the used DVDs, volumes of well over 1,000,000 were sometimes found. These were typically movie blockbusters like John Carpenter's horror film, *Halloween*, and *Bladerunner* or movies with a history of many successful years like Hitchcock's *North by Northwest* and James Bond movies such as *Goldfinger*. For TV, high volume was associated with British mysteries such as *Foyles War*. Low volumes were associated with less well known TV productions such as *The Iceman Cometh*, *The Honeymooners Lost TV Episodes*, and *Dragon County by Tennessee Williams*, which had the lowest rating volume of 515.

Results

Table 1 provides summary data for the 121 DVD data sample. TV dominated the mix followed by drama and horror/sci-fi. A one-way-ANOVA showed no significant difference by genre for days to sale ($F = 1.470$, $df = 9,111$, ns) or initial price ($F = .961$, $df = 9,111$, ns).

Of the 121 DVDs, 8 or 7% were in the high resolution Blu-ray format and 16 or 13% were Criterion, a specialty high-end brand. Box sets of multiple movie titles such as James Bond or multiple TV episodes comprised 61 of the DVDs or 50%. Most of these box sets were TV DVDs where box sets of a group of episodes were common.

The Amazon best seller ranking for the DVDs showed a broad range, from 4,747 to 209,375, with a mean of 73,107 and standard deviation of 58,989. This measure was correlated with days to sale ($r = .422, p < .001$) with a higher value associated with more time to sell. However, the Amazon measure was more a result of sales at any given point in time than a cause of sales, varying considerably from day to day. DVD release date ranged from 10/1/1997 to 7/24/2012 with a median date of 10/19/2004 and mean of 12/31/2004.

The average used DVD valence for Netflix ratings was 3.59 with a standard deviation of .39 and range of 2.2 to 4.2. Rating volume averaged 153,945 with a standard deviation of 304,358 and range of 515 to 1,799,800. The median was 46,764, substantially lower than the mean, reflecting the impact of some very high volumes on the mean like that of the movie, Halloween, with close to two million ratings.

The average initial price for the DVDs was \$21.69 with a standard deviation of \$19.81. A price reduction was required for 30% of the DVDs and up to four times, depending on the DVD and competition. On average, the first price reduction took place 7.5 days after the DVD's initial listing for sale (on day 0) while the second and third price reductions took place on average at 15.9 and 24.7 days following day 0, respectively. The fourth price reduction was only needed for three DVDs and, on average, was 37.7 days from its initial listing.

All DVDs sold within 57 days of their initial listing with 17.4% selling on the first day of their offering (day 0), which could be a day of less than 24 hours depending on when the DVD was listed by Amazon. Another 24.8% sold on the next day (day 1). On average, DVDs took 6.31 days to sell with a standard deviation of 9.69. Not including the first day, or day 0, DVDs took 7.65 days to sell with a standard deviation of 10.16. Across the 12 seasonal waves of sale, there was no significant difference in the time it took to sell the DVDs ($\chi^2 = 5.11, df = 11, ns$).

Table 1: Summary of the DVD Data Sample (n = 121)

Variable	Summary Statistics			
DVD Genre	TV (43, 36%), Drama (25, 21%), Horror/Sci-Fi (12, 10%), Bio/Documentary (10, 8%), Foreign (8, 7%), Mystery/Thriller (8, 7%), Gay/Lesbian (6, 5%), Musical (4, 3%), Comedy (3, 2%), Action/Adventure (2, 2%)			
Blu-Ray Format	No (113, 93%), Yes (8, 7%)			
Criterion	No (105, 87%), Yes (16, 13%)			
Box Set	No (61, 50%), Yes (60, 50%)			
Price Reductions Implemented	No (85, 70%), One (21, 17%), Two (8, 7%), Three (4, 3%), Four (3, 3%)			
	Mean	SD	Minimum	Maximum
Amazon Best Seller Rank	73,107	58,989	4747 Halloween (John Carpenter)	209,375 Dragon County (Tennessee Williams)

Release Date on DVD	10/19/2004*	na	10/1/1997 Whatever Happened to Baby Jane	8/20/2017 Endeavor (Masterpiece Theater)
Valence (Mean Rating)	3.59	.39	2.2 The Tempest (Derek Jarman)	4.2 Poirot (Classic Collection)
Volume	153,945	304,358	515 Dragon County	1,799,800 Halloween
Initial Price	\$21.69	\$19.81	\$5.05 Mark Twain (PBS Documentary)	\$121.00 Broadway Lost Treasures Collection
Days to Sale	6.31	9.69	0 (17.4%)	57 Edward II (Derek Jarman)

* Median shown for release date.

In addition to simple correlations with days to sale, H1 and H2 were also tested through an OLS regression. The dependent variable was days to sale where 0 was the first offering day, 1 was the first day after the initial offering day and 57 represented 57 days after the first offering day, the longest time for any DVD to sell. The independent variables were valence and volume. They were entered into regression one. Three additional regressions were performed with only the control variables changing, proceeding in a hierarchical manner. In the second regression, initial price was entered to serve as a control variable. In the third regression, DVD release date was added. In the fourth regression, the control variables of designation as Blu-ray and Criterion were added.

Table 2 shows the intercorrelations between the dependent variable, days to sale, and the six variables entered into the regressions. Three of the six variables showed a significant relationship with days to sale. Valence and volume had a negative relationship with days to sale, with high valence and high volume associated with a shorter time to sell a product. Also, initial price showed a positive correlation with days to sale, with a higher price associated with a longer time to sell. Blu-ray, the Criterion designation, and release date showed no significant relationship with days to sale.

Table 2: Intercorrelation Between Days to Sale and Independent Variables

Variable	Valence	Volume	Initial Price	Blu-ray	Criterion	Release Date
Days to Sale	-.458**	-.197*	.211*	-.012	-.150	.001

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

Table 3 shows the standardized beta weights for the independent variables across the four regressions. All regressions were statistically significant ($p < .001$). The greatest improvement

occurred in regression 2 where R moved from .47 to .53 with initial price added to the predictors of valence and volume.

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

Analysis	R	F-change	Standardized Beta Coefficient					
			Valence	Volume	Initial Price	Release Date	Blu-ray	Criterion
Reg. 1	.47	16.95	-.436***	-.119	-	-	-	-
Reg. 2	.53	15.29	-.457***	-.109	.243**	-	-	-
Reg. 3	.55	12.84	-.507***	-.124	.237**	.168*		-
Reg. 4	.58	9.42	-.485***	-.230*	.240**	.116	.177	-.105

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

Separate analysis of the bivariate correlations for the six independent variables in Table 3 showed valence and volume were not significantly correlated ($p > .05$). However, volume showed a significant correlation of .664 ($p < .001$) with Blu-ray but was not related to any other independent variable, suggesting movies offered in Blu-ray tended to be more watched with a greater volume of ratings. This is likely due to Blu-ray fostering a longer viewing life for some movies. Also, studios tend to re-issue films in Blu-ray only if there is already a large market for the film. Blu-ray also showed a significant correlation of .246 ($p < .01$) with release date suggesting newer titles were more likely to be issued or re-issued as Blu-ray.

Valence showed a significant correlation of .319 ($p < .001$) with release date with newer titles tending to be better liked. Valence was not correlated with any other independent variable. Criterion films are typically more artistic and esoteric with a smaller viewing public. Classification as Criterion was not related to any independent variable ($p > .05$). Likewise, initial price was not related to any independent variable ($p > .05$). For the regressions, none of the variables showed a variance inflation factor (VIF) of greater than 1.0, suggesting there was no multicollinearity problem (O'Brien, 2007).

The correlation and regression results support H1 for the total sample. Per Table 3, valence (or mean rating) had a significant negative relationship with days to sale in all four regressions ($p < .001$) and showed a significant bivariate correlation with days to sale of $-.458$ ($p < .001$) as shown in Table 2. In the first regression, valence showed a standardized beta of $-.436$ ($p < .001$). Its largest standardized beta of $-.507$ ($p < .001$) occurred in the third regression when DVD release date was added to valence, volume, and initial price as predictors.

When Blu-ray and Criterion were added in the fourth regression, valence had a slightly lower beta of $-.485$. Though neither Blu-ray or Criterion were statistically significant in the last regression ($p > .05$), adding them into the equation moved volume to statistical significance with a beta of $-.230$ ($p < .05$) and release date to non-significance with a beta of $.116$ ($p > .05$).

Thus, the correlation and regression results also support H2 for the total sample. Though volume did not show as statistically significant until the fourth regression, it showed a significant bivariate correlation with days to sale of $-.197$ ($p < .05$) as shown in Table 2. Additional analyses,

not shown, indicated that the significant negative beta for volume in regression four emerged due to the inclusion of Blu-ray. When Blu-ray was entered without Criterion, the beta for volume was $-.232$ ($p < .05$), almost identical to the beta when Criterion was in the analysis. When Blu-ray was removed and Criterion left in the regression, the beta for volume moved to non-significant at $-.115$ ($p > .05$).

To assess whether valence and volume were operating in a different manner for Blu-rays and standard DVDs, regression four was conducted separately for each (without Blu-ray in the analysis). The results showed that volume and valence were predicting sales differently across the two DVD formats. Volume showed a significant beta of $-.926$ ($p < .01$) for Blu-rays but a non-significant beta of $.062$ ($p > .05$) for DVDs while valence showed a significant beta of $-.496$ ($p < .001$) for DVDs but a non-significant beta of $-.150$ ($p > .05$) for Blu-rays, suggesting DVD format was a moderator of the impact of valence and volume on sales. Also, unlike regular DVDs, valence and initial price did not show significant betas for days to sale for Blu-ray ($p > .05$) while release date showed a significant beta of $.531$ ($p < .05$).

Despite the few sold, Blu-ray had a relatively big impact on the importance of valence and volume for days to sale with volume the key factor for Blu-rays, supporting H2, and valence showing the biggest predictive potential for standard DVDs, supporting H1. Also price remained a significant predictor for DVDs in the regression but not for Blu-rays. Across the total sample, valence was the dominant predictor of sales in the regressions, likewise supporting H1. This support continued when regular DVDs were analyzed separately. For volume as a predictor of sales, modest support was shown for H2 in the total sample with support increasing for Blu-rays.

For Blu-rays, it appears this impact for volume occurred only because a narrow mix of Blu-ray quality was used in the study. Unlike the total sample of DVDs, a full range of quality was not built into selection of the few Blu-rays sold. Further, the range of Blu-ray quality was intrinsically narrower at the time of the study as this format was used only for well-rated movies. Given the overall results, it seems likely that valence would emerge as a predictor for Blu-rays just as it did for DVDs if a broader range of Blu-ray quality was purposely included. This might also reduce the predictive potential of volume for Blu-rays.

Discussion

This study focused on determining whether the valence (mean rating) and volume of ratings for DVDs from Netflix relate to the time it takes to sell a used DVD on Amazon. Studies of the second hand market for goods typically focuses on price. We know of no studies that have been directed at how Internet word-of mouth might affect the sale of low-priced, durable used goods. Research has been somewhat contradictory when it comes to the relationship between valence and volume and movie box office sales.

We found higher price was related to more days to sell a used DVD. Though not unexpected, what is more interesting is that the relationship was modest compared to the relationship of valence with days to sale. However, price was not the focus of the study. Rather, the impact of valence and volume of ratings on the time it took to sell used DVDs was the thrust. Price was tracked only

as a control variable though much thought went into setting initial price so the study could adhere to its low price strategy.

While mainstream providers of DVDs in the marketplace may be aware of the impact of these variables on days to sale, it is not something that has been subject to academic investigation. Studies of valence and volume have typically been investigated in the context of movie box office sales though DVDs are becoming a significant portion of the revenue stream in the film and television industry.

Unlike research on box office sales which tends to focus on the few weeks after a movie's initial release, by the time someone decided to purchase any of the DVDs in this study, the DVD had been for sale, on average, for over seven years giving time for considerable consumer awareness to develop on the various titles. Often, the actual movie was available years before the release of the DVD, sometimes on VHS.

This study supports valence as a useful predictor of the time it takes to sell a used DVD that is not in the Blu-ray format. A low valence predicted a longer time to sell, supporting H1. However, valence did not predict sales for Blu-rays which were a narrower subset of DVD quality, more often blockbusters, already well liked. For Blu-rays, volume predicted days to sale and valence didn't, supporting H2 but not H1. While volume showed a modest prediction of days to sale for the total sample, supporting H2, this was not the case for the subset of standard DVDs. Valence is likely more important across a broad mix of DVDs with highly variable valences (or likes and dislikes) than volume. With a broader mix of Blu-rays of varying appeal, it seems likely valence would show a stronger relationship with days to sale for this format than it did in this study and volume might decline in importance.

For new DVDs, Baugher and Ramos (2017) found a similar outcome for valence where it also predicted days to sale, though the relationship was weaker than that found in this study for used DVDs. Likewise in the same study, volume had no impact on days to sale and did not approach significance in any regression despite more Blu-rays offered for sale, 19 percent. However, price was a much stronger predictor of days to sale for new DVDs than uncovered here for used DVDs. These differences suggest buying behaviors for used DVDs function differently from those for new DVDs with price becoming less important in the purchase of used DVDs and valence having predictive potential when there is a broad range of quality.

It appears valence of a used DVD can impact sales due to its signal value. Once price is a constant, any additional delay to purchase may be the result of thoughts that a DVD is not worth purchasing, at any price, and it appears that valence provides this information. Per the Bass model (Bass 1969), valence should influence purchase by reflecting the views of prior adopters. It is likely few rated a DVD's corresponding movie, documentary, or TV show on Netflix (or iMDB) without seeing 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 purchase of a used 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 or movie, or to see discussions in the news or on line. It is not inconceivable that this same quick to buy practice is true for Blu-rays which are likewise often blockbusters and, in turn, may reduce the impact of valence on days to sale for the Blu-ray format while increasing the impact of volume.

More research needs to be done on why volume related much more to days to sale for Blu-rays than regular DVDs and valence didn't. As noted earlier, one possibility is Blu-rays were developed for DVDs which are already well liked. This limited the potential of valence as a predictor but increased the impact of volume given the much larger market sizes for Blu-rays where a Blu-ray with a larger market size was more likely to be sold more quickly than one for a smaller market given the need for more sophisticated equipment to view at the time of the study. Of course, technology changes fast and this may already not be the case.

The study is limited by the mix of used 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 used DVD to sell, which is the common approach used to assess the impact of valence and volume on movie box office sales. However, change in valence and volume over the very short time these DVDs were on sale in any given cycle was likely of minimal consequence with such large sample averages for valence and volume already in place. It is our experience that valence and volume change very little even over the course of several years. Valences associated with high volumes are especially unlikely to show change.

A benefit of the relationship of valence with days to sale uncovered is that it can be used to gauge how long a used DVD will take to sell for those who do not have the time, experience, or resources to create a sophisticated forecasting system. A small vendor, of which there are many on Amazon and eBay, can look at one variable, valence at Netflix, to better understand the time it will take to sell a used DVD that is competitively priced. For a regular DVD with a low valence, a vendor might decide to price their product lower if they wish a faster sale. They can also consider using volume for DVDs in the Blu-ray format where a used Blu-ray with a high volume, no matter the valence, will likely sell quickly if competitively priced. However, valence might play a role when a broader range of Blu-rays exists in the market.

One avenue for future research is to study how Amazon ratings relate to the time it takes for a used DVD to sell. Amazon ratings provide immediately observable views though they invariably involve a far smaller volume of ratings than those on Netflix and can at times relate more to the quality of the DVD than its content. For example, *Bladerunner*, was rated by about fifteen thousand on Amazon at the time of this study while close to two million rated it on Netflix.

Study of sales across markets is another potential avenue for further research on valence and volume as predictors of used DVD sales as it is now possible for a DVD vendor at Amazon to opt into selling their DVD across Amazon platforms on a worldwide basis. For the Netflix and IMDb platforms in the United States, Baugher and Ramos (2017) found moderate correlations between volume and valence for the two.

Research checking whether this correspondence between rating valence and volume is true across world markets would be useful to vendors and help them select the Amazon platform where they would be more likely to quickly sell their used DVDs. It would also show the extent to which the Bass model is true across markets. If there is a strong cross-market correlation, then used DVDs might sell similarly across markets. If not, judicious selection of the Amazon platform for sales with a keener eye toward used DVD price would likely make more sense. It is not unlikely that countries might differ in what is considered a quality movie.

Conclusions

This study adds to the relatively small body of research on the factors that impact the sale of low-priced used durable goods. As a predictor, valence appears to be an important word of mouth variable for the sale of used DVDs. Its potential impact is consistent with the notion that the views of 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 the impact, is yet to be fully understood.

Valence was clearly the dominant factor, not volume, in the sale of regular DVDs. Anyone wishing to sell a used DVD could with some success determine how fast their product might sell if priced competitively by checking valence at a site like Netflix. More research is needed to determine if volume is the best predictor for Blu-rays, and not valence, though the typical narrow high-quality range for Blu-rays suggests volume may be used. This is also available from sites like Netflix. In our study of new DVDs (Baugher and Ramos 2017), price was by far the most important factor for the sale of new DVDs. That was not the case in this study of used DVDs where price showed a modest relationship with days to sale for standard DVDs and no relationship for Blu-rays.

It may be price becomes secondary to word-of-mouth for used durable products that are not expensive. This reduction in the predictive potential for price is worth studying for an array of used products. It is possible consumer views of product quality in its many guises may be more important for predicting days to sale for such used products than price as long as a competitive pricing model is used. For products with a narrower range of quality and higher “likeability” such as Blu-rays in this study, it may be volume of ratings, a possible surrogate measure for market size, might be a better predictor of days to sale for similar used products than valence.

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