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# THE EWOM IMPACT ON SALES DISTRIBUTIONS IN MARKETS WITH DIFFERENT PRODUCT EVALUATION STANDARDS

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## Abstract

*This study investigates the impact of electronic Word-of-Mouth (eWOM) on sales distributions in various markets. The product information in eWOM helps customers to reveal their demands more clearly, thereby leading to the change of sales distributions in online markets. For the research, we categorize the markets based on the similarity level of product evaluation standards. If products in a market have similar evaluation standards, the product information given through eWOM will be applicable to most customers. If products in the market have different evaluation standards, then the information will not be applicable to other customers. Therefore, when product information is delivered through eWOM, in a market having similar product evaluation standards, it will enhance the sales concentration of high-ranking products by reinforcing the objective rankings among the products. In contrast, in a market with different evaluation standards, product information will loosen the sales concentration of the high-ranking products because it helps customers to purchase the product corresponding to their inherently different tastes for the products. These predictions are formulated into three hypotheses and validated with the data collected from Amazon.com. We plotted the cumulative distribution functions of eWOM, which represents the total popularity, and statistically compared them using the Wilcoxon Signed Rank test to show the different eWOM ratio possessed by the high-ranking products. All the test results showed the adequate level of significance; thus the three hypotheses are supported.*

Keywords: eWOM, Electronic commerce, Sales distribution, Product type, Wilcoxon Signed Rank Test

# 1 INTRODUCTION

At present, most of the well-known online retailers are offering electronic Word-of-Mouth (eWOM) systems as essential elements of their businesses (Dellarocas 2003). The eWOM, also known as online rating or review systems, delivers credible and relevant product information to potential customers (Bickart and Schindler 2001), and thus has a significant impact on consumer choices (Duan et al. 2008, Resnik and Zeckhauser 2002).

These characteristics of eWOM have naturally led many researchers to analyze the role of the systems in businesses. They empirically identified the relationships between the eWOM and the sales and price (Chevalier and Mayzlin 2006, Hu et al. 2006, Melnik and Alm 2002), and investigated the cognitive impacts of eWOM on trust and customer's purchase intention (Ba and Pavlou 2002, Forman et al. 2008, Gruen et al. 2006).

However, those studies leave out an important drawback in that they have not analyzed the impact of eWOM from a market perspective. When they conducted research on the role of eWOM, their foci were mainly on either one category of products (e.g., Clemons et al. 2006) or individual customers (e.g., Ba and Pavlou 2002). They did not seriously consider the reality that eWOM exists in the markets where the variety of products compete with each other.

In real businesses, it is difficult to find a market without any competition. Especially in online business, the level of competition is severe (Bandyopadhyay et al. 2005) due to the low entry barrier and transaction cost (Porter 2001). Hence, investigations of eWOM's impact on individual customers or one type of product cannot provide consistent results applicable to the overall market because the results can be easily influenced by the market specific external factors such as competitor's strategies and resources (Teece and Pisano 1994).

This study, therefore, aims to investigate the role of eWOM in the market level. Specifically, we analyze the impact of eWOM on the sales curves which represent the total sales distribution of all products in a market. Sales distribution of a market reflects the concept of market competitiveness because it shows the relative sales amount of each product. In a competitive market, we assume that the sales increase of one product decreases the sales of other products in the market (Mas-Colell et al. 1995). By understanding how eWOM changes the shape of sales distributions with respect to the product evaluation types of the products, we provide insights for the various businesses facing fierce competitions in their markets and suggest practical guidelines on how to manage the eWOM systems for their products to survive in the market.

The study is organized as follows. In theoretical development, we first explain the general impact of eWOM on a market. We then introduce the concept of product evaluation standards similarity to categorize market types. Based on these, we formulate three hypotheses about the specific impacts of eWOM on the sales distributions in various markets. For validation, we collect data from Amazon.com and compare the cumulative distribution function of reviews in each product category using the Wilcoxon Signed Rank test. Finally, the study's contributions to theory and practice are discussed.

## 2 THEORETICAL DEVELOPMENT

In this section, we first explain the role of eWOM and its impact on markets. As an important product information source, eWOM helps customers reveal their demands more precisely. Then we describe the aggregated customer demands in the market level and classify markets based on the product evaluation standards similarity. Lastly, we develop hypotheses about the impact of eWOM on the sales distributions in different markets.

### 2.1 The Role of eWOM: Articulating Customers' Demands

The eWOM systems provide customers quality product information. Through these systems, new reviews are continuously added and updated by experienced users. The contents in the reviews satisfy

the neutrality in opinions because the reviewers are not biased to either sellers or buyers (Dellarocas 2000). It also satisfies the recency with sufficient quantity because many reviewers continuously update the reviews (Park et al. 2007). These characteristics have made eWOM an important product information source on the Internet with high business potentials (Gruen et al. 2006).

Quality product information in the reviews enables customers to more precisely estimate the product value (Russo et al. 1998). It describes the product's features in detail and explains the product's attributes in a manner that only experienced customers can do. As a result, customers who read the reviews can estimate the product value with less uncertainties and risks. In fact, product uncertainties and risks have been considered one of the vulnerabilities in electronic commerce that many customers have tried to avoid and reduce during transactions (Ba and Pavlou 2002).

Once customers are able to more precisely evaluate products with less uncertainties, their willingness to pay for the product (i.e., demand) is also revealed more clearly. In other words, each customer can now precisely estimate his expected utility of the product and make a purchase decision with more confidence and less regret (Mas-Colell et al. 1995). In sum, by providing quality information, eWOM enables customers to know more about a product thus articulate their demand for the product.

## **2.2 Market Categorization: Product Evaluation Standards**

This section categorizes the markets based the shape of the customer demands by introducing the concept of product evaluation standards similarity. Let us assume there are three products, A, B, and C in a market. If there are clear quality differences among the products, such that  $A > B > C$ , then all customers in the market would prefer A than B or C. It is but natural that product A will attract all the customers, whereas B and C will not at all. On the other hand, if there are no clear quality differences among the products, customers will choose a product based on their own preferences and tastes. As a result, each product will capture the certain amount of customers respectively thus there will not be a large difference among sales of the products.

In the market-level, the first case shows the high level of demand concentration on one product while the second case shows the low demand concentration level. The critical difference between the two cases is whether the products in the market have clear and objective evaluation standards (i.e., rankings among the products) or not. As an example of the first case, if *Apple* releases a new iPod series, then there will be two iPod versions in the current market and most potential customers who are considering buying an MP3 player would choose the new one rather than the old one. In this case, we can say that there is a clear quality difference between the two iPod versions because most people expect the new one to be the upgraded version of the old one. In contrast, when John Grisham publishes a new novel, it is not easy to determine whether the new book would be better than his old bestsellers. Some customers would be satisfied with the new book, while some may not. Indeed, his recently published book, *The Associate*, is getting a lower average rating (i.e., 2.5/5) than his former ones (i.e., *The Innocent Man* 3.5; *Bleachers* 3.5) in Amazon.com. In this case, there is no clear and objective ranking among products and customers' demand concentration is weak.

The concept used to distinguish the above two market cases - existence of the objective rankings among products - is not a totally new concept. In the field of economics, by developing concepts of vertical and horizontal differentiations, industrial organization researchers have specified cases when one product captures all demands (i.e., vertical differentiation) and when multiple products equally share the demands (i.e., horizontal differentiation) (Dos Santos Ferreira and Thisse 1996, Sutton 1986). In their conceptualizations, the vertically differentiated market satisfies the consensus from customers about the rankings among products (Degryse 1996) because all consumers agree over the most preferred mix of characteristics and over the preference ordering (Tirole 1988). However, customers in the horizontally differentiated market have no consensus of rankings among products based on their willingness to pay (Degryse 1996) because the optimal choice depends on the particular consumer's taste (Tirole 1988). Versioning goods such as the *Windows* series are typical examples of vertically differentiated products for their clear orders among products (e.g., *Windows XP* is more preferable than *Windows 2000* and *98*). On the other hand, books are frequently cited as horizontally

differentiated goods (Randall et al. 1998) because there is no objective ranking among products. A romance book would be the best choice to some customers while others would choose a thriller book.

The concepts of vertical/horizontal differentiations have already connoted that different product evaluation standards will differentiate market demand shapes (i.e., concentration level). However, one weakness in the concepts is that they have not seriously considered combined markets where products are in part vertically differentiated and in part also horizontally differentiated. In reality, many products are differentiated both horizontally and vertically (Degryse 1996). For example, a 19-inch Samsung TV is a horizontally differentiated good when it is compared with a 17-inch Samsung TV. However, it may likewise be a vertically differentiated good when it is compared with a 19-inch Sony TV. Frankly speaking, there are few purely horizontally or vertically differentiated goods. Most common goods are in the hybrid form as described in the above case.

Therefore, this study extends the concepts of vertical/horizontal differentiation by describing product types as a continuous concept rather than a discrete one. It has been attempted in a couple of prior research (Cremer and Thisse 1991, Tremblay and Polasky 2002), but because they were all researched economically, their results did not provide significant managerial and realistic implications.

As shown in Figure 1, there is a continuum of products of which location is indexed by the *similarity level of product evaluation standards*. Located at the left end of the continuum are products with a high similarity level of product evaluation standards, while at the right end of the continuum are products with a low similarity level of product evaluation standards. Vertically differentiated goods would be the typical example of products having a high similarity level of product evaluation standards, and horizontally differentiated goods would be the prime example of a low similarity level of product evaluation standards. Along this line, other products are distributed based on the similarity level of evaluation standards of their own. For example, hard disk drives (HDD) in computers - their capacities and reliability are consistently considered important - would be located at the left side of the continuum, while a set of cardigans - their evaluation standards vary with color, style, etc. - would be at the right side of the continuum.

We admit that it is not easy to locate all the products in the world on the line because the location will vary based on how we define the scope of the “market” in each case. For example, in the case of *Windows Vista*, if the scope is confined to the *Windows series*, then it will be a versioning good located at the left side of the continuum. However, if we extend the scope to computer operating systems, the similarity level of product evaluation standards among products will be lowered so its location will move to the right side of the continuum. The scope of market is important but difficult to clearly define (Panzar and Willig 1981).

In spite of this fact, it is worth to describe product types with the continuum because it shows not only there are products with various evaluation standards but also we can possibly ‘arrange’ them based on the level of their product evaluation standards similarity. With these arranges as summarized in Figure 1, we can further describe, analyze and compare the products’ attributes.

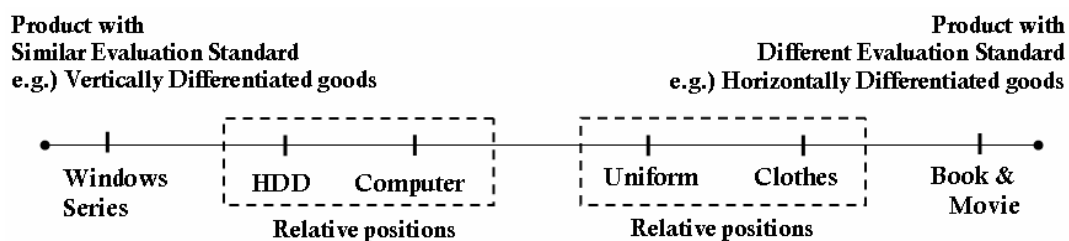


Figure 1. Product Category Continuum

### 2.3 The Impact of eWOM on Sales Distribution

In a market where products have similar evaluation standards, like HDDs, judgements about the product made by some customers would be applicable to most of the customers. For example, if 90% of the reviews in eWOM praise the strong durability and high capacity of an HDD, most of the potential customers who look for its product information would believe the assessment of the HDD and, consequently, their willingness to pay for the product would increase. However, if 90% of the reviews criticize the low reliability and capacity of the product, then potential customers' demand would mostly decrease. Namely, the more information is provided, the more customers would agree with the preceding opinions about the product in the information. Therefore, high quality products would get more customers while low quality products would lose more customers in the market having similar product evaluation standards. This leads to us the following hypothesis.

***H1: If products in a market have similar evaluation standards, the advent of eWOM will enhance the sales concentration level of the market.***

There are some products that exist in the same category but do not have similar evaluation standards among customers. For example, let us assume that there are a number of customers who are looking for information about book A. Even though 90% of the reviews give good recommendations by saying that the book has a beautiful storyline and an interesting structure, those judgements cannot ensure that all the potential customers agree with the assessment because each customer can have different evaluation standards for "beauty" and "interest." Some customers may agree with the judgement in the eWOM but many others would make different judgements. It is because people naturally have different opinions about those abstracts. Moreover, if more information about the larger categories of products having different evaluation standards is provided, customers will be able to find the product that most fits to their preference. In other words, when people have different product evaluation standards, product information in eWOM emphasizes their different demands for various products and accelerates customer choice by making those inherently different tastes clearer. Thus, we have the following hypothesis.

***H2: If products in a market have different evaluation standards, the advent of eWOM will loosen the sales concentration level of the market.***

H1 and H2 were derived based on the different customer responses to eWOM with respect to the type of products and the different viewpoints between customers in the two types of markets are depicted in Figure 2. While H1 and H2 describe the impacts of eWOM in the two types of markets respectively, in the following hypothesis (H3), we compare the impacts of eWOM on the markets with different product types.

The impact of eWOM is determined by the level of product evaluation standards similarity. If the all the customers' evaluation standards are very similar, customers who read the reviews would easily and strongly agree with the opinions in the eWOM. As a result, the demand will be very attracted to a few products. The level of attraction will be determined by the level of standards similarity and it also can be interpreted as the impact of eWOM on the market. From these, we can easily infer the fact that the more similar standards the products have, the stronger customer attraction will occur. These lead to the following hypotheses.

***H3: The sales concentration level of the market with more similar (different) product evaluation standards will be higher (lower) than that of the market with less similar (different) product evaluation standards.***

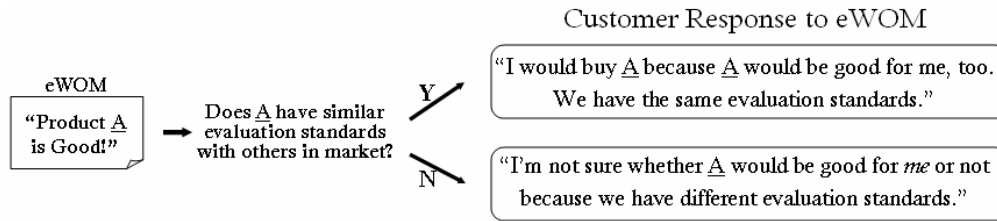


Figure 2. Customer Response to eWOM

### 3 METHODOLOGY

#### 3.1 Sales Parameterization

To investigate the sales distribution changes, we first need a parameter for the sales. However, sales ranking provided by Internet shopping malls is not adequate for the research because the ranking is determined mainly by the current sales rate rather than the historical sales records (Rosenthal 2009). Sales parameter for our research should reflect the product’s overall popularity, not the momentary sales rate, because the eWOM in the study are hypothesized to affect for a certain period of time. Therefore, the number of reviews for each product is selected as a parameter for the general popularity level, which represents the total sales amount as well. In many prior studies, a positive linearity between the amount of referrals and the total sales has been supported (Ghose et al. 2007).

#### 3.2 Data Collection

From February 2-9, 2009, data were collected from Amazon.com, the most exemplary Internet shopping mall in the world. To see the impact of eWOM ideally, we should compare two markets selling the same products within a category, one market with eWOM and the other without eWOM. However, it is hard to find an online shopping mall without eWOM systems because most Internet shopping malls nowadays are running eWOM systems (Dellarocas 2003) and it is practically impossible to control the products sold in their categories. For that reason, we collected datasets from the available Internet shopping mall categories which seemed to be the second best choice to validate the proposed hypotheses as follows.

Objective	Cases	Product Category	# of Products in the Category	Sample size	Ratio of products with at least one review
For H1 Validation	Case 1 (A)	4G USB Memory	260	260	0.418
	(B)	2G USB Memory	749	300	0.371
	Case 2 (A)	8G Memory Card	312	300	0.163
	(B)	4G Memory Card	765	300	0.141
	Case 3 (A)	~500G External HDD	94	94	0.766
	(B)	~300G External HDD	203	169	0.783
For H2 Validation	Case 4 (A)	Recently Published Thriller Book	108	108	0.556
	(B)	Thriller Book	1179	300	0.731
	Case 5 (A)	Recently Published Horror Book	94	94	0.457
	(B)	Horror Book	1184	300	0.927
	Case 6 (A)	~ 8 megapixel Camera	456	300	0.844
	(B)	~ 6 megapixel Camera	725	300	0.792
For H3 Validation	Case 7 (A)	Laser Printer	783	300	0.298
	(B)	All-in-One Printer	716	300	0.437
	Case 8 (A)	LCD TV	1038	300	0.604
	(B)	TV-DVD Combo	129	129	0.628
	Case 9 (A)	Keyboard	335	300	0.594
	(B)	Keyboard-Mouse Combo	80	80	0.663

Table 1. Data Description

First, we prepared two sets of data for one case and three cases for validating one hypothesis. In total, 18 datasets for nine cases to validate three hypotheses were collected (see Table 1). For cases 1 to 6, (A)s were considered as the product categories with less eWOM impacts and (B)s were the product categories with more eWOM impacts. As described in the table, (A) is the relatively new but not yet matured product category, while (B) is the product category that has been sold for a certain period of time and is relatively matured. Naturally, we could assume that (A) is the market with less eWOM impact and (B) is the market with more eWOM impact. Moreover, by selecting (A) and (B) from the same large category, we tried to control other factors such as price and usage. For example, a USB memory stick is a very widely used digital device. Previously, the capacity most often was 2GB, but now many people upgrade their sticks to 4GB. The number of USB memory sticks Amazon.com sells is 749 for 2GB and 246 for 4GB, showing that the 4G USB category is a relatively new market. Moreover, the range of price distributions of the two products shows that there is no significant price difference between datasets, indicating that other factors such as price and category are highly controlled. For cases 7 to 9, (A)s were selected as the products with more similar evaluation standards and (B)s were the products with less similar evaluation standards. For example, compared to simple laser printers, all-in-one printers have more complicated features to evaluate. If you intend to buy a laser printer, your concerns will mostly be related to the speed of printing, resolution, and size. However, if you intend to buy an all-in-one printer, you should examine additional features such as copy speed and fax functions, among others.

For the sample size for each dataset, if a category possessed less than 300 products, we counted the number of eWOM of all products in the category. If a category possessed more than 300 products, we conducted random sampling and collect data from 300 products. Among 18 categories, 11 product categories possessed more than 300 products, so we used a random number generator software to select the products. The profile of the datasets is summarized in Table 1.

## 4 ANALYSIS AND RESULT

For the validation, we drew the cumulative distribution functions (c.d.f.) of the number of reviews in products (A) and (B), and then compared the portions of the reviews possessed by the high-ranking products to check whether the head parts of c.d.f. increased or not. Specifically, to intuitively sense the eWOM impact, we first plotted the c.d.f. of products (A) and (B) in one dimension then compared their shapes. All graphs in the paper show review shares of the upper 5-30% of the products to check if two lines in each graph are distinctively different. Second, to validate the eWOM impact statistically, we conducted a Wilcoxon Signed Rank test to compare the c.d.f. values of the two products. This test has been widely used to analyze paired data when the assumption of a normal distribution is doubtful (Conover 1980). For the test, we again conducted random sampling to match the numbers in datasets (A) and (B), being the same number for cases 1, 3, 4, 5, 8, and 9. In sum, by showing the intuitively and statistically thicker head of one distribution than the other, we validated the hypotheses.

### 4.1 H1 Validation - eWOM impact on Products with Similar Evaluation Standards

Figure 3 shows the c.d.f.s of the two product categories in cases 1, 2, and 3 with the upper 10, 5, and 20% of the products, respectively. Due to the space limitation, the portions of eWOM included in the graphs are determined to represent roughly 80% of the total review amount. Table 2 also presents the Wilcoxon Signed Rank test results of cases 1, 2, and 3. The *p-values*, which are below 0.001, indicate that the differences shown in the graphs are all significant. As seen in Figure 3 and Table 2, the heads of the matured markets are thicker (i.e., sharper increase of c.d.f.) than those of the new markets, thus statistically and graphically supporting H1.

Case 1

Case 2

Case 3



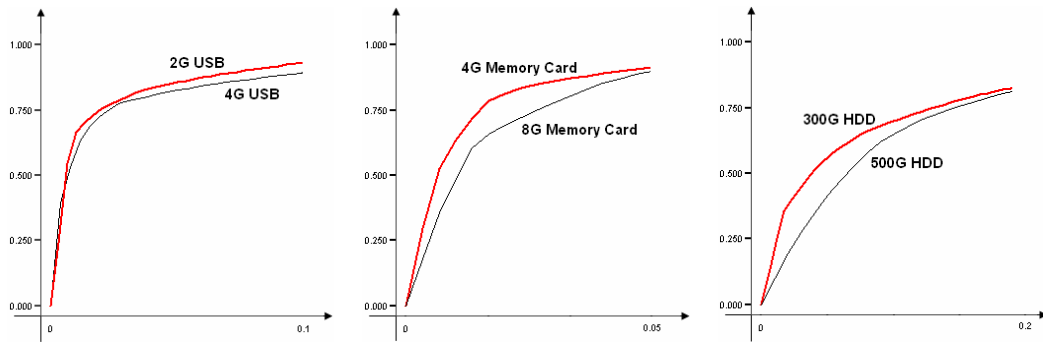


Figure 3. Cumulative Distribution Functions of eWOM amount in Case 1,2,3.

Mean Differences	Ranks	N	Mean Rank	Sum of Ranks	Test Stat.
2G USB vs. 4G USB	Negative ranks <sup>(a)</sup>	104	52.50	5460.00	Z = -8.559 p < 0.001
	Positive ranks <sup>(b)</sup>	1	105.00	105.00	
	Ties <sup>(c)</sup>	155			
	Total	260			
<b>Note:</b> <sup>(a)</sup> 4G USB < 2G USB, <sup>(b)</sup> 4G USB > 2G USB, <sup>(c)</sup> 4G USB = 2G USB					
4G Memory Card vs. 8G Memory Card	Negative ranks <sup>(d)</sup>	61	31.98	1951.00	Z = -6.832 p < 0.001
	Positive ranks <sup>(e)</sup>	1	2.00	2.00	
	Ties <sup>(f)</sup>	238			
	Total	300			
<b>Note:</b> <sup>(d)</sup> 8G Memory < 4G Memory, <sup>(e)</sup> 8G Memory > 4G Memory, <sup>(f)</sup> 8G Memory = 4G Memory					
300G HDD vs. 500G HDD	Negative ranks <sup>(g)</sup>	72	37.49	2699.00	Z = -7.413 p < 0.001
	Positive ranks <sup>(h)</sup>	1	2.00	2.00	
	Ties <sup>(i)</sup>	21			
	Total	94			
<b>Note:</b> <sup>(g)</sup> 500G HDD < 300G HDD, <sup>(h)</sup> 500G HDD > 300G HDD, <sup>(i)</sup> 500G HDD = 300G HDD					

Table 2. Wilcoxon Signed-Rank Test Result of Case 1,2,3.

#### 4.2 H2 Validation - eWOM impact on Products with Different Evaluation Standards

For H2 validation, two cases from the book category and one from the digital device category were selected. As explained, a book is an exemplary product not having objective evaluation standards. The demand for a book varies based on the individual's preference and taste. Likewise, a camera is one of the complicated goods where it is not easy to have agreed evaluation standards. While most of today's cameras have good basic functions such as clean-picture and precise-focus features, potential customers are more concerned with its design and brand, which are not easy to evaluate objectively.

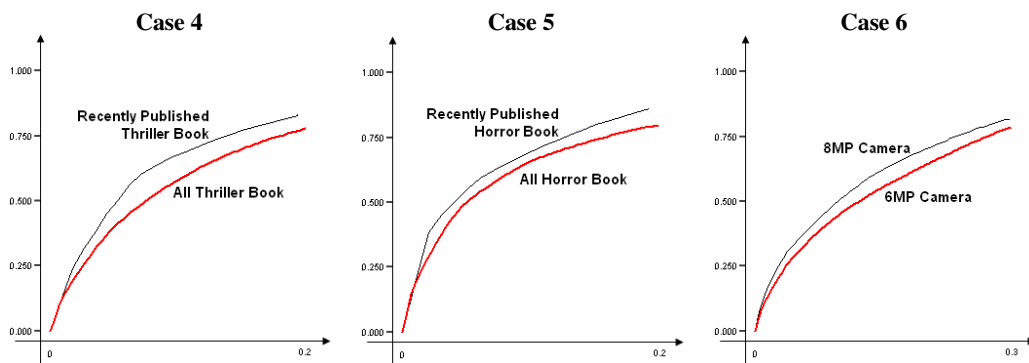


Figure 4. Cumulative Distribution Functions of eWOM amount in Case 4,5,6.

Mean Differences	Ranks	N	Mean Rank	Sum of Ranks	Test Stat.
All Thriller Book	Negative ranks <sup>(a)</sup>	0	0.00	0.00	Z = -7.866

vs. Recently Published Thriller Book	Positive ranks <sup>(b)</sup>	82	41.50	3403.00	
	Ties <sup>(c)</sup>	26			
	Total	108			
<b>Note:</b> <sup>(a)</sup> Recent < All, <sup>(b)</sup> Recent > All, <sup>(c)</sup> Recent = All					
All Horror Book vs. Recently Published Horror Book	Negative ranks <sup>(d)</sup>	0	0.00	0.00	Z = -8.008 p < 0.001
	Positive ranks <sup>(e)</sup>	85	43.00	3655.00	
	Ties <sup>(f)</sup>	9			
	Total	94			
<b>Note:</b> <sup>(d)</sup> Recent < All, <sup>(e)</sup> Recent > All, <sup>(f)</sup> Recent = All					
6MP Camera vs. 8MP Camera	Negative ranks <sup>(g)</sup>	0	0.00	0.00	Z = -13.597 p < 0.001
	Positive ranks <sup>(h)</sup>	246	123.50	30381.00	
	Ties <sup>(i)</sup>	54			
	Total	300			
<b>Note:</b> <sup>(g)</sup> 8MP Camera < 6MP Camera, <sup>(h)</sup> 8MP Camera > 6MP Camera, <sup>(i)</sup> 8MP Camera = 6MP Camera					

Table 3. Wilcoxon Signed-Rank Test Result of Case 4,5,6.

As shown in Figure 4 and Table 3, all three cases consistently show a sharper increase of eWOM in the newly formed markets, which are all statistically supported. These results indicate that eWOM lessens the demand concentration of high-ranking products in markets. Thus, H2 is supported.

### 4.3 H3 Validation – Comparison of the Impact Levels in Multiple Product Types

Products for H3 validation were selected to show the different impacts of eWOM with respect to the similarity level of product evaluation standards. Product evaluation standards become more complicated as the product's attributes increase; thus, products with more attributes were selected as ones with less similar evaluation standards. For example, all-in-one printers have more complicated product features than the simple laser printers, thus it has less similar evaluation standards than other all-in-one printers. As seen in Figure 5 and Table 6, all three cases show significantly thicker heads in the products with less similar evaluation standards. Thus, H3 is supported.

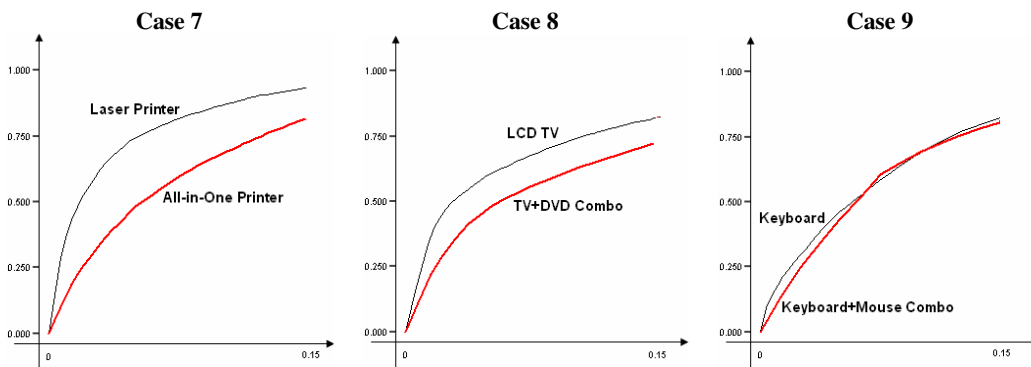


Figure 5. Cumulative Distribution Functions of eWOM amount in Case 7,8,9.

Mean Differences	Ranks	N	Mean Rank	Sum of Ranks	Test Stat.
Laser Printer vs. All-in-One Printer	Negative ranks <sup>(a)</sup>	146	73.50	10731.00	Z = -10.482 p < 0.001
	Positive ranks <sup>(b)</sup>	0	0.00	0.00	
	Ties <sup>(c)</sup>	154			
	Total	300			
<b>Note:</b> <sup>(a)</sup> All-in-One < Laser, <sup>(b)</sup> All-in-One > Laser, <sup>(c)</sup> All-in-One = Laser					
LCD TV vs. TV+DVD Combo	Negative ranks <sup>(d)</sup>	79	40.78	3222.00	Z = -7.684 p < 0.001
	Positive ranks <sup>(e)</sup>	1	18.00	18.00	
	Ties <sup>(f)</sup>	49			
	Total	129			
<b>Note:</b> <sup>(d)</sup> Combo < LCD TV, <sup>(e)</sup> Combo > LCD TV, <sup>(f)</sup> Combo = LCD TV					
Keyboard vs. Keyboard+Mouse Combo	Negative ranks <sup>(g)</sup>	48	25.27	1213.00	Z = -4.772 p < 0.001
	Positive ranks <sup>(h)</sup>	4	41.25	165	
	Ties <sup>(i)</sup>	28			
	Total	80			
<b>Note:</b> <sup>(g)</sup> Combo < Keyboard, <sup>(h)</sup> Combo > Keyboard, <sup>(i)</sup> Combo = Keyboard					

Table 4. Wilcoxon Signed-Rank Test Result of Case 7,8,9.

## 5 CONCLUSION

### 5.1 Summary and Discussion

This study investigates the impact of eWOM on sales distributions in various markets. The product information in eWOM helps customers evaluate products more precisely and thus makes them reveal their demands for the products more clearly. Consequently, eWOM changes the shape of the sales distribution of the market. However, markets can be categorized based on the similarity level of product evaluation standards. Some products such as USB memory sticks have rather similar evaluation standards in that higher capacity and longer durability are generally preferred. On the other hand, some products, such as books and movies, have very different evaluation standards among customers, thus it is difficult to give objective rankings among them. In a market with similar product evaluation standards, if eWOM provides product information, customers can find out which product is “objectively” better than others. Thus, the better one attracts the more customers while the worse one loses more customers. If this is interpreted in the market level, it would be the enhancement of the sales concentration of the market. In contrast, in a market with different product evaluation standards, even though eWOM provides product information, it does not significantly affect the specific rankings of the products because there is no consensus on product evaluation standards. Instead, the information provides about the specific features of the products will help customers find the product that most fits their various tastes. As a result, the more products in a market will share the sales. If this is seen from the market level, it would show the lessened concentration of the sales distribution on the high-ranking goods. These predictions were formulated as three hypotheses and validated with the data collected from Amazon.com. Specifically, the number of reviews for each product was parameterized as the total sales and then the cumulative distribution functions of the reviews in various categories were compared to see the impact of eWOM on the market. We plotted the cumulative distribution functions of eWOM and statistically compared them using the Wilcoxon Signed Rank test to show the different ratio of the reviews possessed by the high-ranking products. All of them showed the adequate level of significance, thus three hypotheses were supported.

### 5.2 Contribution and Implication

The study has the following academic contributions. First, we extended the concept of vertical/horizontal differentiation, originally developed as a discrete concept in the field of economics, into a continuous concept applicable to the IS management field in general and to the eWOM area in particular. The conceptualization in economics is mostly developed based on analytical modelling rather than empirical analyses, it is therefore clear and definite but not very realistic and flexible. For example, in reality, there are seldom purely horizontally or vertically differentiated goods; most commodities are partially vertically differentiated and partially horizontally differentiated. Thus, we introduced a new *similarity level of product evaluation standards* concept, which is the combined concept of the vertical and horizontal differentiation. By doing so, we made our research more applicable to real business practices. Second, this study analyzed eWOM impact in the market level. While the majority of prior studies on eWOM were either about the individual customer’s behavior (Ba and Pavlou 2002) or the impact on a specific type of products (Clemons et al 2006), we extended the view to the market level by considering the situation that each product competed with others in the market. By seeing the portions of the product sales changes (i.e., sales distribution changes), we provide an integrative view on the sales of the whole products in markets. Lastly, our hypotheses were supported by a large quantity of real data collected from various categories. While survey data can be easily contaminated by individual factors, this study could avoid those biases by using more than 4000 datasets from a major Internet shopping mall in the world.

In addition, we have the following implications for practitioners. First, by showing the various sales distribution patterns of the markets, this study gives an idea about the ideal number of products in a category. Conventionally, unlimited shelves of online shopping malls have been considered one of the virtues in electronic commerce environment (Turban et al. 2004). However, for sellers, it is still costly to manage the large number of products thus it is necessary to know the portion of sales generated by the high-ranking products. The more the market is concentrated, the less incentive to extend the number of products is expected. In addition, from the customers' point of view, the larger number of products in a market can be another source of high searching cost. Therefore, if sellers can provide the optimal, not maximum, number of products, it can benefit both sellers and customers by reducing administration cost and searching cost. Second, by showing different eWOM impact levels in various markets, this study provides suggestions to the producers on how they can manage their products against the contents in eWOM. If the market is highly sensitive to eWOM, the seller should be more concerned with the contents of ratings and reviews on the Internet. On the other hand, if the market is not very sensitive to eWOM, then the seller can consider other ways to impress the customers and promote higher sales. Furthermore, based on these, producers can also have a long-term plan for differentiating the product.

### 5.3 Limitation and Future Research

We have a couple of limitations in the validation process which may be ideas for future research. First, parameterizing the total sales with eWOM amount might generate biases. Although a positive linear relationship between sales and amount of referrals has been reported in a number of studies (Ghose et al. 2007), it would be more persuasive to analyze the data of the actual sales amount. Second, even though we compared similar markets with high eWOM impact and low eWOM impact, we could not control all other factors which may have an impact on the market. Ideally, we should have collected datasets from two shopping malls - one mall with eWOM and one without eWOM. However, it was impossible to control the product types of two different shopping malls, thus we substituted and made a second best choice. Finally, the results of this study may include some biases because the sample was collected from one shopping mall. Thus, the replication of this study in diverse shopping malls is needed to improve the generalizability of the findings.

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