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AN EXPLORATORY STUDY OF THE EFFECTS OF PRICE DECREASES ON ONLINE PRODUCT REVIEWS: FOCUSING ON AMAZON'S KINDLE 2

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Abstract

As online shopping proliferates, online product reviews (OPRs) play a crucial role in online consumers' purchasing decisions. Although prior research on the effects of price changes on consumer reactions has provided insightful implications, little is known about the impact of price changes on the characteristics of OPRs. With the growing importance of OPRs as a key social recommendation system for potential consumers' decision-making, it is important to understand the dynamics of OPRs around price changes. We select the Kindle 2 from Amazon.com as our focal product and conduct an exploratory case study. By analyzing 6,714 reviews on the Kindle 2, we examine how consumers respond to price decreases using OPRs. The results show that all four characteristics of OPRs (star-rating, review depth, positive emotion, and negative emotion) are significantly influenced by price decreases. Moreover, we found that the impacts of price decreases on OPRs' characteristics are different between the first and the second attempts at price reduction. Interestingly, the number of reviews per day significantly soars immediately after the first price decrease, while there is no significant change in the number of reviews after the second price cut. We conclude the paper with a discussion of our findings.

Keywords: Exploratory study, Price decrease, Consumer response, Online product review, Kindle 2, Amazon.com, Emotion in online product reviews, collaborative social recommendation systems.

1 INTRODUCTION

As online shopping has become a regular portion of our lives, online product reviews (OPRs), which form a collaborative social recommendation system for potential consumers, play a critical role during the decision-making process of online consumers. Compared with offline or traditional store shopping, consumers who plan to shop online may perceive performance risk, since they cannot physically see or touch the products (Lim 2003). In order to reduce such performance risk, consumers rely on OPRs contributed by other consumers as a major information source for their purchasing decisions (Ghose et al. 2011). Besides, OPRs can also be a communication channel among (potential) consumers, so that it helps consumers express their responses toward products purchased online (Chen et al. 2008). Therefore, managing OPRs becomes of utmost importance for online merchants. Prior research on OPRs has provided valuable insights by identifying online Word-Of-Mouth (WOM) as a potential driver of consumers' behavior (e.g., Harrison-Walker 2001), as well as examining the diverse characteristics of OPRs (i.e., star-rating, review depth, positive or negative emotion, etc.) that influence review helpfulness (e.g., Mudambi et al. 2010), which in turn, leads not only to helping consumers' make purchase decisions, but also to influencing the sales of products and services sold online (Dellarocas et al. 2007).

Among several factors that influence consumers' behavior, which eventually determine the purchase of a specific product, is *price* (Shapiro 1970). It is therefore important for retailers to predict consumers' reactions when setting or changing prices. In practice, of particular interest to both practitioners and academics has been whether or not price changes influence consumer reactions (e.g., attitudes, intentions, and behaviors). Accordingly, the previous literature has provided a variety of evidence of the effects of price changes on consumers' reactions in diverse settings (e.g., Dall'Olmo Riley et al. 2013; Hardie et al. 1993; Yuan et al. 2011). Although the prior research has provided many implications for the dynamics of consumers' reactions to price changes, most of them have been conducted in the traditional store shopping environment. Even a few studies (e.g. Moon et al. 2008) conducted in the context of online shopping have been limited to analyzing the direct relationship between price changes and one or a few consumer response variables (e.g., attitudes, intentions, or behaviors), using experimental or survey data with the unit of analysis as individual respondents, but little effort has been made to investigate how online consumers' reaction to the price change is expressed in OPRs. However, due to the openness of OPRs to the public and its spontaneous reaction to the market price change, OPRs can be more up-to-date information for both online consumers (or even traditional consumers) and online merchants. Thus, in-depth analysis of the consumers' reactions to the price change expressed online (in terms of volumes and the numbers of OPRs and emotional expressions used in OPRs from different time periods before and after price changes) will provide both academia and practice with valuable implications. Therefore, it will be interesting to explore how consumers' reactions to price changes are expressed publicly in a text-based communication channel (i.e., OPRs), using panel data and objective measures of OPRs in the online shopping context.

The purpose of this study is to investigate the impacts of price decreases on four characteristics of OPRs (*star-rating, review depth, positive emotion, and negative emotion*) and *the number of reviews per day*, by analyzing the OPRs on Amazon's Kindle 2. More specifically, we divide our dataset into three groups by the two dates of price discounting and examine whether there are any significant differences in the degree of those four characteristics of OPRs and the number of reviews per day across groups, conducting a univariate analysis of variance (ANOVA). In addition, we will also develop two paired sets of 16 days before-and-after groups around the two dates of the price decreases and will compare the differences of those four characteristics of OPRs and the number of reviews per day, using independent-sample t-tests.

This paper is organized as follows. In the next section, we briefly introduce the relevant concept of OPRs and review the related literature on the relationship between price changes and consumer reactions; the third section presents the research methodology and data collection; and the fourth section provides the details of the data analysis and results. In the fifth section, we summarize the results and provide several

propositions for future research. Finally, in the last section, we discuss the implications, along with the limitations of the study.

2 THEORETICAL BACKGROUND

2.1 Literature Review on the impact of online product reviews (OPRs)

Word of mouth (WOM) is known as one of the most ancient communication methods in the history. WOM is defined as “all informal communications directed at other consumers about the ownership, usage, or characteristics of particular goods and services or their sellers” (Hu et al. 2006, p.324). Compared with the traditional WOM, consumers who shop online rely increasingly on the online WOM. The online WOM provides an open, flexible, diverse network environment, while the traditional WOM is communicated mainly by a face-to-face interaction. As the online communication is prevalent based on e-Commerce sites, the online WOM’s timeliness and generalization can effectively enhance the efficiency of merchant’s marketing strategy (Dellarocas et al. 2006). Nowadays, as consumer-generated product reviews have proliferated in e-Commerce sites and affect consumers’ purchase decisions significantly, it is necessary for online retailers to manage OPRs properly (Forman et al. 2008). A review of prior research on online WOM provides insightful suggestions on how OPRs are used by online consumers to express their opinions for the products they purchase online, as a collaborative (social) communication channel among consumers (Dellarocas et al. 2006). OPRs are created by and informally communicated among consumers, based on personal usage experience, which can serve as an important reference for potential buyers. Thus, we often consider consumer-generated online product reviews as online WOM communications. Unlike the traditional form of WOM, OPRs are overtly shown to the public as a form of text-based discussion, posted on many e-Commerce sites, so that anyone who is interested in the product can contribute to and review OPRs. As such, it is easier for consumers to find OPRs and discover (contribute) useful information from (to) OPRs, than traditional WOM, thus the way online consumers react to the change of price in OPRs should be different from that in traditional shopping environment.

OPRs also play a crucial role for merchants. Dellarocas (2003) has investigated the relationship between online consumer feedback and unknown sellers’ reputations and revealed that the information embedded in OPRs is potentially helpful for firms in such numerous areas as brand building, product development, and quality control. Dellarocas et al. (2007) have further drawn attention to online movie reviews and showed that the metrics of online reviewer demographics can be useful indications of a product’s demand across different consumer segments. Moreover, Chen and Xie (2008) investigated the impacts of seller-created product attribute information and buyer-created review information on product sales.

On the other hand, OPRs are also helpful for consumers by providing valuable information to other shoppers who are interested in purchasing a specific product. Prior literature has suggested that diverse characteristics of an OPR have an impact on consumers’ purchase decision-making. For example, the valence and volume (Chevalier et al. 2003), review extremeness (star-rating) and review depth (word count) (Mudambi et al. 2010), reviewer ranking and negative word percentage (Baek et al. 2012), regret and disappointment (Zeelenberg et al. 2004), review readability, review subjectivity, and the number of reviews (Ghose et al. 2011) are found to have impacts on review helpfulness, which in turn, leads to help consumers’ make purchase decisions.

2.2 Literature review on the impacts of price changes to consumer reaction

Price is one of the most important purchase criteria for consumers (Shapiro 1970). Therefore, merchants should predict consumers’ reactions when they plan to set or change prices. *Table 1* presents a summary of the literature on the impacts of price changes on consumer reactions. As shown in *Table 1*, numerous previous studies have explored the relationship between price changes and consumers’ reactions in diverse settings with a variety of methods.

Author(s)	Method	Sample Size (time)	Sample Source	Independent Variable	Dependent Variable	Findings
Barone and Roy (2010)	Experiment	80	Administrative employees of a Midwestern Univ.	Price decrease	Consumers' responsiveness to targeted discount	Consumers evaluate targeted price promotions more favorable than inclusive offers.
Dall'Olmo Riley et al. (2013)	Experiment	50	U.K. Univ. students	Price decrease	Purchase intention, brand emotion	The distance between brands and their extension increases when prestige brands make discount.
Faruqui and George (2005)	Experiment	2,500 (Jul. 2003~ Dec. 2004)	Consumers in California	Price decrease	Energy use	Consumers conclusively reduced peak-period energy use in reaction to time-varying prices decrease.
Hardie et al. (1993)	Experiment	200 (Jan. 1983 ~ Jul. 1985)	Orange juice purchases in Marion	Price decrease	Brand choice and product attitude	Consumers pay more attention to price loss than gain when they are facing with brand choice situation.
Heussler et al. (2009)	Experiment	210	Business Univ. students	Price increase	Emotions	When price increases, positive emotions have a greater impact on price fairness than do negative emotions.
Homburg et al. (2005)	Experiment	80	Marketing class at a major German Univ. students	Price increase	Customer satisfaction	Satisfaction moderates the relationship between the consumers' emotion valence and perceived motive fairness.
Kachersky (2011)	Experiment	155	U.S. consumers	Price increase	Brand attitude	Total price increases make consumers form less favorable attitude toward retailers and product brands.
Kalwani et al. (1990)	Panel	13,218 (Feb. 15, 1979 ~ May 15, 1980)	Coffee purchases from 4 Kansas cities	Price increase, price decrease	Consumer brand choice	Price loss is greater than the price gain, implying the market reaction.
Lee and Rosenblatt (1986)	Economic model	-	-	Price decrease	Supplier's profit	The relationship between price discounting and supplier's profit is explained by the generalized quantity discount pricing model

(Table 1 continued)

Author(s)	Method	Sample Size (time)	Sample Source	Independent Variable	Dependent Variable	Findings
Low et al. (2013)	Survey	248	Customers of two retail stores	Price increase, price decrease	Satisfaction	Economic satisfaction is negatively associated with price sensitivity while social satisfaction is positively related to price sensitivity.
Mazumdar and Jun (1993)	Experiment	250	Undergraduate business students	Price increase, price decrease	Purchase attitude	Multiple price increases are evaluated more unfavorably than a single price increases.
Monahan (1984)	Economic model	-	-	Price decrease	Seller's profit	Through anticipating and planning his/her price promotion, a seller can improve his/her profit situation.
Moon et al. (2008)	Experiment	116	New Zealand Business undergraduate students	Price increase	Purchase intention	Price does not significantly affect consumer purchase intentions.
Raghubir et al. (2004)	Conceptual study	-	-	Price increase, price decrease	Consumer evaluation	Price decline has an influence on information effect.
Teng (2009)	Survey	117	Consumers in 11 fast-food restaurants	Price decrease	Consumers' attitudes and purchase intentions	Regardless that demand reaches the lowest point, price decrease still influences consumers' attitude and purchase intention.
Yuan and Han (2011)	Experiment Survey	20	Undergraduate students	Price increase, price decrease	Search behavior	Price changes influences consumers' searching behavior.

Table 1. Summary of literature on the effects of price changes on consumer reaction

According to these previous studies, price changes (price increases and/or price decreases) have significant impacts on consumers' attitudes (e.g., Hardie et al. 1993; Kachersky 2011; Mazumdar et al. 1993), intentions (e.g., Dall'Olmo Riley et al. 2013; Moon et al. 2008; Teng 2009), behaviors (e.g., Faruqui et al. 2005; Kalwani et al. 1990; Yuan et al. 2011), satisfaction (e.g., Homburg et al. 2005; Low et al. 2013), and evaluations (e.g., Raghurir et al. 2004). Although they have provided valuable insights about the dynamics of consumer reactions to price changes, most of them were conducted in the context of offline or traditional store shopping environments (where consumers' reactions are not overtly shown to the public), along with experimental data (or surveys). As such, our literature review on the impact of price changes on consumers' reactions shows that in spite of the practical and theoretical importance of OPRs (another way for consumers to react to price changes), little effort has been made to look into consumer reactions expressed in the form of OPRs. Therefore, it is necessary to explore how consumers react to price changes in the context of online shopping, using panel data and objective properties of OPRs.

Thus, in this study, we explore the relationship between price changes (i.e., two price decreases) and the characteristics of OPRs (i.e., *star-rating*, *review depth*, *positive and negative emotion*, and *the number of reviews per day*) as different types of consumer reactions, using Amazon's Kindle 2 reviews. As this study is a data-driven exploratory case study, instead of providing a detailed pre-defined hypothesis, we suggest the following preliminary proposition; *a price change (decrease) in an online marketplace significantly influences the various dimensions of OPR properties (star-rating, review depth, positive and negative emotion, and the number of reviews per day)*. Based on our findings, we will provide several propositions for future study. In the next section, we will provide our research methods, followed by a discussion of the results and the conclusion.

3 RESEARCH METHODOLOGY

3.1 Research design

In order to explore the impacts of price decreases on consumers' reactions in the context of an OPR, we conduct a single exploratory case study, focusing on the Kindle 2's reviews on Amazon.com. Even though anybody can become members of Amazon.com by registering, only the Amazon.com account members who have successfully purchased items can start posting reviews, and they can write only one review on the same purchased item.¹ Amazon.com also allows consumers to disclose their Amazon-verified badges, such as real name, location, top 100 reviewers, etc. which could help the consumers' buying decision. Moreover, Kindle 2 is one of the representative products produced by Amazon, and mainly sells on Amazon.com. We design our study as a case study, following Baxter's (2008) recommendation. According to Baxter (2008, p.545), a case study design should be considered "when (a) the focus of the study is to answer 'how' and 'why' questions; (b) we cannot manipulate the behavior of those involved in the study; (c) we want to cover contextual conditions because you believe they are relevant to the phenomenon under study; or (d) the boundaries are not clear between the phenomenon and context." Since (a) the focus of this study is to answer "how" consumers' reactions in OPRs change when prices decrease; (b) we cannot manipulate reviewers' (consumers') behavior; (c) we want to cover contextual conditions when prices decrease; and (d) the boundary between the phenomenon and context is not clear in this study, an exploratory case study is well suited for our research purpose specific to OPRs.

Moreover, we choose to conduct a "single" case study, following Dubé and Paré's (2003) suggestion; a single case study is most favorable when the case represents (1) a substantively significant case; (2) a critical case; (3) an extreme or unique situation; or (4) a revelatory case. Since the Kindle 2 is one of the representative and leading products of Amazon.com and its price was reduced twice during the eight months of its product lifecycle, the Kindle 2 can be considered as the most significant, critical, and best-suited case for this study. Amazon's Kindle 2 was first released on February 23, 2009 and stopped selling on October 22, 2009. During the exact eight months of public selling, Amazon first

¹ <http://www.amazon.com/gp/help/customer/display.html/?nodeId=201145120>

reduced its price from the original \$359 to \$299 on July 8, 2009, and further reduced its price to \$259 on October 7, 2009.²

Our eight-month dataset is divided into three groups by the two dates of price discounting for the test of Study 1: Group 1; Group 2; and Group 3. In addition, the two paired sets of 16 days³ before-and-after groups around the two dates of price decreases are also developed for the test of Study 2: Group A and Group B; Group C and Group D. Furthermore, Groups composed of days, which are the units of analysis of Study 3,⁴ are additionally developed by summing up the frequencies of reviews per day for the test of Study 3: Groups 4, 5, and 6 and Groups E, F, G, and H.

In order to explore the impacts of two price decreases on the four characteristics of OPRs (*star-rating*, *review depth*, *positive emotion*, and *negative emotion*) and *the number of reviews per day*, we design three studies. First, Study 1 examines whether there are significant differences in the degree of the four characteristics of OPRs among Group 1, Group 2, and Group 3, using an ANOVA and Duncan tests. Second, Study 2 compares the statistical differences of the four characteristics of OPRs between the before-and-after groups (Groups A and B; Groups C and D), conducting independent-sample t-tests. Finally, Study 3 validates whether there are any significant differences in the number of reviews per day across groups (Group 4, Group 5, and Group 6) and compares the statistical differences of the number of reviews per day between the before-and-after groups (Group E and Group F; Group G and Group H), performing an ANOVA, Duncan tests, and independent-sample t-tests. It should be noted that the units of analysis of Studies 1 and 2 are individual OPRs, while the units of analysis of Study 3 are days.

3.2 Data collection and measurement

We collected a panel dataset containing a total of 6,714 OPRs of the Kindle 2 on Amazon.com over a period of eight months (from Feb. 23, 2009 to Oct. 22, 2009), using web-mining methods. First, we used a web crawler (also known as a spider or a robot) to download the web pages containing the Kindle 2's OPRs from Amazon.com. Then, we wrote a Java code to parse each web page and extract the meaningful parts of the OPRs. For each review, we extracted the following data: (1) *star-rating*, (2) *the date of the review written*, and (3) *the textual review content*.

Variables	Operational Definition	Measurement	Reference
Star-rating	Consumers' evaluation on product's quality in an OPR, indicating their responses toward the purchased product	Numerical star rating ranging from 1 to 5 scales (Amazon.com)	(Krosnick et al. 1993; Mudambi et al. 2010)
Review depth	Total word counts of an OPR based on the assumption that longer reviews contain more information	# of total words (LIWC)	(Ghose et al. 2011; Mudambi et al. 2010)
Positive emotion	Positive word percentage in an OPR	$\frac{\text{\# of positive emotion words}}{\text{\# of total words}}$ (LIWC)	(Forman et al. 2008; Ghose et al. 2011)
Negative emotion	Negative word percentage in an OPR	$\frac{\text{\# of negative emotion words}}{\text{\# of total words}}$ (LIWC)	(Forman et al. 2008; Ghose et al. 2011)
The number of reviews per day	The total frequency of OPRs for each day	# of total counts of reviews in a daily basis	(Ghose et al. 2011)

Table 2. Variables and measurement

Subsequently, we used the text-mining method to measure variables used in the study. Since the large volume of reviews made it impractical to manually conduct a content analysis, we used the Linguistic

² http://en.wikipedia.org/wiki/Amazon_Kindle#Kindle_2

³ The Kindle 2 sales were discontinued (Oct. 22, 2009) 16 days after the second price decrease (Oct. 7, 2009).

⁴ The units of analysis of Study 1 and Study 2 are reviews.

Inquiry and Word Count (LIWC) software program (Pennebaker et al. 2007). Its validity has been verified by more than 100 prior studies which adopted this methodology in the field for online WOM, including blogs (Cohn et al. 2004), instant messages (Slatcher et al. 2006), online reviews (Ludwig et al. 2013), etc. LIWC provides linguistic processes (e.g., word per sentence, word count), psychological processes (e.g., positive emotion, negative emotion), perceptual processes (e.g., achievement, money), and spoken categories (e.g., non-fluencies, assent) that categorize 80 output variables (Pennebaker et al. 2007). The LIWC program searches for target words or word stems based on systematically pre-classified linguistic categories, and the word counts are represented as a percentage of the total number of words (Pennebaker et al. 2007). Since *Star-rating* was identified from a web crawler, *Review depth*, *Positive emotion*, and *Negative emotion* were measured by the LIWC. Finally, *the number of reviews per day* was calculated by summing up the numbers of reviews per day, performing SQL queries in Microsoft SQL Server 2008 R2. Variables and measurements used in the study are shown in *Table 2*.

4 DATA ANALYSIS AND RESULTS

The purpose of this study is to explore the impacts of price decreases on the four characteristics of OPRs and the number of reviews per day. In order to test the three studies designed, we performed an ANOVA, Duncan tests, and independent-sample t-tests. IBM SPSS Statistics version 20 was used to test all of the three studies (Study 1, Study 2, and Study 3).

4.1 Study 1

To examine whether there are significant differences in the degree of the four characteristics of OPRs (*star-rating*, *review depth*, *positive emotion*, and *negative emotion*) among Group 1, Group 2, and Group 3, we conducted an ANOVA and Duncan tests as a post-hoc analysis. The results of Study 1 are presented in *Table 3*.

Variables		Group 1 ^a (N=4,572)	Group 2 ^b (N=1,854)	Group 3 ^c (N=288)
Star-rating	Mean	4.21	3.51	4.23
	SD	1.321	1.777	1.290
	ANOVA	F(2,6711) = 125.653***		
	Duncan	Group 2 < Group 1 = Group 3 (p < 0.05)		
Review depth	Mean	164.64	141.96	132.58
	SD	192.396	154.953	189.301
	ANOVA	F(2,6711) = 12.850***		
	Duncan	Group 3 = Group 2 < Group 1 (p < 0.05)		
Positive emotion	Mean	5.26	5.01	5.56
	SD	3.102	2.957	2.964
	ANOVA	F(2,6711) = 6.332**		
	Duncan	Group 2 < Group 3 (p < 0.05)		
Negative emotion	Mean	0.95	1.09	0.92
	SD	1.199	1.460	1.167
	ANOVA	F(2,6711) = 8.901***		
	Duncan	Group 3 = Group 1 < Group 2 (p < 0.05)		

^a Group with original price consisting of 4,572 OPRs from Feb. 23 to Jul. 7, 2009;

^b Group with the first price decrease consisting of 1,854 OPRs from Jul. 8 to Oct. 6, 2009;

^c Group with the second price decrease consisting of 288 OPRs from Oct. 7 to Oct. 22, 2009

† p<0.1; * p<0.05; ** p<0.01; *** p<0.001

Table 3. Results of ANOVA and Duncan test in Study 1

Based on the results of Study 1, all four of the OPR characteristics were found to be significantly different across groups. To be more specific, after the first attempt at a price discount, the degree of star-rating and review depth decreased significantly, while negative emotion increased significantly. However, positive emotion did not significantly change. After the second price decrease, on the other

hand, both star-rating and positive emotion increased significantly, while negative emotion was found to be significantly reduced. However, review depth did not significantly change.

4.2 Study 2

To explore the statistical differences of the four characteristics of OPRs, right before and after price decreases, data drawn from independent-sample t-tests about those four OPR characteristics for the 16 day-period involving the before-and-after groups (Group A and Group B; Group C and Group D) were collected. The results of Study 2 are shown in *Table 4*.

Variables		Group A ¹ (N=295)	Group B ² (N=536)	Group C ³ (N=327)	Group D ⁴ (N=288)
Star-rating	Mean	4.28	2.40	4.35	4.23
	SD	1.275	1.787	1.222	1.290
	t	$t=17.623^{***}$		$t=1.205$	
Review depth	Mean	133.51	119.68	157.31	132.58
	SD	133.506	119.163	179.925	189.301
	t	$t=1.533$		$t=1.660^\dagger$	
Positive emotion	Mean	5.39	4.62	5.10	5.56
	SD	3.037	2.605	2.995	2.964
	t	$t=3.824^{***}$		$t=-1.900^\dagger$	
Negative emotion	Mean	0.97	1.28	0.92	0.92
	SD	1.223	1.707	1.094	1.167
	t	$t=-2.958^{**}$		$t=0.004$	

¹ Group with 16 days before the first price decrease consisting of 295 OPRs from Jun. 22 to Jul.7, 2009;

² Group with 16 days after the first price decrease consisting of 536 OPRs from Jul. 8 to Jul.23, 2009;

³ Group with 16 days before the second price decrease consisting of 327 OPRs from Sep. 21 to Oct.6, 2009;

⁴ Group with 16 days after the second price decrease consisting of 288 OPRs from Oct. 7 to Oct.22, 2009

$^\dagger p<0.1$; $* p<0.05$; $** p<0.01$; $*** p<0.001$

Table 4. Results of independent-samples t-test in Study 2

Based on the results of Study 2, all of the four characteristics of OPRs were found to change significantly, although the degree of change varied. More specifically, just after the first attempt at price discounting (from \$359 to \$299), the degree of star-rating and positive emotion significantly decreased, while negative emotion significantly increased. However, review depth did not change significantly. Immediately after the second price decrease (from \$299 to \$259), on the other hand, only positive emotion marginally increased ($p<0.1$), while review depth was found marginally reduced at the 0.90 confidence level. However, the star-rating and negative emotion did not significantly change.

4.3 Study 3

In Study 3, we additionally explored the differences in the number of reviews per day among groups divided by the two dates of the price discounts (Group 4, Group 5, and Group 6), as well as the 16 day-period involving the before-and-after groups (Group E and F; Group G and H), performing ANOVA/Duncan tests and independent-sample t-tests, respectively. The units of analysis of Study 3 are days. *Figure 1* presents the daily trends of the number of reviews and groups analyzed in Study 3. The results of Study 3 are presented in *Table 5* and *Table 6*.

Based on the results of Study 3, the average number of reviews per day was found to significantly decrease between Group 4 and Group 5. However, immediately after the first attempt at price discounting, the average number of reviews per day drastically increased. The impacts of the second price discount on the number of reviews per day were not found to be significant.

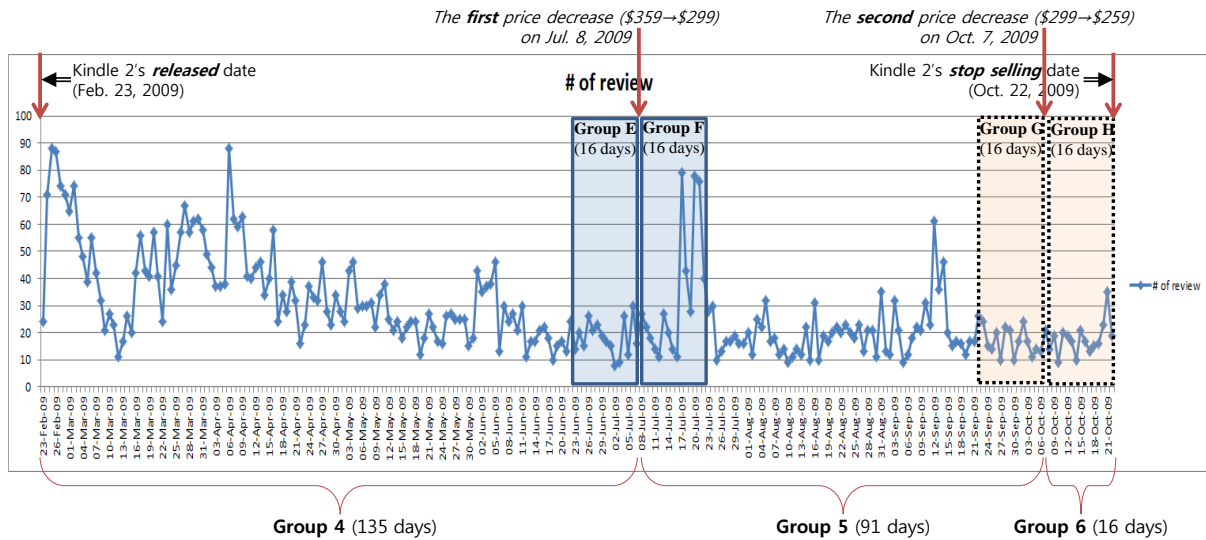


Figure 1. Daily trend of the number of reviews and groups analyzed in Study 3

Variable		Group 4 ^a (N=135)	Group 5 ^b (N=91)	Group 6 ^c (N=16)
Number of reviews per day	Mean	33.87	21.73	18.00
	SD	17.706	13.590	6.000
	ANOVA	F(2,239)=19.820***		
	Duncan	Group 6=Group 5<Group 4 (p<0.05)		

^a Group with original price consisting of 135 days with the number of OPRs per day from Feb. 23 to Jul. 7, 2009;

^b Group with the first price decrease consisting of 91 days with the number of OPRs per day from Jul. 8 to Oct. 6, 2009;

^c Group with the second price decrease consisting of 16 days with the number of OPRs per day from Oct. 7 to Oct. 22, 2009

† $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 5. Results of ANOVA and Duncan test for the number of reviews per day in Study 3

Variable		Group E ¹ (N=16)	Group F ² (N=16)	Group G ³ (N=16)	Group H ⁴ (N=16)
Number of reviews per day	Mean	18.44	33.50	17.19	18.00
	SD	6.324	23.751	5.167	6.000
	t	t = -2.451*		t = -0.410	

¹ Group with 16 days before the first price decrease consisting of 16 days with the number of OPRs per day from Jun. 22 to Jul. 7, 2009;

² Group with 16 days after the first price decrease consisting of 16 days with the number of OPRs per day from Jul. 8 to Jul. 23, 2009;

³ Group with 16 days before the second price decrease consisting of 16 days with the number of OPRs per day from Sep. 21 to Oct. 6, 2009;

⁴ Group with 16 days after the second price decrease consisting of 16 days with the number of OPRs per day from Oct. 7 to Oct. 22, 2009

† $p < 0.1$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 6. Results of independent-samples t-test for the number of reviews per day in Study 3

5 DISCUSSION OF RESULTS AND PROPOSITIONS

A major goal of this paper is to explore how online consumers react to price changes of products sold online, which is expressed in the characteristics of OPRs. Following the exploratory case study approach, we chose Amazon's Kindle 2's OPRs and designed 3 studies. We analyze how the

characteristics of OPRs are influenced by price decreases and found that price decreases in a product sold online significantly changes four characteristics of OPRs (*star-rating*, *review depth*, *positive emotion*, and *negative emotion*) and even the number of OPRs posted per day. Based on the findings of our exploratory study, we'd like to provide the following propositions for future research.

In Study 1, we look at more long-term time periods and compare the means of the four characteristics of OPRs (*Star-rating*, *Review depth*, *Positive emotion*, and *Negative emotion*), taken from three different time periods (Group 1: the four characteristics of OPRs during the period between the product launch and the first price drop; Group 2: the four characteristics of OPRs during the period between the first price drop to the second price drop; Group 3: the four characteristics of OPRs during the period between the second price drop and the withdrawal of the product). We found that after the first price drop, the degree of the star-rating and review depth significantly decreased, while negative emotion significantly increased, but after the second price drop, both the star-rating and positive emotion increased significantly, while negative emotion was found significantly reduced.

Intuitively, we may think that price decreases are welcomed by consumers all of the time. Moreover, previous studies have also found that price discounts enhance consumers' perceptions of saving value and improve attitudes toward competitors' brands (Fraccastero et al. 1993), and that price discounts remove financial barriers and offer consumers economic benefits, which will arouse positive emotions within consumers (Raghubir et al. 2004).

However, the findings from Study 1 suggest that in the context of OPRs, where consumers' (mostly post-usage) opinions are expressed via text-based communication channels that are open to public, the impact of price decreases on consumers' reactions is not simply linear; rather, it seems that there is an optimal point of price decrease for positive responses (high star-rating, increased positive emotion and decreased negative emotion) from online consumers. That is, the findings of Study 1 shows that when the price decreased the first time, the reactions of online consumers were mostly negative (decreased star-rating, increased negative emotion, stable positive emotion, and reduced review depth.), but when the price decreased the second time, the reactions of online consumers became positive (increased star-rating and positive emotion and decreased negative emotion). Although the reactions of online consumers toward price changes (decreases) could also be influenced by various external factors (e.g., competitors' products, seasonal effects, types of products, etc), one thing that we can propose from our finding is that the impact of price change on the products sold online with respect to the four characteristics of OPRs is *significant*, but *non-linear*, so that price change brings about significant change in the dynamics of OPRs but there exist optimal price points for each of the four characteristics of OPRs. Thus, the propositions that we can provide based on Study 1 are as follows:

Proposition 1: *The price decrease in a product sold online is significantly associated with the change in the Star-rating, Review depth, Positive emotion, and Negative emotion in OPRs*

Proposition 2: *The impact of a price decrease in a product sold online on the change in the Star-rating, Review depth, Positive emotion, and Negative emotion are non-linear, in that there are optimal price points for each of the four characteristics of OPRs.*

In Study 2, we looked into more short-term time-periods (Groups A, B, C, and D: the two paired sets of the four characteristics of OPRs for the 16-day periods involving the before-and-after groups around the two dates of price decreases) and compared the means of the same four characteristics of OPRs as those in Study 1. We also found that even within short-term time scopes, online consumers negatively react to the first price drop and positively react to the second price drop, and that the impact of the first price drop on the four characteristics of OPRs is generally stronger than the impact of the second price drop. Two interesting points from the results of Study 1 and Study 2 combined are as follows. First, the degree of positive emotion drastically drops immediately after the first price discount, but slowly recovers in the long run, so that long-term increase in positive emotion may nullify the significant short-term decrease in positive emotion. Also, the degree of review depth is not impacted by the first price cut, but significantly drops in the long run. However, these findings cannot be suggested as propositions for future research, as these phenomena could be specific only to our focal product. One thing that we can propose from the findings of Study 2 is that the significant

impact of price change on the four characteristics of OPRs on a short-term basis can be diminished with repetitive price changes over time. Taken together, we provide the following proposition.

Proposition 3: *The impact of continuous price decreases in a product sold online on the change in Star-rating, Review depth, Positive emotion, and Negative emotion will diminish over time.*

In Study 3, we investigated the impact of price drops on *the average number of OPRs per day* by comparing three long-term time-periods (Group 4: the number of OPRs per day during the period between the product launch and the first price drop; Group 5: the number of OPRs per day during the period between the first price drop to the second price drop; Group 6: the number of OPRs per day during the period between the second price drop and the withdrawal of the product) and also comparing four short-term time-periods (Groups E, F, G, and H: the number of OPRs per day during the two paired sets of the 16 day-day periods involving the before-and-after groups around the two dates of price decreases). The findings from Study 3 suggest that while over a long period of time, the average number of OPRs per day significantly decreased (which is not surprising at all), over a short period of time immediately after the price change, the average number of OPRs per day dramatically increased. As such, the findings of this study show that a significantly higher number of OPRs are contributed to the e-Commerce site immediately after the price decrease, which implies that the decrease in the price not only changes the characteristics of the OPRs but also increases the average number of OPRs posted per day, at least for a short period of time, and the impact of the price decrease on the average number of OPRs per day also diminishes over time. Taken together, we provide the following propositions.

Proposition 4: *The price decrease in a product sold online is significantly associated with the average number of OPRs posted per day, for a short period of time.*

Proposition 5: *The impact of continuous price decreases in a product sold online on the average number of OPRs posted per day will diminish over time.*

6 CONCLUSION: IMPLICATIONS AND FUTURE RESEARCH

As this research is an exploratory case study, based on an analysis of data from the OPRs of a single product (Kindle 2), we do not intend to report our statistical findings as though they were the result of a statistical analysis for pre-defined hypotheses based on theoretical development. Nor are the propositions in the previous section intended to be immediately tested with other datasets. Rather, based on our findings and propositions, we would like to provide insightful implications for further theoretical development and practice.

6.1 Theoretical implication

The results of this paper have a number of theoretical implications, as follows. First, this study is among the first attempts to address the impact of price change on both the objective and subjective properties of OPRs. As shown in Table 1, extant studies have investigated the impact of price change on consumers' reactions in traditional (offline) environments and have suggested that price decreases have a positive impact on consumers' overall reactions, and also that the relationship between price change and consumers' reactions is mostly linear. However, the findings from this study and our propositions (1 and 2) suggest that the impact of price decrease on various aspects of consumers' reactions in OPRs is more complex (non-linear) than that in offline settings. For example, in the case of the Kindle 2, the reaction to the first price drop was mostly negative, but became slightly positive at the time of the second price drop. As such, we have shown that consumers' reactions to price changes in the context of OPRs are more complex and non-linear. Therefore, we contribute to the body of knowledge on the impact of price change in e-Commerce environments. We suggest that future research on the impact of price change in e-Commerce environments consider consumers' reactions (intentions or behaviors) to price change as more dynamic than traditional environments (e.g. non-linear). *Using our propositions, future research should design simulations that explore optimal price points for the best combination of the various characteristics of OPRs on certain products.*

Second, we also look into both the long- and short-term effects of price change and find that the effect of the price change on consumers' reactions in terms of the four characteristics (star-rating, review depth, and positive and negative emotion) and the average number of OPRs per day changes over time, and the effect of the price change on consumers' reactions varies, according to the time scopes that we take. For example, we showed that the price decrease is significantly associated with the average number of OPRs posted per day for a short period of time, but the impact of continuous price decreases on the average number of OPRs posted per day will diminish over time. This result and our propositions (3, 4, and 5) suggest that when future research investigates the impact of price change in OPRs, we should consider the number of price changes (as well as the direction of the changes: increase or decrease), as well as the time variant nature of the impact of the price change on OPRs.

6.2 Practical implications

The results of this study will provide insightful implications for online marketers. First, this study shows that price change brings about changes in both the objective characteristics and emotional responses of OPRs. As suggested in the introduction, OPRs are key information sources for online consumers to look into before they make purchases online, which means that changes in the characteristics of OPRs influenced by price change may lead to either the success or failure of products. Thus, when online marketers plan to change prices, the first thing they may want to try is to test the reactions of potential consumers by asking some sample consumers (e.g., internal consumers or pilot consumers) to answer how they would react and express their opinions online. In this way, merchants can quickly find out how the price change might positively or negatively influence the performance of their sales.

Second, the results of this study imply that simply decreasing prices might not always be a good idea. Our findings showed that the effect of the first price decrease on consumers' reaction was mostly negative, while the second price decrease was moderately welcomed by consumers. Thus, online merchants should make strategic decisions for price changes to improve the sales of their products, rather than simply discounting the price. They should scan the competitive environment around a certain product and also understand the trends of the reactions in the OPRs on a short-term basis and set up more dynamic pricing plans in order to get the best out of the OPRs' role on sales performance.

6.3 Limitations

The first limitation of this study is that it looked at only the impact of price decrease. Future research should look at the impact of both increase and decrease of price change on the characteristics of OPRs. Or, it would be interesting for future research to look at the impact of dynamic pricing strategy (e.g., the impact of the frequency or variance of price change) on OPRs. Second, as we look into the impact of price change on the characteristics of OPRs, we may go further than the characteristics of OPRs as dependent variables. That is, future research could look at the impact of price change on both OPRs and purchasing behaviors, so that it may investigate the mediating role of the characteristics of OPRs between the price change and actual sales of a product online. Third, in this paper, we used objective data and quantitative analysis with text-mining methodology, rather than alternative approaches that rely on subjective interpretations of OPRs (Human ratings of the characteristics of OPRs). Future studies may use both methods (text-mining and human ratings) to triangulate the findings from the two methods, which will provide more enriched findings. Finally, the product type matters when we investigate the role of OPRs (e.g., Mudambi and Schuff (2010)). Finally, due to the uniqueness of our focal product (Kindle 2), which has two price drops in a rather short term period, it is not possible for now to find similar cases for a multiple-cases study based on quantitative data. Thus, we were not able to investigate the impact of product types (e.g., search goods vs. experience goods) on the reactions in OPRs. Future research could adopt a multiple case study approach and investigate the impact of product type on the relationship between price changes and OPRs.

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