

RESEARCH ABOUT THE ONLINE REVIEW EFFECTS ON PRODUCT SALES IN DIFFERENT STAGES

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Abstract

With the fast development of E-commerce, online review has become an important source of product information for consumers. Consumers depend on online review to different degrees for products in different sales stages. Based on the information of 209 types of cell phones on a large e-commerce website, this article tries to find out the influence of recent review on the sales of products new to shelves and those put on shelves earlier (new products and old products for short hereinafter), and analyzes how different the effects are. Besides the review amount and valence, the article especially addresses the influence of review distribution on the sales. The results show positive correlation of the recent review amount and negative correlation of review variation (which reflecting the distribution of reviews) with recent sales. However, we also find that when the percentage of positive reviews is below a certain value, it affect consumers' purchase decision more, while this ratio reaches a higher level (for example 0.9), its effect decreases and customers won't consider it a key influencing factor. The research also points out that recent review amount affects recent sales of new products more than that of old ones significantly. These findings contribute to online review research both theoretically and practically.

Keywords: Online review, E-commerce, Sales stage, Review distribution.

1 INTRODUCTION

Along with the fast development of the internet, e-commerce has become a common way of shopping. Research shows that contents generated by users are more reliable than ads (Sheth 1967). Nowadays, most large retail websites have established their own review systems to encourage users to make comments on the quality of products they have bought and share their shopping experiences. Online review has become an important information source for potential buyers. Meanwhile, it has also attracted attentions of researchers worldwide. Many scholars have studied the relationship between online review and the sales from different perspectives, such as the influence of review amount, rating, positive and negative review ratio, and variation of the rating (Chevalier & Mayzlin 2006; Duan et al. 2005). As the research is deepened, some scholars consider moderating variables when studying the relationship between online review and the sales, such as the type of products, consumer's experiences and cultural background (Zhu & Zhang 2010; Gu et al. 2012).

Some studies explore the differentiated influence of online review on popular products and unpopular ones (Zhu & Zhang 2010; DellaroCas et al. 2010), and some conduct comparative research on the effect of online review on search products and experience products (Hao et al. 2010; Park & Lee 2009), but few divide products according to the time they are put on shelves and study how online review affects products in different sales stages. This article divides cell phones sold on www.360buy.com into categories of products new to shelves and those put on shelves earlier, and compares the influences of recent review on the sales of the two types. It turns out that the amount and coefficient of variation (CV) of recent review can affect the recent sales of the two types significantly and in a more significant way those new to shelves than the other type.

Different from similar studies which explore the impact of all reviews on product sales, this paper pay attention to recent reviews. Recent reviews refer to all those reviews posted during the month before our data collecting week. We also prove that influence of recent review on recent sale is more than reviews post earlier. Here we must emphasize that recent reviews and recent sale do not coincide in time, so there no serious endogenous problem in our analysis.

The remainder of this paper is organized as follows. Section two introduces related research; section three proposes the hypotheses and models; section four provides the empirical analysis. The conclusions are outlined in section five.

2 LITERATURE REVIEW

The online review is an important reflection of public opinion for products. Studies in this regard focus on the review contents, usefulness and its relationship with the sales, etc.. Among the studies, those about the influence of online review on the sales mainly focus on the review amount, orientation, variance of scores, information about reviewers, as well as other factors, because such

factors reflect the “informative” and “convincing” nature of the public opinion. The more reviews on a product, the more possible it might be known by consumers and the more buyers. The influence of the informative nature of online review on the sales has been proved by many researches (Chevalier & Mayzlin 2006; Liu 2006; Cui et al. 2012; Duan et al. 2005; Chen et al. 2003). Users can grade products they have bought and service they enjoyed. In retail websites, there are usually five grades for products and services, with the one star indicating worst products or service and five stars meaning the most satisfactory. A final grade will be calculated out based on all grades for the product. The higher the final grade, the better quality it indicates, and the more convincing for potential buyers. Some studies prove the positive promotion of ratings for products sales(Reinstein & Snyder 2005; Sawhney & Eliashberg 1996), while some others have found no significant correlation between ratings and sales(Duan et al. 2005; Chen et al. 2004). Besides, higher positive review ratio indicates better product quality and stronger inclination of consumers to buy the product. Some scholars argue that consumers not only pay attention to the review amount and grade, but also the credibility and exposure of reviewers themselves (Hu et al. 2008). Table 1 summarizes major research conclusions about the online review. As far as we know, few studies have focused on the relation between the review distribution and the sales. This article holds that with the same review amount, different distribution can influence consumers’ purchase decisions, and analysis is made in this regard.

Does the online review influence the sales in different ways as time changes? Does it affect products in different sales stages differently? The research on the relationship between online reviews on Yahoo! Movies with the box office revenue by Liu (2006) found that the online review can effectively explain the weekly box office revenue, especially in the period when a new movie is launched. By studying 71 movies shown between 2003 and 2004, Duan et al. (2005) found that the review affects the box office more in the second week than in the first week after a new movie hits the cinema. Analysis by Cui et al. (2012) of panel data of 332 new products sold on Amazon.com in nine months finds that the review influence on the sales is significant when products are new to shelves, but weakens later.

Influential factors	Major conclusions	Literatures
Review amount	Review amount and product sales are positively related. No significant relationship between review amount and sales. Significant review influence on sales of new products which weakens over time.	Chevalier & Mayzlin 2006; Cui et al. 2012 Chintagunta et al. 2010 Liu 2006; Cui et al. 2012
The valence of online reviews	Ratings and product sales are positively related. No significant relationship between the valence of online reviews and product sales. Negative review more influential than positive ones.	Ye et al. 2009; Gu et al. 2012; Reinstein & Snyder 2005; Chintagunta et al. 2010 Liu 2006; Duan et al. 2005; Chen et al. 2004 Yang & Mai 2010; Park & Lee 2009

	Negative review more influential for experience products than for search products. Positive review more influential for search products than for experience products.	Park & Lee 2009 Hao et al. 2010
The variation of ratings	Variation of ratings and sales are positively related. Variation of ratings and sales is positively related in case of low total ratings.	Clemons et al. 2006 Sun 2012
Reviewer information	Consumers concern about the reputation and exposure degree of the reviewers.	Hu et al. 2008

Table 1. A Summary of Related Literatures

3 HYPOTHESES AND MODELS

Consumers usually search product information before they decide to buy, and online review is the most direct and accessible source of information. For popular products sold on large online retailers, there might be tens of thousands review for each of them, but most past reviews can hardly influence consumers' decision making in a direct way, as consumers usually only read the first pages of reviews. Besides, the products may be sold from different sources and recent reviews can better reflect present product quality than past reviews. Therefore, this article holds that consumers are concerned with not only the review content and product rating but also the releasing time of the review, as recent review is more influential for recent sales and more reliable to predict recent sales volume. In this article, recent review means all those made in a month prior to data collection.

Online review research shows that the review amount is an important factor influencing the sales, and the more a product is reviewed, the more it is exposed and accessible by potential buyers and the more possibly it is bought. On the other hand, hot discussion can attract potential consumers to buy and discuss the product due to social needs and herd mentality (Godes & Mayzlin 2004). Therefore, this article holds the same expectation based on previous research.

Meanwhile, this article believes that in the case of the same review amount, different distribution has different effects on the sales. According to previous research (Hu et al. 2011; Hu et al. 2011; Hu et al. 2012), product review is manipulated in many cases by retailers or manufacturers. If many reviews are post in one day and several days, consumers' perception of the truthfulness might be affected. The CV of recent review is calculated by dividing the standard deviation of daily review amount with the average value of daily review amount, reflecting the variation of recent review distribution. Higher CV indicates more unequal review distribution.

This article uses the positive review ratio to reflect the reviewers' emotional inclination. This ratio is presented on the product page on www.360buy.com (the proportion of four-star and five-star ratings). Higher positive review ratio indicates more satisfactory products which are more attractive to potential buyers.

The following hypotheses are proposed accordingly:

H1: Recent review influences recent sales.

H1.1: Positive correlation of the recent review amount with recent sales.

H1.2: Negative correlation of CV of recent review with recent sales.

H1.3: Positive correlation of recent positive review ratio with recent sales.

As data about the sales volume are commercial secrets, www.360buy.com and most other large online retailers do not release the accurate sales volume of individual products, but only provide a sales ranking. As this ranking is based on the historical sales volume by granting comparatively big weight to recent weekly sales volume, this article regards this ranking as the ranking of recent sales. The sales ranking is negatively correlated with the sales volume. For example, the most sold products rank first. According to Chevalier&Mayzlin (2006), the ranking and sales volume bear a linear relationship, namely, $\ln(sale) = \beta_0 - \beta_1 * \ln(Rank)$, so the sales is indicated by $-\ln(Rank)$.

The model about the influence of recent review on recent sales is as follows:

$$-\ln(Rank) = \beta_0 + \beta_1 RecNum + \beta_2 RecVar + \beta_3 RecPos + \varepsilon \quad (1)$$

Consumers have no enough and uniform understanding about advantages and disadvantages of products new to shelves, thus there are few online reviews, to which potential buyer pay more attention. As time goes by, consumers know better about the product from more diverse sources, and become less reliant on online review, which, therefore, becomes less influential in promoting the sales. According to the research on movie box office made by Liu (2006), online review affects the box office more when the movies just hit the cinema. This article tries to find out whether this conclusion can apply to typical search products (for example, the cell phone).

The following hypotheses are proposed accordingly:

H2: Recent review affects recent sales of new products more than that of old ones.

H2.1: The recent review amount affects recent sales of new products more than that of old ones.

H2.2: The CV of recent review affects the recent sales of new products more than that of old ones.

H2.3: The recent positive review ratio affects the recent sales of new products more than that of old products.

The general model to test the differentiated influence is as follows:

$$-\ln(Rank) = \beta_0 + \beta_1 RecNum + \beta_2 RecVar + \beta_3 RecPos + \beta_4 ProType + \beta_5 RecNum * ProType + \beta_6 RecVar * ProType + \beta_7 RecPos * ProType + \varepsilon \quad (2)$$

Table 2 provides the definition of variables.

Variables	Definition
<i>RecNum</i>	Refers to the amount of recent review
<i>RecVari</i>	Refers to CV of recent review. It reflects the variation of recent review, and is calculated by dividing the standard deviation of daily review amount with the average value of daily review. The higher CV indicates more unequal review distribution.
<i>RecPosi</i>	Refers to the ratio of recent positive review, namely, the

	proportions of four-star and five-star review.
<i>Rank</i>	Refers to the ranking of the recent sales.
<i>ProType</i>	Refers to the product category. It is a dummy variable in the model, with 0 indicating new products, and 1 for old ones.
<i>RecNum*ProType</i>	Refers to the interaction of the recent review amount and the product type.
<i>RecVari* ProType</i>	Refers to the interaction of the CV of recent review and the product type.
<i>RecPosi* ProType</i>	Refers to the interaction of the recent positive review ratio and the product type.
<i>TotNum</i>	Refers to the amount of total reviews since the product is available.
<i>TotPosi</i>	Refers to the ratio of total positive reviews, namely, the proportions of four-star and five-star review.

Table 2. Variable definition

4 DATA COLLECTION AND ANALYSIS

4.1 Data collection

The data of this research are collected from www.360buy.com, which is one of the largest online retailers in China. It provides numerous kinds of products, detailed product descriptions, as well as the sales ranking and consumers' review. This article collected information about cell phones put on shelves before March 31, 2012 including product information like the product name, time to be put on shelves, sales ranking, total review amount, positive and negative review ratios, reviewer's ID and grade, review time, content and so on.

4.2 Data processing

Products are categorized as those new to shelves and those put on shelves earlier, the former of which refer to products put on shelves in 2012 and the latter indicate those put on shelves before 2012. A total of 87 products in the first category and 122 in the second category are selected randomly. The daily review amount for each product from February 25 to March 25, 2012 is used to calculate the recent review amount, coefficient of variation, and recent positive review ratio for each cell phone. The data of time that the product was put on shelves, total review amount and total positive review ratio are collected directly from the website. The sale rank reflects weekly product sale amount. According to our data collecting time, the sale rank in this article refers to the sale during March 26 and March 31, 2012. Therefore, there is no serious endogenous problem in our analysis. The descriptive statistics about major variables are shown in Table 3.

Type	Variable	Minimum	Maximum	Mean	SD
New Products (N=87)	<i>Rank</i>	13	894	403.72	264.54
	<i>RecNum</i>	1	564	67.75	100.10

	<i>RecVari</i>	.25	5.39	1.75	1.41
	<i>RecPosi</i>	.00	1.00	.90	.13
	<i>Rank</i>	36	811	337.43	158.52
Old Products	<i>RecNum</i>	4	640	172.68	127.05
(N=122)	<i>RecVari</i>	.21	3.55	.70	.54
	<i>RecPosi</i>	.73	1.00	.91	.05

Table 3. Descriptive statistics

4.3 Data analysis

4.3.1 Analysis of recent review influence on recent sales

Table 4 is the correlation analysis matrix of major variables for 209 products, indicating significant correlation of recent review amount and CV with the recent sales amount. The correlation coefficients between recent review amount, CV and recent positive review ratio are less than 0.8.

Variables	<i>-Ln(Rank)</i>	<i>RecNum</i>	<i>RecVari</i>	<i>RecPosi</i>
<i>-Ln(Rank)</i>	1			
<i>RecNum</i>	.448** (.000)	1		
<i>RecVari</i>	-.408** (.000)	-.402** (.000)	1	
<i>RecPosi</i>	.094 (.178)	.105 (.131)	-.023 (.738)	1

N=209; P<0.01, **

Table 4. Outcome of correlation analysis

Regression analysis of the total 209 cell phones according to Model (1) shows that the adjusted R^2 is 0.255 (R^2 is 0.266), reaching the level of similar studies, D-W test value is 1.630 and the residuals are not obviously correlated. According to the analysis of variance, F is 24.73 and $p < 0.001$, the model has statistical significance. Besides, collinear diagnosis is made to the regression equation, showing that the tolerance value of all variables are above 0.1 and there are no multi colinearity.

Variables	NSC	SC	T	Sig.
<i>constant</i>	-6.113		-13.175	.000
<i>RecNum</i>	.002**	.333**	5.068	.000
<i>RecVari</i>	-.196**	-.273**	-4.174	.000
<i>RecPosi</i>	.440	.052	.868	.386

(NSC: non-standardized partial regression coefficients; SC: standardized partial regression coefficient)

Table 5. Regression analysis about the influence of recent review on recent sales

As shown in Table 5, the regression coefficients of *RecNum* and *RecVari* is significant, indicating statistical significance of the influence of recent review amount and CV on the recent sales amount. Recent review amount is positively related to recent sales amount and recent review CV is the negatively related, proving the H1.1 and H1.2. The regression coefficients of *RecPosi* is not significant statistically, indicating no significant influence of the ratio on the sales amount and not supportive to H1.3.

Many researches also arrive at the conclusion that the percentages of positive reviews having less explanatory power for sales, and that might be attributed to the comparatively high positive review ratio and minor difference between different products. Judith A. Chevalier & Dina Mayzlin find that reviews are overwhelmingly positive in both Amazon.com and BarnesandNoble.com.

The above discussion has not touched the essence of the problem, in order to explore the inner causation, we select those items whose *RecPosi* is less than 0.9 from the 209 products, and we got 65 cell phones. Table 6 shows the correlation analysis of these 65 items, and we find that the positive reviews ratio is significantly related to the sale amount in this case. Therefore, we believe that when the percentage of positive reviews is below a certain value, it may affect consumers' purchase decision more, while this ratio reaches a higher level(for example 0.9), its effect decreases and customers won't consider it a key influencing factor as shown in Table 4.

Variables	<i>-Ln(Rank)</i>	<i>RecPosi</i>
<i>-Ln(Rank)</i>	1 (.019)	.290* (.019)
<i>RecPosi</i>	.290* (.019)	1

N=65; P<0.05,*

Table 6. Correlation analysis of 65 low- *RecPosi* cell phones

Different from similar studies which explore the impact of all reviews on product sales, this paper pay attention to recent reviews. We try to find the relationship between recent reviews and recent sales, and we must emphasize that here recent sale refers to weekly sale. *-Ln(Rank)* is used to stand for recent sale, which is based on weekly sale rank. Recent reviews refers to all those reviews posted during the month before our data collecting week, therefor recent reviews and recent sale do not coincide in time, so there no serious endogenous problem in our regression analysis. Our study shows recent reviews amount and recent review CV could explain more than a quarter of sale changes. The significant impact of recent reviews on recent sales indicates that consumers will read first pages of reviews before making decisions, and they concern the releasing time of the review.

To go further, we need to compare the effect of recent reviews and all the reviews since a product is put on shelf. We know from Table 4 that recent review amount and CV is significantly related to recent sales. Table 7 is the correlation analysis matrix of total reviews and sales, and we find that the both total review amount and total positive review ratio are not significantly correlated to recent

sales. Therefore we believe that recent reviews influence recent sales more than total reviews.

Variables	<i>-Ln(Rank)</i>	<i>TotNum</i>	<i>TotPosi</i>
<i>-Ln(Rank)</i>	1	.052 (.456)	.122 (.077)
<i>TotNum</i>	.052 (.456)	1	.145* (.037)
<i>TotPosi</i>	.122 (.077)	.145* (.037)	1

N=209; P<0.05,*

Table 7. *Correlation analysis of total reviews and sales*

4.3.2 Analysis of different influence of recent review on products in two categories

The product category is taken as a dummy variable, with 0 indicating new products and 1 for old ones. The Model (2) is used to test whether the recent review influences the sales of products in two categories differently. The analysis result is shown in Table 6.

Variables	NSC	SC	T	Sig.
<i>Constant</i>	-6.077		-12.922	.000
<i>RecNum</i>	.006**	.928**	7.420	.000
<i>ProType</i>	.278	.170	.258	.797
<i>RecNum* ProType</i>	-.004**	-.674**	-4.634	.000
<i>RecVari</i>	-.203**	-.282**	-3.658	.000
<i>RecVari * ProType</i>	-.021	-.014	-.177	.860
<i>RecPosi</i>	.463	.055	.938	.350
<i>RecPosi* ProType</i>	-.483	-.269	-.402	.688

(NSC: non-standardized partial regression coefficients; SC: standardized partial regression coefficient)

Table 8. *Regression analysis of the adjustment of product categories on the recent review amount influence*

According to the result, the adjusted R^2 is 0.418 (R^2 is 0.437), the independent variables can well interpret the dependent variable, and F test result has statistical significance. As indicated in Table 8, the coefficient of recent review amount and recent review CV is significant statistically, which is consistent with the result of Model (1). What is more, the interaction of recent review amount and product type also has significance, indicating that recent review amount influences the sales of products in two categories differently. The partial regression coefficient of recent review amount is 0.06, implying positive correlation between recent review amount and the sales; and that of the

interaction is -0.04, of which the absolute value is lower than that of the former. When the product category is “1”, the positive influence of recent review amount on sales is partially offset by the interaction; while the product category is “0”, the interaction cannot offset the influence of recent review amount. Therefore, the recent review amount can impose more influence on the sales amount of products new to shelves, **supporting H2.1**.

As shown in Table 8, the coefficients of *RecVari * ProType* and *RecPosi* ProType* are not significant, therefore the impact of recent review CV and positive review ratio on recent sale is not adjusted by the product category. There is no significant difference in the influence of recent review CV and positive review ratio on products in different categories, **not supportive to H2.2 and H2.3**. The reason why the influence of these two factors on sale is not adjusted by product category needs to be explored deeply in the future. Though we now do not know the exact reason why this situation exists, still the research result itself inspires us a lot in management of online customer reviews.

5 CONCLUSION AND DISCUSSION

5.1 Conclusions

Based on data of cell phones sold on www.360buy.com, this research analyzes the influence of online review on products in different sales stages, and holds that consumers not only pay attention to the review content but also to the time it is released. Recent review can better reflect the current product quality and can directly affect the sales as consumers usually read the first pages only. Products are divided into two types according to the time that they are put on shelves. Potential buyers rely on online review to different degrees for products in different categories. The article first examines the effect of recent review on all products, and then compares its influences on different product categories, and finds that:

- The recent sales is positively affected by the recent review amount, and negatively affected by recent review CV. That means the seller should take measures to encourage online review release and especially on products not reviewed for long, and they may send emails or short messages to consumers to encourage them to make online review on products they have bought; at the same time, the sellers should pay attention to the review distribution, as more equal the distribution is, the better it can promote the sales.
- When the percentage of positive reviews is below a certain value, it affect consumers' purchase decision more, while this ratio reaches a higher level (for example 0.9), its effect decreases and customers won't consider it a key influencing factor. According to this finding, sellers need not to try hard to improve the positive review ratio of products whose percentage already reaches a certain value (for example 0.9).
- The recent review amount affects new products much more than old ones. There is no significant difference between the influences of recent positive review ratio on products in different categories, and it is the same for recent review CV. That indicates different effects of online review on products in different sales stages, and sellers should manage online review according to the product's life cycle. They should encourage the releasing of online review on new products more than on old ones. Main conclusions of the research are listed in Table 8.

H1: Recent review influences the recent sales	H1.1 Positive correlation of recent review amount with recent sales.	Supported
	H1.2 Negative correlation of CV of recent review with recent sales.	Supported
	H1.3 Positive correlation of recent positive review ratio with recent sales.	Partially Supported
H2: Recent review affects recent sales of new products more than that of old ones.	H2.1 The recent review amount affects recent sales of new products more than that of old ones.	Supported
	H2.2 The CV of recent review affects the recent sales of new products more than that of old ones.	Not Supported
	H2.3 The recent positive review ratio affects the recent sales of new products more than that of old products.	Not Supported

Table 9. *Research conclusions*

5.2 Research limitation

Despite some useful findings, this research still has some limitations:

- Data used in this article are from one online retailer and for a specific type of products. Although the retailer is one of the largest B2C websites and the data sample is representative to some degree, the applicability of the research findings to other websites and product types and online retailers with different cultural background should be further examined;
- Cell phones are categorized as new and old ones according to the time they were put on shelves. The division should be more specific in later research, in hope of getting more accurate conclusions;
- This article does not take into consideration other important factors influencing the sales, such as promotion information and cell phone brands. Further studies can consider such variables for more precise conclusions;
- This article only focuses on product suppliers and touches little the features of consumers. According to previous research, consumer features can adjust the influence of online reviews. Improvement should be made in this regard in further research.

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