

# Sales Effects of Online Product Reviews: A Comparison of Two Different Types of Sellers

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## Abstract

There is much evidence that product reviews are important to sales in online markets. However, little is deeply discussed about how much the product reviews affect sales, and the validity of the influence also lacks supports of empirical studies. This paper posits that the influence of online product reviews on sales is different by market structure. In this study, we propose statistical models to explore how the volume and valence of product reviews affect online sales and the difference in these influences between two types of sellers, self-operated store and marketplace. The data in this study were retrieved from a large-scale online B2C mall in China. Major findings in the present study suggest that (1) for both the two types of sellers, the volume of product reviews in preceding period positively affect sales in subsequent period, but its influence is more pronounced for self-operated store than it for marketplace, and (2) the impact of proportion of negative reviews on sales is somewhat stronger for marketplace than it for self-operated store. Endogenous issue in dynamic panel data is addressed in the estimation. This study enables to retailers to further understand the relation between product reviews and sales in online shopping. Management implications and future research directions are discussed at the end.

## Keywords

Product Reviews, Volume, Valence, Market Structure, Dynamic Panel Data

## 1. Introduction

In the last decade, more and more consumers are getting used to shopping online, and online retail has claimed an ever-growing share of total retail sales. Meanwhile, with the rapid proliferation of Internet technology, customers also share their experience or provide feedback on a product or service they have bought or experienced, which is known as online product reviews, thereby affecting other consumers' purchase decision-making processes (Chu and Kim, 2011; Doh and Hwang, 2009; Godes and Mayzlin, 2004). There is an interesting observation that in most online markets, the successful sellers who have good sales also have a huge number of product reviews. One widely-held explanation in academia and practical circle holds favorable product reviews can increase other customers' intention to purchase (Chatterjee, 2001; Dellarocas et al., 2007; Khare et al., 2011). It is

precisely for this reason, many online sellers thus provide some incentives to inspire customers to write reviews after their purchase, which is designed to attract more patronage.

This study focuses on how product reviews influence sales in B2C online markets. Due to the existence of the information asymmetry, sales effect of product reviews is one of the most-focused concerns in e-retailing studies, and prior research has documented that the use of product reviews has a strong impact on consumer purchase (De Maeyer, 2012; Floyd et al., 2014; Chevalier and Mayzlin, 2006). Despite the evidence on the importance of product review in online markets, little is known about the detail of its influence on sales performance.

Prior research in online marketing literature discussed the impacts of product reviews mainly from the perspectives of volume and valence (Gu et al., 2012; Zhang et al., 2012). Interestingly, the influences of product reviews on sales in empirical studies were mixed and equivocal (Floyd et al., 2014). Many studies have demonstrated that the volume of product reviews is positively correlated with sales performance (Anderson and Salisbury, 2003; Li and Hitt, 2008). The relevant literature attributed that this is because online product reviews can enhance consumers' expected quality, trust, and purchase attitudes toward the product (Duan et al., 2008b; Liu, 2006). However, some researches disagrees with this opinion. For instance, Chen et al. (2004) suggests that the above effects was not remarkable. With respect to the valence of product reviews, decades of research have shown that negative information is more strong, influential, predictive, and difficult to resist than positive information in e-markets (Chatterjee, 2001; Zhang et al., 2010). Similar to the influence of review volume, there is also conflicting results relating how review valence affect sales in the literature. Numerous studies have suggested that positive product review is positively related to consumer purchase decisions, whereas negative review has an unfavorable impact on product attitudes (Cabral and Hortacsu, 2010; Liu, 2006). However, Ghose and Ipeiritos (2011) and Gu et al. (2012) found the sales effect of review valence is negligible.

In this study, we posit that the mixed results with sales effects of product reviews may be caused by the difference of market structure, which is seldom discussed in the literature (Ye et al., 2013). To make the issue clearly, we simply classify the structure of B2C online sellers as two types, self-operated store (i.e., products and all services are provided by operation platform, such as Amazon) and marketplace. The objectives of the present study are twofold: (1) to obtain an accurate assessment of the relations between product reviews and sales, and (2) to investigate the differences in these relations between the two different types of sellers, if any. In our paper, we conduct a data tracking on a popular online B2C markets in China, JD.com, and propose statistical models to explore the sales effects of product reviews from two dimensions, volume and valence, and discuss the differences

between self-operated store and marketplace.

This study provides insights not only for analysis methodology but also for online marketers and managers. The comparison of the sales effects of online product reviews for different market structure can help retailers to further understand the mechanism of product reviews action for improving the effectiveness of shop evaluation management to meet customer needs. In addition, the application of web crawling can be used to collect reliable and comprehensive information, which include competitors and their own, to assess the directional changes in their sales outcomes. This may help them quickly find business opportunities and analyzes competitive relationships in a cost-efficient manner.

The rest of the paper is organized as follows. Section 2 reviews the literature related to the rations among sales performance, review volume or valence, and market structure. We describe the study design and data collection in Section 3, and propose complete estimation processes with statistical models, and explicate the analysis findings in Section 4. Finally, Section 5 concludes the study with contribution of this study and discussions of the managerial implications and directions for future research.

## **2. Literature Review**

Prior research deals with sales effects of online product review usually focus on its volume and valence (Duan et al., 2008a; Floyd et al., 2014). However, although the relationship between reviews and sales in online shopping has been commonly discussed by the relevant literature, the findings of empirical studies on how product reviews influence sales performance were mixed and equivocal. In addition, Ye et al. (2013) has indicates that the marketing effects will be moderated by market structure. Building on this idea, this study posits that market structure, specifically the types of sellers, may also moderates the influence of product reviews on sales, though this speculation still lacks empirical evidence to support by the literature. Therefore, this study incorporates the antecedent factors, i.e., (1) the volume and valence of online product reviews and (2) the types of sellers, into sales performance model to explore an accurate assessment of the sales effects of online product reviews.

### **2.1 Volume of Product Reviews**

The volume of product reviews is an important dimension to reveal the degree of consumers' comments or feedbacks in online markets from the quantitative aspects (Floyd et al., 2014). Because there is information asymmetry in e-markets, prior research has demonstrated that the volume of reviews is usually considered as a reflection of other consumers purchase outcomes, which be thought to reduce uncertainty, increase consumer awareness, and can generates greater sales

(Anderson and Salisbury, 2003; Godes and Mayzlin, 2004; Liu, 2006). De Maeyer (2012) pointed out that review volume can offer one perspective on the product popularity, and Duan et al. (2008a) speculated that a considerable number of user evaluations can help other new or potential customers to make a purchase decision more easily by influencing both their awareness of the product and perceptions of its quality. In addition, an opinion expressed by more people may convey the correctness of the position, many studies also have asserted that abundant product reviews can increase the persuasiveness of online word-of-mouth (Floyd et al., 2014; Khare et al., 2011). However, although there is extensive research has demonstrated that the volume of online reviews has a positive impact on consumer purchase intention and sales outcomes, as the empirical evidence, the specific extent of this influence remain unclear.

Combining the above aspects, this study proposes the following hypothesis on the relationship between the volume of product reviews and sales performance.

**H1:** *The volume of online product reviews has a positive impact on sales.*

## **2.2 Valence of Product Reviews**

Valence of product reviews means the preference carried in the word of mouth information (Floyd et al., 2014). Compared with review volume which can reflect the popularity of product, the valence mainly demonstrates its quality or character with positive or negative evaluation. In most previous studies, review valence is usually measured from the rating or textual context of the product review (Hu et al., 2009; Sun, 2012). Similar to the volume of reviews, the use of valence also contributes to consumers purchase decision-making by eliminating uncertainty and avoiding risks. As a common consensus, due to information uncertainty in online markets, positive product reviews typically enhance consumers' expected quality and attitudes toward that product, while negative reviews may usually have an unfavorable impact on product attitudes (Liu, 2006).

Though there are already discussions of review valence, interestingly, the empirical evidence regarding detailed assessment of the sales effects of review valence is conflicted and inconclusive. Chevalier and Mayzlin (2006) indicated that the valence of online reviews has a strong impact on sales volume of books, and the similar results for hotel bookings and movies are also found by Ye et al. (2009) and Chintagunta et al. (2010). However, the significant impact of review valence on sales is not supported by some other empirical works (e.g. Duan et al., 2008a). One possible explanation for the mixed results may because of the difference between "positive" and "negative" feedbacks. According to prospect theory, negative information is more strong, influential, predictive, and difficult to resist than positive information (Kahneman and Tversky, 1979). As the application of this theory, there is evidence suggests that the effect of negative reviews on online sales

is somewhat stronger than it of positive reviews, which is because a potential loss has a greater impact on consumer perceptions and decision-making than an otherwise equivalent gain (Baumeister et al., 2001; Li and Shimizu, 2018). In addition, another possibility is that the sales effects of product reviews may be moderated by other external factors, as will be discussed subsequently.

Therefore, given the aforementioned finding in the literature, we propose the following simple hypothesis concerning the influences of review valence on sales.

**H2:** *Proportion of negative online product reviews negatively influence sales.*

### **2.3 Types of Sellers (Market Structure)**

As some studies in the e-commerce literature have speculated, this study also considers that the relationship between product reviews and sales will be moderated by market structure factors. In prior research, the structure of online markets was usually classified as the size of sellers, the extent of product differentiation, or the market entry conditions. Hou and Blodgett (2010) distinguished the online markets by the number of sellers and divided the marketplaces into thick markets (markets with a large number of sellers) and thin markets (markets with a small number of sellers). On the basis of this classification, Ye et al. (2013) discussed the difference in the relation between seller reputation and sales performance between those two markets and found the impact of seller reputation on sales is larger for thick markets than it for thin markets. Building on this idea, this study tries to extend the literature and examine how market structure moderate the sales effects of product reviews in B2C online markets.

Compared with the study of Ye et al. (2013) who focus the environment on C2C online markets which is more similar to marketplace, there are two different types of sellers, namely self-operated store and marketplace, in vast majority of B2C markets like Amazon.com. Since there is at most one self-operated store in a B2C online platform while lots of sellers deal at marketplace, self-operated store is similar to the thin markets while marketplace is similar to the thick markets in a sense. Consumer can directly obtain not only shopping cart service (i.e., order and payment) but also shipping and all after-sales service from the operating e-platform if they shop from self-operated store, while customers must contact the sellers by themselves when they have some troubles after purchasing from marketplace (Karaer and Erhun, 2015). Therefore, it is considered that consumers may perceive more risks of product and service quality and focus more on product reviews when they shop from marketplace than from self-operated store. On the other hand, due to the existence of homogeneous competition and quality uncertainty among the marketplace, this also will result in that consumer is more willing to read the content of other buyers' feedback before making a purchase decision (Chen et al., 2004; Hou and Blodgett, 2010).

Based on such recognition, consequently, two hypotheses are offered as follows.

**H3a:** *The influence of review volume on sales performance is more pronounced for marketplace than it for self-operated store.*

**H3b:** *The influence of review valence on sales performance is more pronounced for marketplace than it for self-operated store.*

In subsequent section, we will describe data collection processes and propose statistical models to test the above hypotheses.

### 3. The Data

In this section, we present the study design include data collection, and describe details of the variable measurements for the entire study. Because traditional survey approach cannot obtain a genuine relationship between reviews and sales, in this study, we need to collect data on online product reviews, sales performance, and sellers' type from the real online market situation. The present study focused on JD.com, which is one of the fastest growing and the most popular online B2C markets in China, with nearly 300 million active users and 1.3 trillion turnover. We developed a Python-based Web Crawler to track the above data and conducted the data tracking once a week to avoid the time noise. In addition, due to variety and differentiation in product categories, it is not feasible to have a general result about the sales effects of product reviews for all products. Therefore, this study selected ladies shoulder bags as the target products, which is because of the variety and availability of similar products sold in both marketplace and self-operated store with relatively stable sales.

The data relate to product reviews and sales performance were collected from the sales page of each relevant product. In this study, we selected two years data for the period from August 1, 2014 to July 31, 2016. After the process of data matching and cleaning, in which any invalid data with system error and serious noise were deleted, we obtained complete unbalanced panel data for 861 products with 89 weeks (in maximum). Relevant data in this study include the information of seller type, product SKU,<sup>(1)</sup> sales price, selldate, and the detail of product reviews which includes the feedback rating, specific content, the number of helpfulness votes, and purchased date. The data on product reviews and sales performance were matched by product SKU and the date of purchase. After referring to the relevant literature, aggregated data were made available to us, which include monthly sales performance for each relevant product (Ye et al., 2013).

Independent variables relate to product reviews. The characteristic of review is assessed through its volume and valence. The volume of reviews can be measured by using the overall accumulated number of observable reviews at each period. The valence of product reviews is measured by calculating the proportion of negative reviews. We used the number of negative reviews divided by the number of total

reviews (in percent) to obtain the negative proportion. Prior research has shown that these indicators have strong impacts on sales (Floyd et al., 2014). Proportion of negative reviews in the present study can be processed as follows.

$$p_{i,t} = N_{i,t}/R_{i,t}$$

where  $p_{i,t}$  denotes the proportion of negative reviews for product  $i$  at period  $t$ ;  $N_{i,t}$  and  $R_{i,t}$ , respectively, indicate the accumulated number of negative and overall customer reviews, which can be easily aggregated from the dataset. Although the product page provides the total number of product reviews, the value is only the approximate number (e.g. 45,000+), which is not accurate. Consequently, volume was determined by counting the number of individual reviews that are stored in our database. Additionally, in this study, negative product reviews refer to those customer comments or feedbacks with a rating less than 2 stars, while those with a rating greater than 4 stars are classified as positive.

Dependent variable in this study is the sales of each product. However, given the attributes of product webpage on JD.com, the accurate information of sales at each period cannot be obtained. Therefore, the number of monthly product reviews were combined and used as a substitute for sales, which is a practical approach because previous studies have found a linear relationship between sales and volume of reviews (Ye et al., 2011; Zhu and Lai, 2009). Since the review can only be written by a customer who has bought the product, which means that the consumer bought a product at period  $t$ , thus his/her review will be displayed at period  $t + 1$ . Thus, the sales can be processed by the following equation.

$$S_{i,t} = R_{i,t+1} - R_{i,t}$$

where  $S_{i,t}$  is the indicator of sales volume at period  $t$ , which is measured by using the difference between the number of overall reviews at period  $t$  and  $t + 1$ .

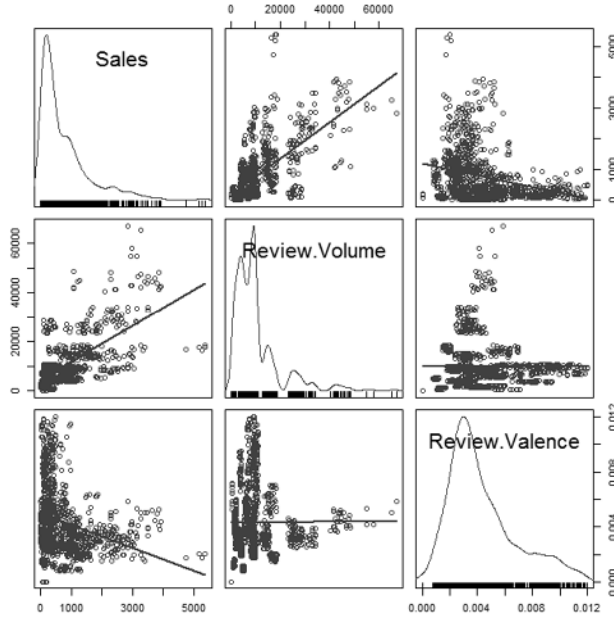
In the present study, moderator is seller type, which can be easily distinguished based on the information source. We measured the moderator as a dummy variable to control the structure of online markets, which takes the value of 1 if the seller is self-operated store. Control variables are the regular price and selling duration for each product  $i$  at period  $t$ . Regular price is denoted as the mode<sup>(2)</sup> of selling price during the relevant period, and selling duration is measured as the intervals between the date of product launch and the date at period  $t$ .

#### 4. Models and Estimations

Before the modeling, we briefly confirm the relations among review volume and valence, and sales. Figure 1 displays a plot-matrix of these relations. We can intuitively notice that the number of overall product reviews and sales performance were correlated in a positive fashion, while the correlation between the proportion of negative reviews and sales were seemed to be not significant. However, there may be a potential problem that the influence from other factors such as price and

sales duration were not controlled, which may cause the correlations to be incorrect. In addition, the issue of spurious correlation may also exist. In this section, to study how online product reviews influence sales performance, two statistical models are proposed. We first provide a general model in which control factors are considered. This is followed by an endogenous test with the using of dynamic panel data. Thereafter, we introduce the market structure as a moderator to investigate the difference in sales effects on product reviews across seller types. The influences of both review volume and valence will be discussed.

**Figure 1: Plot-matrix of Correlations of Sales with Review Volume and Valence**



A general statistical model to assessing the sales effect of product reviews is simply to include the variables of quantitative surrogates (i.e., volume and valence) and discuss the regression coefficients of review variables in sales response model without considering the difference of market structure. In this paper, the general estimation method called Model 1 is used to test the hypotheses H1 and H2, which are proposed in the previous section. Model 1 includes the target variables of review volume and valence, and is specified as follows.

$$y_{i,t} = \beta_0 + \beta_1 x_{i,t} + \beta_2 p_{i,t} + \alpha_1 z_{1i,t} + \alpha_2 z_{2i,t} + \epsilon_{i,t}$$

$$\epsilon_{i,t} = u_i + e_{i,t}$$

where  $i$  is the individual dimension and  $t$  is the time dimension, which identify product and period, respectively;  $y$  is the logarithm of sales (i.e.,  $y_{i,t} = \ln S_{i,t}$ );  $x$  is natural logarithm of accumulated number of overall reviews (i.e.,  $x_{i,t} = \ln R_{i,t}$ );  $z_1$  is log of price; and  $z_2$  represents selling duration.  $S_{i,t}$ ,  $R_{i,t}$ , and  $p_{i,t}$  are defined



the same as previously. In addition, the error term  $\epsilon_{i,t}$  is i.i.d. normally distributed and dependent on both individual and time.  $u_i$  is individual-specific and time-invariant effects, while  $e_{i,t}$  represents the error which is dependent with both individual and time. The use of dynamic panel model can obtain precise estimates. In this model,  $\beta_1$  and  $\beta_2$  are the core parameters capturing the influences of review volume and valance on sales, while other parameters (i.e.,  $\alpha_1$ , and  $\alpha_2$ ) relate to the impacts of control variables.

One point is worth noting in the above estimations that the lag of explained variable enters the model as an explanatory variable in form ( $S_{i,t} = R_{i,t+1} - R_{i,t}$ ). It makes the within estimator inconsistent in the case that it is analyzed using a static panel estimation with fixed effects. Based on such recognition, we decided to estimate the models by using GMM (i.e., Generalized Method of Moment).

**Table 1: Parameter Estimates of Model 1 and Model 2**

Model 1				Model 2			
	Estimate		t-value		Estimate		t-value
$\beta_0$	-3.17		-0.41	$\beta_0$	-6.12		-0.22
$\beta_1$	0.81	***	7.36	$\gamma_0$	4.47		0.81
$\beta_2$	-156.44	*	-1.75	$\beta_1$	0.75	***	4.09
$\alpha_1$	-0.45	***	-5.34	$\gamma_1$	0.24	**	2.01
$\alpha_2$	0.41		0.13	$\beta_2$	-290.62	**	-2.12
				$\gamma_2$	145.47	**	1.99
				$\alpha_1$	-0.48	***	-6.31
				$\alpha_2$	0.34		0.52
No. of Group			861	No. of Group			861
F-Statistic			53.78	F-Statistic			91.48
A-Bond test for AR (1)			-6.87	A-Bond test for AR (1)			-9.41
A-Bond test for AR (2)			1.41	A-Bond test for AR (2)			0.61
Hansen test			31.53	Hansen test			29.12

Note: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Table 1 (left) presents the parameter estimates of Model 1 with the entire data. Consistent with the results in the literature, the estimation result indicates that product review in online markets has an impact on sales indeed. Specifically, H1 predicts that the number of overall reviews (i.e., review volume) has a positive impact on sales performance. After controlling for the impacts of regular price and selling duration, a significant and positive estimate was obtained, which relates to the effect of review volume on sales at the 0.01 level (i.e., 99% credible interval does not cover zero). Parameter  $\beta_1$  represents this effect. Therefore, H1 is supported. Similarly, in H2, proportion of negative product reviews is speculated to have a negative effect on product sales in online shopping. This hypothesis can be verified by parameter  $\beta_2$ . However, although the estimate of  $\beta_2$  is negative, which means the direction of its effect is as expected, the p-value of this estimate is 0.08. That is to say, the null hypothesis cannot be rejected at 5% significant level. Thus, the

estimation result with real-time data tracking in Model 1 did not completely support H2. Additionally, as the control variable, the effect of price on sales is negative.

To explain why the influence of negative proportion of product reviews on sales was not significant at the 0.05 level in the whole dataset, we posit that the influence may be moderated by other external market factors. In our dataset, the sellers can be divided into two types. One is self-operated store, which all services include selling and shipping are provided by JD.com. Another one is tenant store, which JD.com only provides the marketplace or platform, and products or services are offered by each vender/seller. In addition, item assortments and seller size are obviously larger for self-operated store than those for marketplace. In this study, we speculate the seller type moderate the relation between sales and product reviews. To verify this speculation, a new model called Model 2 is proposed, in which the types of sellers, as the proxy of market structure, is introduced as the moderator. In Model 2, we focus on the difference in the sales effects of product reviews between the two seller types. Model 2 is formed as follows.

$$y_{i,t} = (\beta_0 + \gamma_0 D_i) + (\beta_1 + \gamma_1 D_i)x_{i,t} + (\beta_2 + \gamma_2 D_i)p_{i,t} + \alpha_1 z_{1i,t} + \alpha_2 z_{2i,t} + \epsilon_{i,t}$$

where  $D$  is a dummy variable, denoting the structure of markets, which take the value of 1 if the product is directly sold by JD.com, and all other variables are defined the same as previously.

In Model 2,  $\gamma_1$  and  $\gamma_2$  are the regression coefficients of the slope dummies, which respectively capture the differences in sales effects of review volume and valence between self-operated store and marketplace. Parameter  $\gamma_0$  reflects the brand value of JD.com (i.e., self-operating).

Estimation results for Model 2 appear in Table 1 (right). Consistent with the results in Model 1, the estimate of  $\beta_1$  is positive and significant, providing the evidence that the volume of product reviews in preceding period positively affect sales in subsequent period in marketplace. Interestingly, the estimate of  $\beta_2$  in Model 2 is negative and significant at the 0.05 level, which was not significant in Model 1. This result means that the negative influence of proportion of negative reviews on sales is confirmed in marketplace. In H3a, the influence of review volume on sales is speculated to be more pronounced for marketplace than it for self-operated store. Parameter  $\gamma_1$  in Model 2 reveals this relation. As shown in the table, the estimate of  $\gamma_1$  is significant at the 0.05 level. However, contrary to what we predicted in the hypothesis, the estimation result is positive, which means the influence of review volume on sales is stronger for self-operated store than it for marketplace. Therefore, the findings do not support H3a.

Similarly, H3b predicts that the impact of review valence on sales is stronger for marketplace than it for self-operated store. This hypothesis can be verified by parameter  $\gamma_2$ . The estimate of  $\gamma_2$  in Model 2 is positive, whose direction is

contrary to  $\beta_2$ . In addition, the result is significant at the 0.05 level, but the 95% confidence interval of  $\beta_2 + \gamma_2$  covered zero. This indicates that the proportion in negative product reviews has a negative impact on sales for marketplace, but the influence is not significant for self-operated store.

## 5. Conclusions and Discussion

Despite the substantial interest in online product reviews, meta-reviews on the findings of related research show the sales effects of reviews were mixed and conflicted (Floyd et al., 2014). To further understand how product reviews influence sales performance in online shopping, this study traced the sales and reviews data on the fastest growing online B2C markets in China, JD.com. We provided dynamic panel data models based on GMM estimations to measure accurate relationships of sales with review volume and valence, which cannot be consistently estimated by means of traditional approaches. In addition, Ye et al. (2013) has documented that the degree of sales effects will be moderated by market structure. Building on this idea, in this paper, we posited that market structure, specifically seller type, also can moderate the influence of review volume and valence on sales performance.

Prior research has indicated that the volume of product reviews is positively related to sale because a higher volume of product reviews is thought to increase consumer awareness of the product and perceptions of its quality, thereby generate greater sales (Chen et al., 2004; Liu, 2006; Duan et al., 2008a; Floyd et al., 2014). In our study, this positive relation was further confirmed. We noticed that because of the asymmetric information and perceived risks in online shopping, the increase of the number of product reviews can contribute to improve subsequent sales performance for both platform own store (i.e., self-operated store) and marketplace, as well as the social influence. A possible reason is that product review is a vital, trustworthy source of information for people to gather product-related information (Chevalier and Mayzlin, 2006; Dellarocas, 2006), that helps them avoid laborious search efforts and mitigate decision making risk (Duan et al., 2008b). Valence of product reviews in this study was measured by using the proportion of negative reviews, which is judged based on their textual context. The literature has documented that negative reviews may involve product denigration, rumor, or complaints, and usually have an unfavorable impact on product attitudes (Floyd et al., 2014; Liu, 2006), and thus hinder sales (Li and Shimizu, 2018). However, the result in our analysis shown that *ceteris paribus*, especially in invariant volume of reviews, the influence of the negative proportion in total reviews on sales was not strict significant, though its direction was negative as the literature indicated.

In addition, consider the function of product reviews that can help consumers to expend less energy on information gathering and thus mitigate the risk of decision making (Gruen et al., 2006; King et al., 2014), we speculated that the impacts of

review volume and valence on sales performance are more pronounced for marketplace than them for self-operated store. This speculation is due that all services in self-operated store are directly provided by the online platform, whose trust and market loyalty are relatively high. By contrast, since the perceived risks in marketplace are higher, consumers will pay more attention on product reviews when they shop marketplace. However, the findings in our study suggested that compared with the self-operated store, the influence of proportion of negative reviews on sales for marketplace was relatively high, while the effect of review volume was less. This means that when perceived risks are high in markets, the influence of product reviews depends more on the preference carried in the review information (Chevalier and Mayzlin, 2006; Li and Hitt, 2008). On the contrary, consumer respond to the bandwagon effect when the risks are low.

This study mainly contributes to the existing literature in two ways. First, we improved the accuracy of sales effects of online product reviews. Unlike the method in prior research that these effects were usually estimated by using time-series or cross-sectional data, this study adopted dynamic panel data models to obtain an accurate measurement. Compared with the existing literature, the approach in the present study is better able to study the dynamic behavior of complex issues. The second contribution of this study is to investigate the differences in the relations of sales with review volume and valence across market structure, and specifically the types of sellers. Although there is evidence that the sales effects of product reviews in existing studies produced mixed results, the reasonable explanations are still insufficient in the literature. Building on the idea of Ye et al. (2013), this study introduced a moderator of market structure, and pointed out that the conflict results in the literature may be caused by the types of sellers (in this study, self-operated store and marketplace), which have different market prestige, and competition model in online markets. This finding also provides support to the reviews-sales relationship, on which previous studies in the literature have speculated.

Several managerial implications can arise from the findings of our study. First, retailers in online market should focus more on the social influence and bandwagon effect. The evidence shows that the number of product reviews positively affects sales performance. This means that products with high reviews can improve consumer awareness and purchase decision. Meanwhile, as the long-term effect, the increase of product reviews also can form invisible advertisement effect to save cost spending in promotion. Second, in platform e-markets, and specifically the marketplace where the competition is intense and the perceived risk is high, retailers should lay more emphasis on the valence of reviews. That is to say, it is important for retailers to improve the quality of product and customer service, and it is also necessary to reduce the proportion of negative feedback. We think this

study can help managers of B2C markets to recognize the importance of valence and volume of product reviews, and improve the effectiveness of store evaluation management.

Inevitably, there are some limitations in our study. First, we only focus on one product, shoulder bag, to discuss sales effects of product reviews. We cannot sure whether other products sold on online markets behave similarly to our findings. It is necessary to collect more empirical data, which covers a wider range of diverse products, to further validate our conclusions. Second, sales data were not forthcoming. If possible, future studies could use such data to analyze the direct effect of product reviews. At last, the effects from some special promotions, like Black Friday or Double 11, were not considered. In many cases, the relation between product reviews and sales will be strongly influenced by such special promotions. The above issues need to be further explored in the future.

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<sup>(1)</sup> A stock keeping unit (SKU) is a 6-8 character long alphanumeric code used to identify a product and track its inventory. The SKU for each product and seller is a unique number. The character length of SKU in this study is 7.

<sup>(2)</sup> The mode is the value that appears most often in the dataset.

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