Impact of Online Consumer Reviews on Product Sales: Quantitative Analysis of the Source Effect

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Abstract: Objective: This study tries to analyze the source effect of online consumer reviews such as seller-site, seller-blogger, and personal-blogger reviews and focus especially on close relationships between online consumer reviews and product sales. Method: Hypotheses were proposed as to whether online consumer reviews from different sources have differential effects on product sales. Experimental data were obtained from an online bookseller. Regression analysis was adopted to test hypotheses. Conclusions: Several important findings emerged from the results: 1) online consumer reviews that came from different sources had differential impacts on product sales, and the effect of personal blogger reviews was most influential among the three kinds of reviews; and 2) the manner by which consumers used online consumer reviews varied with the source of reviews. These findings suggest useful implications for online sellers in terms of how to manage online consumer reviews, especially personal blogger reviews.

Keywords: Electronic commerce; Word-of-mouth; Online consumer review; Blog; Source effect

1 Introduction

The sales figures of online shopping are continually increasing. Online retailer sales were $104 billion in 2003, which was a 39% increase compared to that in 2002 [1]. This increase reached $172 billion in 2005 and is expected to reach $329 billion in 2012 [2]. It has been discovered that with a gradually increasing population of Internet users, online shopping skills of consumers have been improving [3]. Above all, relatively rich and highly educated young consumers have contributed to the amazing success of online shopping [4,5,6,7]. What are the characteristics of online shopping that entice consumers to shop online and thereby lead to such huge growth? There have been studies on this interesting issue. Some focus on the reasons why consumers use online shopping (i.e., lower prices, increased convenience, and customer services) compared to offline shopping [8,9, 10]. In addition, 52% of online consumers use the Internet to search for product information, and 24% of them use the Internet to browse products before making decisions on what to purchase [11]. Therefore, it can be assumed that the growth of online shopping is due to the Internet's

capability of providing consumers information about products efficiently.

Online consumer reviews are widely used as an effective tool that can improve the efficiency of finding product information. A recent research found that approximately 50% of young Internet surfers relied on word-of-mouth recommendations before the purchase of CDs, movies, DVDs, and games [12]. Because online consumer reviews can provide new information from the perspective of customers who have purchased and used the desired product [13], many consumers tend to regard product information in online consumer reviews as being more persuasive and trustworthy compared to seller-created information [14,15,16]. Due to these characteristics, online consumer reviews have been verified by several studies to affect consumers' decision-making processes and can play an important role in raising product sales by influencing consumers' purchasing intentions [17,18].

In general, online consumer reviews are classified into four categories according to their purposes. The first two categories pursue profits. One of them is seller sites, such as Amazon, which sell products directly to consumers,

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and the other is agent sites, such as Epinion, which support transactions between sellers and consumers. The remaining two categories do not receive any benefit from sellers. One of them refers to third parties, such as Google and Yahoo, which provide valuable product information to consumers, and the other is blogs that are used by consumers to express personal opinions and thoughts. There are various types of blogs based on their sources: personal blogs, industry blogs, publication blogs, and corporate blogs [19]. Personal blogs are the most common form of providing relatively subjective information because they are individual media. It can be said that personal-blogger reviews are more consumer-oriented than those from other media or information sources [20].

According to the Pew Internet & American Life Project, blog readerships have increased by 58% since 2004 [21]. Surge in popularity has resulted in six million blogs all over the world [22]. Blogs are one of the most widely-used media as over 12,000 new blogs are created daily, and 4.6 blogs on average are being updated every second [23]. Blogs have enough marketing values to be used by corporations, such as Nike, Microsoft, and IBM, which have tried to establish new business models by incorporating blogs [24]. The social influence of blogs is becoming powerful because several media elites and celebrities frequently use them [25,26]. Therefore, it is natural that many studies have investigated the effect of blogs. However, in contrast with studies about properties of blogs, it is intriguing to note that few studies have examined the role of blogger reviews on consumer buying behavior, while comparing with other online consumer reviews. This is surprising when considering the growing impact of blogs as a social medium.

Thus, the goal of this study is to examine the role of blogger reviews as a sales motivator and investigate whether blogger reviews affect product evaluations to increase product sales significantly. Furthermore, this study investigates whether there are meaningful differences between blogger reviews and other online reviews in terms of the impact on product sales; it examines whether there are significant differences among various kinds of blogger reviews, including personal-blogger and seller-blogger (corporate-blogger) reviews in particular. For experiments, we collect and analyze data from one of the most popular online booksellers in Korea.

2 Literature Review

2.1 Blog and Blogging

The term 'blog' was coined by Peter Merholz in 1999, and blogging has attracted wide media attention since the 2004 presidential election in the U.S.A. [19]. Blogs mean frequently updated Web sites written in a diary-like style with personal observations and news listed chronologically on the site as well as commentaries and recommended links [25,27]. Interactive communication via the Internet creates a unique environment, also known as Web 2.0, which supports creativity and collaboration among users. The role of blogs representing the wisdom of crowds has become emphasized based on the properties of Web 2.0 [28].

Moor and Efimova [27] have described blogs as a Web-native format that take advantage of unique features found in the Internet. Marlow [29] noted that what distinguishes blogs from previous Web media depends on the sociability and recognizance that make blogs a community because every individual who takes part is connected to each other through the social tie of readership. This is consistent with the properties of blogs that Winer, a blog pioneer, has described [22]:

- Personalized: Blogs are designed for individual use, and their style is personal and informal,
- Web-based: Blogs can be updated frequently,
- Community-supported: Blogs can be linked to other blogs and Web sites,
- Automated: Blogging tools help bloggers to present their words easily.

Due to these features as personalized media, blogs are more human-oriented and have highly subjective content [20]. Blogs have created a high-tech Consumer-to-Consumer mode of communication that cannot be controlled by corporations [19]. Blogs have become one of the most powerful information sources for conveying public opinions on the Web [30]. The individuality of blog distinguishes it from other information sources [31].

Internet users tend to think that blogs are more credible media, compared to not only traditional newspapers, radio, and TV, but also online media, such as online newspapers and magazines. More importantly, it is found that those who rely little on traditional media are more likely to view blogs as credible information sources [25]. However, Banning and Sweetser [32] found no observable difference in credibility between traditional media and non-traditional media (personal and media blogs). Mack, Blose and Pan [19] compared personal blogs, seller (corporate) blogs, and traditional word of mouth offline in terms of perceived credibility and perceived trustworthiness. They discovered that even bloggers considered traditional word of mouth as a more credible information source than blogs. Despite some debate about blogs, it is crucial to note that blogs are a meaningful information source and can be used to complement existing media, rather than replace them [33]. Therefore, blogs have become a viral marketing site based on peer-production and can be promoted to induce online person-to-person interactions [20].

2.2 Online Consumer Reviews and Word-Of-Mouth

Online consumer reviews are being provided by individual consumers who voluntarily exchange product information. They can be seen as a form of electronic word of mouth, which is composed of extremely weak ties based on anonymity [34]. Online consumer reviews can be differentiated from traditional word of mouth in terms of the level of scalability, speed of diffusion, persistence, and measurability [35].

In addition, online consumer reviews can be used flexibly according to marketing strategies of sellers. First, whenever necessary for their benefits, sellers can control the extent of online consumer reviews by deciding whether to offer product information [36]. Such properties of online consumer reviews have potential benefits because of not only positive reviews which are favorable for sellers but also negative ones which can be manageable. In an online shopping environment, negative reviews have been found to exert more influence on consumers' attitudes towards the product, persuasion, and purchasing intention, compared to positive reviews [16, 37,38]. Therefore, controlling online consumer reviews is one of the most important factors for sellers' profits.

Second, measuring the effectiveness of online reviews can be possible, compared to traditional word of mouth. Once a review is established, it can be stored semi-permanently for future reference [29]. It is possible for sellers and consumers to trace online consumer reviews when needed because the records of reviewers, dates, and content remain permanently. Godes and Mayzlin [12] showed how to evaluate the impact of online consumer reviews by measuring volume and dispersion. Therefore, the value and effect of online consumer reviews especially regarding product sales and revenues can be analyzed quantitatively, and marketing managers can benefit from this feature of online reviews [14,15,35, 39,40].

Third, as one of useful decision aids akin to feedback mechanisms and recommendation systems, online consumer reviews have been used to support the information search behavior of consumers seen in an online shopping environment. The immense variety of information available online provide opportunities for manufacturers and retailers to make word-of-mouth information accessible easily. Online consumer reviews could be used to help consumers make efficient decisions and overcome information overload by reducing the uncertainty of information quality [15]. This is consistent with the role of traditional word of mouth, which is used to overcome uncertainty and decrease the amount of information processing for products [41].

A similarity between online consumer reviews and traditional word of mouth is that both directly affect consumers' purchasing behavior. Several studies have demonstrated how traditional word of mouth affects purchasing decisions of consumers [23,42]. In the same manner, online consumer reviews have directly affected consumers' purchasing behavior [38,40,43]. Park, Lee and Han [13] emphasized a moderating role of consumer involvement when analyzing the effect of review quality and quantity on purchasing intentions of consumers. Chatterjee [44] found that online consumer reviews, product prices, and retailer familiarity were significantly related to consumers' purchasing intentions.

Mayzlin [40] found that a firm's ability to communicate with consumers through online word of mouth is a profitable strategy; therefore, online consumer reviews can help increase product sales by stimulating purchasing intentions and positively affecting the final decision-making of consumers. As online consumer reviews are relatively informative in terms of credibility and relevance, they can also play an important role as a free sales assistant by providing consumers with product information according to their idiosyncratic preferences [36].

2.3 Review Sources and Product Sales

It can be assumed from previous studies that there are positive interrelationships between online consumer reviews and product sales. Chevalier and Mayzlin [40] found that the number of reviews and ratings had a significant effect on product sales of online book retailers and that both one-star and five-star reviews were important in influencing sales. Based on data from Amazon, Hu, Liu and Zhang [15] emphasized the importance of reviewer quality and exposure, which can stimulate product sales by reducing the uncertainty perceived by consumers. In addition, Dellarocas, Awad and Zhang [35] and Dellarocas, Zhang and Awad [14] found that online consumer reviews could be utilized to formulate a revenue-forecasting model for the movie industry. Duan, Gu and Whinston [39] and Liu [45] noted that online consumer reviews could be used as a predictor of box-office revenues.

The relationships between product sales and online consumer reviews from seller sites and third parties have been examined [15,39,45]. Some studies have analyzed whether blogger reviews have a meaningful influence on product sales. In those studies, blogger reviews were used to build a sales-forecasting model. Mishne and Glance [46] formulated a model for predicting movie sales by using sentiment information in blogger reviews, and Gruhl et al. [47] found that adding blog data had a positive effect on the prediction of sales ranks of online sites such as Amazon. Because blogs, in particular, are considered to be a credible and human-oriented information source [20,25], blogger reviews can have more influence on product sales than other kinds of reviews. Mack, Blose and Pan [19] found that personal- and seller-blogs were different in terms of perceived trustworthiness and perceived credibility; these results

mean there may be a significant source effect across different types of blogs.

Many studies have proven how a receiver's recognition about an information sender can affect consumption of messages [48,49,50]. Even though contents may be the same, the recognition differences might affect consumers' behaviors significantly. This kind of source effect can influence recognition of credibility and quality for information as well as consumer buying behavior. Different sources can be a crucial variable in moderating consumption of online information. Therefore, product information from credible sources could be assumed to positively affect the decision-making process of consumers.

Variation in the information source influences information evaluation by consumers. Sundar [51] found that the presence of quoted sources affected quality and credibility of online news. Accordingly, consumers' attitudes, responses, and perceived usefulness regarding product information could be influenced by the source effect. Furthermore, the source effect can be enormous with regard to persuasion [52]. It is noteworthy that the source effect especially applies to consumers' purchasing decisions [53]. Changes in physical appearance and accent were significantly related to purchasing intentions of consumers who tried to buy automobile insurance. Senecal and Nantel [54] found that various recommendation sources could differ in the impact on consumer choice by comparing three types of Web sites: seller, commercially-linked third parties, and non-commercially linked third parties.

Likewise, it was found that source credibility affected consumer persuasion and could change his or her attitude. Harmon and Coney [55] noted that variations in the source credibility influenced consumer decision-making in a buying-and-leasing situation. Sternthal, Dholakia and Leavitt [56] emphasized the role of timing in delivering a message that may moderate the effect of source credibility. Mishne and Glance [46] noted that if a consumer perceived corporations to be highly credible, the consumer is more likely to think favorably of the companies' advertising and brand and include them in consideration when the consumer needs to purchase a product. Product information from a credible source has a positive impact on consumer attitudes and purchase intentions toward the product.

3 Research Hypotheses

3.1 Quantity of Reviews and Product Sales

The number of online consumer reviews of a product represents the product's popularity [36] and therefore is much related to consumer decision-making. Huang and Chen [57] noted that consumers monitor other people's comments regarding specific topics and use them as a basis for their own choices. Thus, the number of online reviews was found to positively affect consumer choice, only when the quantity of positive reviews was large enough to overcome negative attitudes from negative reviews and heighten consumers' purchase intentions. Park, Lee and Han [13], and Park and Kim [18] found that the quantity of positive online reviews significantly heightened consumers' purchasing intentions and the number of reviews had a stronger effect on purchasing intentions than other factors, especially for low-involvement consumers with low expertise.

Many studies have verified positive relationships between the quantity of online consumer reviews and product sales. Duan, Gu and Whinston [39] and Liu [45] noted that the number of consumer postings was significantly correlated with movie sales. Dellarocas, Awad and Zhang [35] and Dellarocas, Zhang and Awad [14] used the volume of online reviews as one of the most important variables to formulate a sales-forecasting model. Chevalier and Mayzlin [17] suggested that seller-site reviews had positive effects on product sales; they observed that book sales between two seller sites (Amazon and Barnes & Noble) depended on the difference in the number of reviews across the sites.

However, even though the direct effect of the quantity of blogger reviews on product sales is not examined yet, it can be assumed that an increasing volume of blogger reviews is positively associated with product sales. Two kinds of blogger reviews (seller-blogger and personal-blogger reviews) are thought to have more impact on product sales than seller-site reviews because consumers tend to consider blogs as a human-oriented information source [20]. Among them, an increase in the quantity of personal-blogger reviews is most influential because they could be considered to possess more consumer-oriented information than seller-blogger reviews. Because seller blogs have the same domain address as the seller's site, consumers can think that seller-blogger reviews seem to be similar with seller-site reviews. Based on the abovementioned findings related to the quantity of reviews, the following hypotheses have been proposed:

H1-1: Personal-blogger reviews influence product sales more positively than seller-site reviews
H1-2: Personal-blogger reviews affect product sales more positively than seller-blogger reviews
H1-3: Seller-blogger reviews influence product sales more positively than seller-site reviews

3.2 Quality and Length of Reviews and Product Sales

As opposed to the quantity of online consumer reviews, not enough studies have examined the effect of quality reviews on product sales because it is difficult to measure quality properly. Chatterjee [44] noted that there were no

standard criteria on quality for the content of online consumer reviews. However, some scales have been developed to measure the quality dimension of information and these could be applied to quantitatively analyze the quality of reviews. Negash, Ryan and Igbaria [58] noted that there were many important determinants to perceive information quality, including accuracy, precision, currency, output timeliness, reliability, completeness, conciseness, format, relevance, understandability, usefulness, sufficiency, freedom from bias, comparability, and quantitativeness. In addition, they viewed information quality as having two dimensions: informativeness, which is an ability to inform consumers of product alternatives; and entertainment, which is an ability of media to fulfill audience needs for emotional release. Park, Lee and Han [13] noted that high-quality reviews were more logical and persuasive, and supported consumer evaluations based on the facts about a product.

However, the problem of how to use these scales to measure the quality of reviews still remains unresolved. Hu, Liu and Zhang [15] found that only the reviewer quality, which was not the quality of reviews, was a meaningful variable related to product sales. But several other studies have insisted that the quality of reviews has a positive effect on the consumer purchasing intention. Lee, Park and Han [16] found that the quality of online consumer reviews positively affected purchasing intentions and attitudes for products, especially of consumers who were highly involved. From the findings that consumers' purchasing intentions are significantly stimulated by high-quality reviews, it can be assumed that the quality of reviews is positively related to product sales. If online reviews can provide consumers with useful and objective product information, the consumers are positively stimulated to purchase the product. Therefore, the following hypotheses can be proposed.

H2-1: High-quality online consumer reviews positively affect product sales more than low-quality online consumer reviews.
H2-2: High-quality (personal- and seller-) blogger reviews positively affect product sales more than high-quality seller-site reviews.
H2-3: High-quality personal-blogger reviews positively affect product sales more than high-quality seller-blogger reviews.

It was verified that the length of online consumer reviews had positive relations with product sales. Chevalier and Mayzlin [17] found that consumers read not only summary statistics such as the number of stars but also the full text of seller-site reviews; consumers also tended to respond more positively to shorter seller-site reviews than longer ones. From these results, it can be assumed that reading longer seller-site reviews may require more intense cognitive efforts from consumers than reading shorter ones. Meanwhile, consumer responses to blogger reviews could be different because of the information sharing and mutual learning

characteristics of blogs arisen from simple egocentricity as well as passion for knowledge [59]. That is, consumers visit blogs not only for getting simple product information but also for creating and sharing knowledge; further it is possible to say that long blogger reviews lead consumers to positive responses. It can be inferred that longer blogger reviews do not meaninglessly waste the cognitive capacity of consumers; rather, they stimulate purchase decisions of consumers.

H3-1: Longer personal-blogger reviews have more positive impacts on product sales than shorter seller-site reviews.
H3-2: Longer personal-blogger reviews have more positive impacts on product sales than longer seller-blogger reviews.
H3-3: Longer seller-blogger reviews have more positive impacts on product sales than shorter seller-site reviews.

3.3 Rating and Relative Age of Reviews and Product Sales

Based on seller-site reviews obtained from Amazon and Barnes & Noble, Chevalier and Mayzlin [17] noted that five-star and one-star reviews had more influence on product sales than other reviews, and the impact of one-star reviews was greater than that of five-star ones. This finding has meaningful implications in two respects. First, positively-rated seller-site reviews can be used to stimulate product sales. Second, the presence of a negative effect is consistent with the results of other studies [16,37,38], although online consumer reviews were found to be overwhelmingly favorable [15,17].

In contrast, consumers who read longer blogger reviews have more intentions to purchase the product, and they do not seem to care about how many stars blogger reviews have because they tend to lay much importance to communicate and share information with other consumers. This tendency may be strengthened especially when consumers read personal-blogger reviews. Therefore, it can be supposed that the rating of blogger reviews may not affect product sales irrespective of whether they are rated positively or negatively. However, consumers who read seller-site reviews tend to read the content and check the number of stars as well; therefore, the rating may be meaningful to seller-site reviews regarding product sales.

H4-1: Positively-rated seller-site reviews have more positive impacts on product sales than positively-rated (personal- or seller-) blogger reviews.
H4-2: Negatively-rated seller-site reviews have more negative impacts on product sales than negatively-rated (personal- or seller-) blogger reviews.

By analyzing seller-site reviews obtained from Amazon, Hu, Liu and Zhang [15] noted that the impact of

seller-site reviews on product sales would decrease with time. Because there may be only a limited number of sources for product information in the initial phase of product introduction, consumers tend to depend on online consumer reviews. However, consumers can expand sources to friends and newspapers to obtain useful recommendations with the passage of time; then, the influence of reviews begins to diminish progressively. Therefore, it is found that there would be a meaningful change in the impact of online consumer reviews on product sales with a lapse in time, especially for seller-site reviews.

In contrast, it is expected that the impact of blogger reviews on product sales would be maintained over time. It is because consumers visit blogs to get product information and recognize themselves as members of a huge community network [59]. In other words, consumers tend to read blogger reviews not only for a specific purpose to purchase products but also for other private needs. Therefore, in contrast to seller-site reviews, it can be assumed that the impact of blogger reviews on product sales could not change drastically with the passage of time.

H5-1: The impact of personal-blogger reviews on product sales does not diminish over time.
H5-2: The impact of seller-blogger reviews on product sales does not diminish over time.
H5-3: The impact of seller-site reviews on product sales diminishes over time.

4 Research Method and Measurement

4.1 Products of the Target Online Store

Online stores sell many products from various categories that possess several attributes and levels of the same attribute [60]. Online shopping helps consumers efficiently access and evaluate product attributes. However, access to product information may be limited according to categories; therefore, products are often classified based on the extent of how much useful information consumers can get for product attributes. On one end of the spectrum are commodity products whose quality can be evaluated clearly and concisely, and on the other end of the continuum are "look and feel" products whose quality is difficult to assess online. Similarly, products can be grouped into high-touch products and low-touch ones. The former comprises of products that require physical inspections by consumers prior to purchase [30, 61]. The latter are those products that are generally suitable for buying online because their values are placed on quick shopping [10].

The book is a quasi-commodity like a CD, DVD, and PC, and has the following features: low touch, low price, and mature online market [60, 62]. Consumers can easily buy a book online [63] and consider quick search, large

selection, and the best price as the most important and distinctive shopping attributes [9]. This is consistent with the finding of Girard, Silverblatt and Korgaonkar [64], stating that consumers strongly want to buy books online because most attributes can be assessed easily on the Internet.

4.2 Data Collection

The book closely corresponds with the objective of this study, which tries to examine the role of review sources in the relationship between online consumer reviews and product sales. The experimental data were gathered from one of well-known online booksellers in Korea who sells music CDs, DVDs, movie tickets, and cosmetics as well. There are two important reasons why we chose the bookseller. First, it simultaneously provides consumers with three different types of consumer reviews: seller-site, seller-blogger, and personal-blogger reviews. By comparing these three review sources, this study tried to verify the source effect of online consumer reviews on book sales.

Second, the bookseller not only provides sales rankings of individual books sold but also provides "Sales Points" based on the sales period and actual sales. Therefore, by using the sales points, this study overcomes the limitations of previous studies that used sales rankings instead of using actual sales [?, 15]17][46]. In order to minimize bias caused by book genre, this study only included business books encompassing economics, management, and investment. In all, we collected 4,892 online consumer reviews for 100 books ranked high in the number of reviews and sales points.

Consumers can read/write three kinds of online consumer reviews when they visit the target bookseller's Web site: forty-letter reviews, My Reviews, and Thanks To Blogs (TTB) reviews. The forty-letter reviews are online reviews that consumers read/write directly in the seller's site; thus, they are classified as seller-site reviews. My Reviews are written in blogs that are provided by the bookseller; therefore, they can be classified as seller-blogger reviews because they have the same domain address as the seller's site. TTB reviews are personal-blogger reviews and are provided through personal blogs that are linked to the bookseller. Therefore, consumers are able to read TTB reviews through the target bookseller and personal blogs.

4.3 Independent and Dependent Variables for the Study

This study chose product sales as a dependent variable and several variables as independent ones including the quantity of reviews, quality of reviews, length of reviews, rating of reviews, and relative age of reviews to test

hypotheses that examine the relationship between different sources of online consumer reviews and product sales. Each variable was stratified to have various levels based on proper criteria. Even though we could not access actual sales data, the target bookseller helps consumers compare sales by providing sales points, which can be thought of as a proxy for actual sales. Similarly, the bookseller aggregated how many consumers reveal their opinions through online consumer reviews and made these data visible to consumers so that we could count the quantity of reviews.

Usually it is difficult to measure the quality of consumer reviews online because there is no standard on how to evaluate the quality of reviews and moreover the evaluation process can be subjective. Therefore, we developed a 3-point-scale to measure the quality of reviews based on previous studies [45], and decided to take into consideration three quality dimensions for evaluation of reviews: relevance, objectivity, and informativeness [58].

To measure the quality of reviews, evaluators read 4,892 reviews independently and assigned them one of three scales. They assigned one point to online reviews that had nothing to do with the desired book or product-related reviews that were highly subjective; two points to those reviews that contained objective information related to the book; and three points to those reviews that had objective product information and opinions of the reviewers. The majority rule was then applied to integrating different categories assigned by the evaluators.

The length of an online consumer review was measured by counting the number of letters in the review. We classified a length of a review into five levels according to the number of letters. The levels were as follows: less than 100, 100-500, 500-1000, 1000-2000, and more than 2000 letters. Through this process, it was possible to determine the number of short or long reviews for a given book. Another variable Rating was used to evaluate the level of satisfaction and perceived usefulness for a book on a scale of one to five stars with five stars being the best [17].

Online consumer reviews such as forty-letter reviews and My Reviews observed in the seller site revealed rating information because the site allowed consumers to evaluate and rate written reviews. However, TTB reviews often did not have the rating information because there was no such a function to evaluate reviews in the personal blogs; Embedding of the evaluation function entirely depends on the blogger's intention. Therefore, we could not include TTB reviews that did not contain ratings when we analyzed the relationship between the number of stars and product sales.

The age of reviews indicates how long a certain online consumer review has been on the site. We defined it as the "relative age" because the release date of each book (i.e., the absolute age) drastically varied [15]. Thus, for each book, we divided the age of reviews, including forty-letter

reviews, My Reviews, and TTB reviews, into six levels with equal duration: less than 6, 6-12, 12-18, 18-24, 24-30, and more than 30 months after the release of the book. By measuring the relative age of online consumer reviews, it is possible to examine whether the impact of online consumer reviews changes over time.

5 Analysis Results

5.1 Descriptive Statistics

Table 1 shows the descriptive summaries of online consumer reviews for the individual variables analyzed in this study. The total number of online reviews was 4,892: 903 seller-site reviews (18.46%), 3,366 seller-blogger reviews (68.80%), and 623 personal-blogger reviews (12.74%). In general, online reviews were positively rated. Seller-site reviews did not have high ratings and were short because of length constraints (less than forty letters). The quantity of seller-blogger reviews was the biggest among the three kinds of reviews; also, the relative age was much younger than that of others. It is plausible to assume that consumers who wrote seller-blogger reviews had a propensity to provide reviews immediately after the release of a book. The quantity of personal-blogger reviews was the smallest, but the average length was much longer than that of other reviews. From these results, consumers were found to spend a lot of time and effort to write personal reviews on their own blogs.

As shown in Table 2, the quality of seller-site reviews was low, whereas the quality of seller-blogger or personal-blogger reviews was high. Low quality of seller-site reviews comes from length limit because consumers cannot write all the information they want to provide. Moreover there was little disagreement on review quality between review evaluators (approximately 2% of 4,892 reviews) because there was clear distinction between high-quality reviews (three points) and low quality ones (one point) in terms of three quality dimensions such as relevance, objectivity, and informativeness.

Table 3 shows the length distribution of seller-blogger and personal-blogger reviews; it was found that the most popular reviews were seller-blogger reviews with 100-500 letters and personal-blogger reviews with 500-1000 letters. Table 4 shows that three types of reviews were positively rated (four or five stars) in general and this phenomenon was consistent with the observations of Hu, Liu and Zhang [15], and Chevalier and Mayzlin [17]. In addition, one needs to consider that many personal-blogger reviews did not have rating information because of the absence of standardized rating functions. Table 5 shows the relative age of online consumer reviews.

Table 1: Summary of descriptive statistics

Source of review	Total number	Mean quantity	Mean quality	Mean length (letters)	Mean rating	Mean age (months)
Seller-site reviews (forty-letter reviews)	903	9.03(9.90)	1.34(0.43)	24.01(7.62)	3.95(1.10)	24.32(23.77)
Seller-blogger reviews (My Reviews)	3366	33.36(16.55)	2.67(0.25)	784.64(316.19)	4.16(0.35)	11.5(12.60)
Personal-blogger reviews (TTB Reviews)	623	6.23(5.40)	2.67(0.657)	1049.10(587.66)	3.93(1.14)	21.96(22.54)

Note: Numbers in parentheses are standard deviations.

Table 2: Number of reviews by quality

Quality	1	2	3	Missing
Seller-site reviews(forty-letter reviews)	519(57.48%)	327(36.21%)	0	57(6.31%)
Seller-blogger reviews(My Reviews)	229(6.80%)	596(17.71%)	2507(74.48%)	34(1.01%)
Personal-blogger reviews(TTB Reviews)	25(4.01%)	72(11.56%)	510(81.86%)	16(2.57%)

Note: 3 points represent the highest quality.

Table 3: Number of reviews by length

Length	<=100 letters	100-500 letters	500-1000 letters	1000-2000 letters	>=2000 letters
Seller-blogger reviews (My Reviews)	234 (6.95%)	1336 (39.69%)	877 (26.05%)	745 (22.13%)	174 (5.17%)
Personal-blogger reviews (TTB Reviews)	27 (4.33%)	158 (25.36%)	187 (30.02%)	161 (25.84%)	90 (14.45%)

Table 4: Number of reviews by rating

Rating	1	2	3	4	5	Missing
Seller-site reviews(forty-letter reviews)	19(2.1%)	31(3.4%)	111(12.3%)	321(35.6%)	421(46.6%)	-
Seller-blogger reviews(My Reviews)	89(2.6%)	98(2.9%)	458(13.6%)	1233(36.6%)	1488(44.2%)	-
Personal-blogger reviews(TTB Reviews)	2(0.3%)	8(1.3%)	56(9.0%)	107(17.2%)	156(25.0%)	294(47.2%)

Note: Number 1 means a negative rating and number 5 indicates a positive rating.

Table 5: Number of reviews by relative age

Relative age	<= 6 months	6-12 months	12-18 months	18-24 months	24-30 months	>= 30 months
Seller-site reviews (forty-letter reviews)	270(29.9%)	175(19.4%)	100(11.1%)	102(11.3%)	59(6.5%)	197(21.8%)
Seller-blogger reviews (My Reviews)	1930(57.3%)	457(13.6%)	253(7.5%)	189(5.6%)	125(3.7%)	412(12.2%)
Personal-blogger reviews (TTB Reviews)	172(27.6%)	94(15.1%)	64(10.3%)	69(11.1%)	37(5.9%)	187(30.0%)

Note: Relative age is expressed by the number of months after release.

Table 6: Results of the analysis for testing H1

Variable	Correlation with Sales Points	Regression coefficient
Number of seller-site reviews(forty-letter reviews)	0.690***	493.8***
Number of seller-blogger reviews(My Reviews)	0.731***	366.54***
Number of personal-blogger reviews(TTB Reviews)	0.656***	780.5***
R-square		0.687

*p<0.10; **p<0.05; ***p<0.01

Table 7: Results of the analysis for testing H2

Variable	Correlation with Sales Points	Regression coefficient
Low-quality seller-site reviews(forty-letter reviews)	0.669***	380.5
Moderate-quality seller-site reviews(forty-letter reviews)	0.624***	507.3
High-quality seller-site reviews(forty-letter reviews)	-	-
Low-quality seller-blogger reviews(My Reviews)	0.517***	1325
Moderate-quality seller-blogger reviews(My Reviews)	0.557***	407.4
High-quality seller-blogger reviews(My Reviews)	0.605***	345.13***
Low-quality personal-blogger reviews(TTB Reviews)	0.365***	2980
Moderate-quality personal-blogger reviews(TTB Reviews)	0.383***	13
High-quality personal-blogger reviews(TTB Reviews)	0.613***	579.2**
R-square		0.714

*p$<$0.10; **p$<$0.05; ***p$<$0.01

Note: The blank cell ('-') means there are no reviews corresponding to that variable
(e.g., there are no high-quality seller-site reviews).

5.2 Testing Hypothesis H1 about the Quantity of Online Reviews for Stimulating Sales

Table 6 shows a statistically significant positive correlation between the amount of online consumer reviews and sales points. It is clear that sales points increased as the number of seller-site, seller-blogger, and personal-blogger reviews increased, regardless of the source of reviews. This finding is in agreement with the results of previous studies [14,35, 39,45].

Regression analysis was applied to investigating if there were differences in the impact on sales points. An examination of regression coefficients revealed that sales points increased most by increasing the number of personal-blogger reviews (780.5, p-value=0.000) and second most by increasing the number of seller-site reviews (493.8, p-value=0.000). These results support H1-1 and H1-2 but not H1-3 because the quantity of seller-blogger reviews was found to be less influential than that of seller-site reviews. The rejection of H1-3 may be due to the feature of seller-blogger reviews having all the characteristics of seller-site and personal-blogger reviews. From these results, it is possible to confirm the presence of source effect in the relationship between the quantity of reviews and product sales.

5.3 Testing Hypothesis H2 Regarding the Importance of Review Quality

In this subsection, the relationship between the quality of online consumer reviews and sales points (H2) was investigated. As can be confirmed in Table 2, most of the blogger reviews tended to be in high quality, as opposed to seller-site reviews that were not in high quality, which could be due to the length restriction. Table 7 shows that all of the variables related to the quality of reviews had significant correlations with sales points. However, based on the regression analysis, only high-quality seller-blogger and personal-blogger reviews were found

to have a meaningful impact on sales points. One thing to note is that the target bookseller did not have high-quality seller-site reviews (Table 2); that is, the impact of high-quality seller-site reviews on product sales could not be investigated sufficiently in this study (H2-2). Further research is needed to understand the role of quality in seller-site reviews.

Hypothesis-testing results partially supported H2-1, suggesting that an increase in high-quality reviews tends to promote product sales more than that in low-quality reviews. In addition, an increase in high-quality personal-blogger reviews (572.9, p-value=0.029) contributed more to encourage sales points than that in high-quality seller-blogger reviews (345.13, p-value=0.000). Thus, it can be said that H2-3 is acceptable. That is, consumers are thought to respond positively to blogger reviews that are written carefully.

5.4 Testing Hypothesis H3 Associated with the Length of Reviews

As shown in Table 8, the number of seller-site reviews that were shorter than 100 letters was selected as a significant variable (493, p-value=0.000), and this result is similar with the finding obtained by Chevalier and Mayzlin [17], suggesting that shorter seller-site reviews were better than longer ones. However, one needs to consider that every seller-site review must be shorter than forty letters because of the length restriction in the target bookseller site; that is, the impact of 'longer' seller-site reviews could not be examined in this study. In spite of the limitation regarding length, shorter seller-site reviews played an important role in encouraging product sales.

On the contrary, the influence of personal-blogger reviews that are longer than 2000 letters was much bigger (2896, p-value=0.002) than that of all the other reviews. H3-1 and H3-2 can be acceptable. These results may be due to idiosyncrasies in the blogging behavior of consumers who are trying to communicate and share

Table 8: Results of the analysis for testing H3

Variable	Correlation with Sales Points	Regression coefficient
Seller-site reviews(forty-letter reviews) less than 100 letters long	0.690***	493***
Seller-site reviews(forty-letter reviews) 100-500 letters long	-	x
Seller-site reviews(forty-letter reviews) 500-1000 letters long	-	x
Seller-site reviews(forty-letter reviews) 1000-2000 letters long	-	x
Seller-site reviews(forty-letter reviews) more than 2000 letters long	-	x
Seller-blogger reviews(My Reviews) less than 100 letters long	0.549***	x
Seller-blogger reviews(My Reviews) 100-500 letters long	0.679***	594***
Seller-blogger reviews(My Reviews) 500-1000 letters long	0.515***	x
Seller-blogger reviews(My Reviews) 1000-2000 letters long	0.299***	x
Seller-blogger reviews(My Reviews) more than 2000 letters long	0.232***	x
Personal-blogger reviews(TTB Reviews) less than 100 letters long	0.084	x
Personal-blogger reviews(TTB Reviews) 100-500 letters long	0.458***	x
Personal-blogger reviews(TTB Reviews) 500-1000 letters long	0.618***	1606***
Personal-blogger reviews(TTB Reviews) 1000-2000 letters long	0.476***	x
Personal-blogger reviews(TTB Reviews) more than 2000 letters long	0.506***	2896***
R-square		0.702

*$p<0.10$; **$p<0.05$; ***$p<0.01$

Note: To select statistically significant variables, we employed a stepwise variable selection method. Stepwise regression requires two cutoff values, one for entering variables, and one for removing them. A 5% significance level for the cutoff values was used. 'x' means the corresponding variable was not selected for the final regression model.

information with each other. Therefore, the longer blogger reviews are, the more consumers may be inclined to devote their attentions to reading blogger reviews. Considering the test result of H2-3 together, suggesting the role of high quality personal-blogger reviews on product sales, personal-blogger reviews should be written carefully as long as possible to stimulate purchasing decisions of consumers.

Intriguingly, only the seller-blogger reviews between 100-500 letters were selected to be significant (594, p-value=0.000). Seller-blogger reviews between 100-500 letters had more positive impacts on product sales than seller-site reviews less than 100 letters. Thus, H3-3 can be acceptable.

5.5 Testing Hypothesis H4 about the Impact of Rating on Product Sales

The results in Table 9 show that only two variables are statistically significant, five-star seller-site reviews (1133.3, p-value=0.006) and three-star seller-blogger reviews (755.5, p-value=0.049). Positively-rated seller-site reviews contributed to an increase in sales points more significantly than positively-rated blogger reviews. H4-1 can be acceptable. However, H4-2 cannot be acceptable because the impact of negatively-rated reviews from all kinds of sources on sales points was not meaningful.

It is interesting that none of variables related to personal-blogger reviews were statistically meaningful. Ratings of personal-blogger reviews were not important for explaining sales points. It is worth noting that the quantity of personal-blogger reviews had a big impact on

sales points (H1-1 and H1-2). Furthermore, personal-blogger reviews with high quality and long length had a significant impact on sales points (H2-1, H2-3, H3-1, and H3-2). Now consumers tend to focus on the content only of personal-blogger reviews and do not care about the number of stars. On the contrary, when consumers read seller-site reviews, they have focused on investigating whether the rating was positive or not. In addition, idiosyncrasies were found in moderately-rated seller-blogger reviews (three stars).

5.6 Testing Hypothesis H5 about the Influence of Blogger Reviews over Time

Table 10 shows that personal-blogger reviews had a meaningful impact on sales points only when they were written less than six months after the release of the book. From this result, we reject H5-1, assuming that the influence of personal-blogger reviews on product sales was always significant regardless of the lapse of time. Personal bloggers tend to be recognized as a useful information source and their opinions positively affect consumer's purchasing decisions merely at the early stage of product introduction. At first consumers need a lot of product information and thus personal blogger reviews are treated as a good source of information. However, consumers tend to pay more attention to seller-blogger reviews in the medium term and seller-site reviews in the long term.

On the contrary, it can be said that the impact of seller-blogger reviews remained significant over time, and this result partially supports H5-2. As opposed to the finding of Hu, Liu and Zhang [15], suggesting that the

Table 9: Results of the analysis for testing H4

Variable	Correlation with Sales Points	Regression coefficient
Seller-site reviews(forty-letter reviews) with one star	0.225**	x
Seller-site reviews(forty-letter reviews) with two stars	0.167*	x
Seller-site reviews(forty-letter reviews) with three stars	0.229**	x
Seller-site reviews(forty-letter reviews) with four stars	0.587***	x
Seller-site reviews(forty-letter reviews) with five stars	0.747***	1133.3***
Seller-blogger reviews(My Reviews) with one star	0.107	x
Seller-blogger reviews(My Reviews) with two stars	0.072	x
Seller-blogger reviews(My Reviews) with three stars	0.236**	755.5***
Seller-blogger reviews(My Reviews) with four stars	0.553***	x
Seller-blogger reviews(My Reviews) with five stars	0.716***	x
Personal-blogger reviews(TTB Reviews) with one star	0.016	x
Personal-blogger reviews(TTB Reviews) with two stars	0.055	x
Personal-blogger reviews(TTB Reviews) with three stars	0.202**	x
Personal-blogger reviews(TTB Reviews) with four stars	0.401***	x
Personal-blogger reviews(TTB Reviews) with five stars	0.409***	x
R-square		0.698

$p<0.10$; $*p<0.05$; $***p<0.01$

Note: To select statistically significant variables, we employed a stepwise variable selection method. Stepwise regression requires two cutoff values, one for entering variables, and one for removing them. A 5% significance level for the cutoff values was used. 'x' means that the corresponding variable was not selected for the final regression model.

Table 10: Results of the analysis for testing H5

Variable	Correlation with Sales Points	Regression coefficient
Seller-site reviews(forty-letter reviews) written less than 6 months after release	-0.076	x
Seller-site reviews(forty-letter reviews) written 6-12 months after release	0.475***	735***
Seller-site reviews(forty-letter reviews) written 12-18 months after release	0.538***	x
Seller-site reviews(forty-letter reviews) written 18-24 months after release	0.613***	x
Seller-site reviews(forty-letter reviews) written 24-30 months after release	0.408***	1691***
Seller-site reviews(forty-letter reviews) written more than 30 months after release	0.372***	1350***
Seller-blogger reviews(My Reviews) written less than 6 months after release	0.253**	225***
Seller-blogger reviews(My Reviews) written 6-12 months after release	0.651***	x
Seller-blogger reviews(My Reviews) written 12-18 months after release	0.678***	1352***
Seller-blogger reviews(My Reviews) written 18-24 months after release	0.662***	1600***
Seller-blogger reviews(My Reviews) written 24-30 months after release	0.262***	1140***
Seller-blogger reviews(My Reviews) written more than 30 months after release	0.231**	x
Personal-blogger reviews(TTB Reviews) written less than 6 months after release	0.313***	1076***
Personal-blogger reviews(TTB Reviews) written 6-12 months after release	0.413***	x
Personal-blogger reviews(TTB Reviews) written 12-18 months after release	0.513***	x
Personal-blogger reviews(TTB Reviews) written 18-24 months after release	0.543***	x
Personal-blogger reviews(TTB Reviews) written 24-30 months after release	0.377***	x
Personal-blogger reviews(TTB Reviews) written more than 30 months after release	0.142	x
R-square		0.803

$p<0.10$; $*p<0.05$; $***p<0.01$

Note: To select statistically significant variables, we employed a stepwise variable selection method. Stepwise regression requires two cutoff values, one for entering variables, and one for removing them. A 5% significance level for the cutoff values was used.'x' means the corresponding variable was not selected for the final regression model.

impact of seller-site reviews on product sales diminished over time, this study found that the influence of seller-site reviews remained significant after a considerable lapse of time; thus, we reject H5-3. Both seller-site and seller-blogger reviews are not losing a meaningful effect on product sales over time, and this common feature stems from the fact that they share the same domain address.

6 Conclusions

Several interesting findings have emerged from the results of this study, and there are some suggestions and implications for online retailers. First, all of the online consumer reviews provided by seller sites, seller blogs, and personal blogs were found to have significant impacts on product sales. In particular, the influence of personal-blogger reviews was most significant. In other words, the quantity of personal-blogger reviews can contribute most to encourage product sales compared to other reviews when other conditions remain unchanged. This indicates that sellers who want to increase product sales should actively use personal-blogger reviews. Sellers need to not only attract consumers who visit their Web sites to write reviews on the purchased products but also figure out how to make personal bloggers who are scattered all over the Internet advertise the sellers' products. It can be helpful in encouraging product sales to have personal bloggers reveal their own opinions and thoughts about products elaborately because high-quality reviews by personal bloggers most lead to product sales. As with the TTB reviews, sellers can help consumers read personal-blogger reviews in the seller site without needing to visit personal blogs by linking the seller site and personal blogs together. Second, the way of using online consumer reviews varies according to the review source, especially for seller-site reviews and personal-blogger reviews. When consumers read seller-site reviews, they tend to concentrate on summary statistics such as the review rating and refer to particularly five-star reviews before making purchasing decisions. By contrast, consumers tend to read the entire content of personal-blogger reviews deliberately without considering the review rating. Therefore, sellers need to design their Web sites to gain attention of consumers quickly by placing as many five-star-rated seller-site reviews as possible. In addition, sellers need to understand that long and well-written personal-blogger reviews have a significant impact on product sales and provide comfortable environments that can help consumers read reviews carefully.

It is interesting that seller-blogger reviews are provided from two sources such as seller sites and personal blogs, and seem to reveal a mix of respective properties of seller-site and personal-blogger reviews. Seller-blogger reviews are similar with personal-blogger ones because long and well-written reviews affect product sales significantly. In contrast, seller-blogger reviews are similar with seller-site ones because both reviews give significant impacts on product sales when they are shorter in length and the effects on sales do not shrink over time. Because seller-blogger reviews are found to have relatively less positive impacts on product sales, it is a better marketing strategy for sellers to concentrate their efforts on employing personal-blogger reviews when sellers should choose one type of blogger reviews.

Finally, sellers should notice that the impact of online consumer reviews on product sales is significantly different depending on review sources. For seller-site and seller-blogger reviews that come from sellers, product sales do not diminish associated with the age of online reviews. As opposed to these results, the impact of personal-blogger reviews on product sales is meaningful only for the first six months following the release of a product. Consumers tend to regard personal bloggers as a helpful source of information only at the early stage of product introduction and as a reliable source when there are no other channels to seek product information. However, the impact of personal bloggers begins to shrink as consumers start to find other information sources including seller-sites and seller-blogger reviews.

Despite of several contributions, the following limitations exist. First, more sophisticated scales are needed to measure the quality of online consumer reviews. This study found that the quality of blogger reviews was meaningfully associated with product sales. However, most of blogger reviews (combing seller-blogger and personal-blogger reviews) were basically in high quality. In other words, blogger reviews were written better than seller-site reviews from the beginning. Therefore, this pattern can cause bias in the results. In addition, this study considered relevance, objectivity, and informativeness to be three dimensions of review quality. The relationship between the quality of reviews and product sales needs to be further studied by embracing additional dimensions from diverse perspectives.

Second, the results of this study cannot be applied to other product categories because it dealt with a relatively casual product such as books. That is, paying attention on relatively expensive products that require consumers to understand complicated functions can deliver different experimental outcomes, as opposed to books that are low-price and low-touch products that in general do not require expertise. Therefore, the presence of source effect depends on product category and it is worth researching further by marketers who try to use online consumer reviews as their marketing strategies to attract consumers. Similarly, the role of blogger reviews on product sales cannot be generalized because this study only used a small number of personal-blogger reviews. Accordingly, future research has to particularly include a large number of personal-blogger reviews that are scattered around the Internet. Finally, in addition to the variables verified in this study, finding other factors such as the font, color, and position that constitute online consumer reviews may be an interesting topic. That is, how these elements of online consumer reviews affect consumer response to product may be an interesting issue in the field of consumer behavior in an electronic commerce environment. Particularly, some studies can be worth pursuing to develop marketing strategies that increase product sales by stimulating consumers' purchasing decisions.

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