Investigating the influence of regulatory focus on the efficacy of online review volume versus valence

Elika Kordrostami

*Department of Marketing and Business Information System,
Rohrer College of Business, Rowan University, Glassboro, New Jersey, USA*

Yuping Liu-Thompkins

*Department of Marketing, Strome College of Business, Old Dominion University,
Norfolk, Virginia, USA, and*

Vahid Rahmani

*Department of Marketing and Business Information System,
Rohrer College of Business, Rowan University, Glassboro, New Jersey, USA*

Abstract

Purpose – Valence and volume of online reviews are generally considered to influence sales positively. However, existing findings regarding the relative influence of these two components have been inconclusive. This paper aims to explain some of these inconsistencies by examining the moderating role of regulatory focus (both as a chronic disposition and as a situational focus induced by the product category) in the relationship between online review volume/valence and consumers purchase decisions.

Design/methodology/approach – Two studies were conducted. Study 1 used a 2 (Volume: high/ low) * 3 (Valence: high/medium/low) within-subject experimental design. Study 2 analyzed real-world data from Amazon.com. Logistic and panel regression analyses were used to test the research hypotheses.

Findings – The studies confirmed the hypothesized effect of regulatory focus on online review valence and volume effects. Specifically, Study 1 showed that online review valence was more impactful for consumers with a promotion focus than for consumers with a prevention focus. The opposite was true for online review volume effects, where consumers with a prevention focus were influenced more by volume in their decision-making compared to consumers with a promotion focus. Study 2 showed that the pattern of results we found in Study 1 also applied to situational regulatory focus induced by the product category. The effect of review volume on sales rank was stronger for prevention-oriented products, whereas the effect of valence was stronger for promotion-oriented products.

Research limitations/implications – In Study 1, one product category was involved in the study (Digital camera). Involving more different product categories will add reliability to the results of current research. Also, it can offer external validity to current research results. In Study 2, there was no exact measurement for sales, as Amazon.com does not share that kind of information. Instead, Sales Rank was used as a proxy variable. Future research could look into the websites that offer access to the exact sales information.

Practical implications – The current research findings suggest the need for companies to adapt their consumer review management strategy to the regulatory orientation of their target market and products. When a promotion-focused mindset is targeted, strategies for increasing the favorability of product reviews should be used, in contrast, tactics for increasing the quantity of reviews may be more suitable when a prevention-focused mindset is involved.

Originality/value – To the best of the authors' knowledge, this research is the first to investigate the interaction between regulatory focus of consumers and products and online review components.

Keywords Regulatory focus, Purchase intention, Online retailing, Amazon.com, Online review valence, Online review volume

Paper type Research paper

Introduction

Since its inception, online shopping has grown quickly both in terms of scale and prevalence. During the past five years, the number of online shoppers globally rose from 1.32 billion in 2014 to 1.92 billion in 2019 (Oberlo, 2020). As a result, both practitioners and academics have shown a keen interest in investigating the factors that influence consumers' online shopping behavior. Extant literature indicates that online review information plays a crucial role in online products sales (Watson *et al.*, 2018). Among the various components of online reviews, valence (ratings of a product) and volume (number of reviews available for a product) are considered especially salient and impactful characteristics.

Quite some studies have investigated the effect of volume and valence on consumers' online shopping process [See meta-analyses by Babić Rosario *et al.* (2016), Floyd *et al.* (2014), Purnawirawan *et al.* (2015) and You *et al.* (2015)]. Previous research shows that both volume and valence positively impact consumers' online shopping decisions. Nevertheless, existing empirical evidence regarding the relative importance of volume versus valence is inconclusive. For example, a meta-analysis by You *et al.* (2015) across multiple industries reveals that volume has a greater influence on sales than valence does. However, in another meta-analysis conducted by Floyd *et al.* (2014), the authors conclude that valence rather than volume has a stronger effect in online shopping. The relative importance of volume versus valence in influencing consumers' online shopping behavior has significant practical implications. In the search for the ideal product to buy, consumers often face a tradeoff between review volume and valence, as higher volume usually results in lower valence due to the endogenous variation in consumers' opinions (Moe and Schweidel, 2012).

In an attempt to explain the inconsistencies in the literature on the relative influence of online review volume and valence, this research examines the moderating role of regulatory focus in the relationship between online reviews volume/valence and purchase likelihood. Regulatory focus theory (Higgins, 1997) suggests that people tend to have either a promotion or a prevention orientation in approaching their desired goals. We argue that depending on consumers' regulatory orientation, the effect of either valence or volume of online reviews on consumers' likelihood to purchase a product will become more salient. Moreover, products can also be associated with different regulatory orientation (Ku *et al.*, 2012; Mourali *et al.*, 2007), which can influence whether valence or volume will be more influential in consumers' purchase decisions. Figure 1 depicts the conceptual framework of the current research.

The findings of this research extend our knowledge of consumers' online shopping behavior by examining the complexities of the relationship between online review volume/valence and purchase intention. We show that the relationship is not static but can vary across individuals and across products depending on their regulatory orientation. Our research findings will enable practitioners to more effectively fine tune their marketing apparatus based on the idiosyncrasies of their consumer and product characteristics.
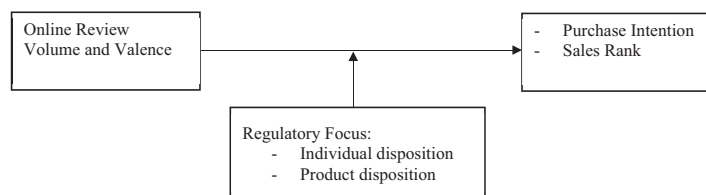

Figure 1.
Conceptual model

Online reviews

According to Hennig-Thurau *et al.* (2004), online review is "any positive or negative statement made by potential, actual, or former customers about a product or company, which is made available to a multitude of people and institutions via the Internet" (p. 39). Research has shown that consumers use online reviews to reduce the risks associated with purchase-related decision-making (Bond *et al.*, 2019; Maslowska *et al.*, 2017). Essentially, online reviews help consumers by providing them with information that can reduce the uncertainties associated with decision-making (Fan *et al.*, 2017). In the sections below, we review existing research on online reviews with a focus on the two most commonly studied review attributes, volume and valence. We first discuss the effects of each separately and then compare between valence versus volume effects.

Online review valence effects

Online review valence shows the general positive or negative nature of reviews. Previous research has shown that online review valence could be considered as a proxy for product quality (Watson *et al.*, 2018). Positive online reviews signal higher quality to the marketplace which in turn enhance consumers' attitude toward a product (Purnawirawan *et al.*, 2015). For example, De Langhe *et al.* (2015) investigated thousands of online reviews on Amazon. com and showed that consumers largely rely on online review valence as an indicator of objective quality even though the reality (i.e. the quality scores from *Consumer Reports*) does not necessarily corroborate. Previous research in the literature have examined the influence of review valence on increasing sales (Babić Rosario *et al.*, 2016; Floyd *et al.*, 2014; Maslowska *et al.*, 2017; You *et al.*, 2015), increasing helpfulness rating of online reviews (Wang *et al.*, 2015; Park and Nicolau, 2015) and consumers' choice and booking intentions (Floh *et al.*, 2013; Purnawirawan *et al.*, 2015; Wang *et al.*, 2015).

Regarding the impact of positive online reviews on sales, Zhu and Zhang (2010) found that higher review valence increased the sales of less-popular video games. Moreover, Blal and Sturman (2014) analyzed online review and sales data from Tripadvisor.com and STR Global. They showed that positive review valence increased sales of luxury hotels. A meta-analysis conducted by Floyd *et al.* (2014) of 412 review-sales relationships from 26 articles showed that online reviews have a significant impact on sales, especially when valence is included in the evaluation. Similarly, You *et al.*'s (2015) meta-analysis of 610 review-sales relationships from 51 studies revealed a significant impact of online review valence on sales.

At a more micro-level, previous research has shown significant review valence effects on individual consumer choice and purchase intention. For example, Floh *et al.* (2013) took a deeper look at the relationship between online reviews and purchase intention. Through three experiments, they demonstrated that valence at its extreme points (purely positive and negative) made online reviews more impactful on consumers' purchase intention for books, hotels and running shoes. Finally, a meta-analysis by Purnawirawan *et al.* (2015) further established a positive effect of online review valence on attitude toward the product.

Besides attitude and purchase intention, numerous studies have found review valence to play an important role in consumers' assessment of the helpfulness of a review. For example, Casaló *et al.*'s (2015) experimental research looked into the impact of online review valence in the hotel industry and showed that travelers find positive online reviews from experts to be the most useful.

Online reviews volume effects

The number of reviews (i.e. volume) is another important component of online reviews. Previous research has shown that higher number of online reviews increases the perceived

correctness and reliability of reviews among consumers (Park *et al.*, 2012; Zhu and Zhang, 2010). In addition, prior research demonstrates that consumers use the number of available reviews as an indicator of product popularity (Zhang *et al.*, 2014).

Previous research has shown that online review volume can positively influence sales (Chintagunta *et al.*, 2010; Liu, 2006). For example, Chevalier and Mayzlin (2006) showed that a higher number of online reviews for a given book was related to higher sales of that book. Liu (2006) showed that higher review volume for a movie positively impacted the future sales. In the video game industry, Zhu and Zhang (2010) showed that an increase in the number of online reviews for less popular games led to higher sales. Recent meta-analyses collectively provided support for the positive effect of volume on (Babić Rosario *et al.*, 2016; Floyd *et al.*, 2014; You *et al.*, 2015; Zhang *et al.*, 2013)products' sales performance.

Mixed results on the impacts of online reviews volume and valence

Although previous research shows that valence and volume both significantly impact sales (Babić Rosario *et al.*, 2016; Floyd *et al.*, 2014; You *et al.*, 2015), the relative influence of the two is still debated in the literature (Watson *et al.*, 2018; Yang *et al.*, 2012). The findings from Floyd *et al.*'s (2014) meta-analysis show that valence is more influential than volume, whereas Babić Rosario *et al.* (2016) and You *et al.* (2015) both point to higher impact generated by online review volume than review valence.

The current research argues that regulatory focus theory can partly explain the inconsistent relative weight of online review volume versus valence in product purchase decisions. Regulatory focus theory suggests that people adopt approach or avoidance strategies in their decision-making process, depending on their motivational principles (Crowe and Higgins, 1997; Higgins, 2012). According to this theory, people can be categorized into two main categories based on what motivates them toward their desired end-state: promotion-oriented and prevention-oriented (also known as promotion-focused and prevention-focused). Our research postulates that the relative effect of online review volume and valence is contingent on regulatory orientation such that a promotion orientation would result in more attention to the valence of online reviews than a prevention orientation. Volume of online reviews, in contrast, more positively influences those with a prevention orientation compared to those with a promotion orientation.

Moderating role of regulatory orientation of consumers and products

In this section, we present formal hypotheses on how regulatory focus can moderate the effect of online review valence and volume. Extending previous research, we argue that regulatory focus varies not only across consumers but also systematically across products. In the former case, a consumer may gravitate more toward review valence or volume depending on his or her general disposition toward prevention versus promotion. In the latter case, some products may also consistently see relatively higher weight of valence or volume depending on whether their primary purpose is to promote a positive outcome or to prevent an undesirable situation. We discuss each of these two cases in turn below.

Individual disposition of regulatory focus. Regulatory focus theory implies that consumers can be categorized based on their motivation and the strategies that they adopt to reach their goals. A promotion focus is related to advancement, eagerness, risk-taking, status and uniqueness, whereas a prevention focus is related to vigilance and avoiding mistakes. Previous research has shown that these different goal orientations impact how people process information to achieve their desired goals in life (Higgins, 2012). For example, Pham and Chang (2010) showed that regulatory orientation affects how consumers form their consideration sets in decision-making.

The different needs of promotion – versus prevention-focused consumers can dictate how these consumers may use online review information in their decision-making. Regarding review volume, it can serve as an indicator of information reliability and popularity and hence can reduce perceived risk (Bond *et al.*, 2019; Park *et al.*, 2012). This is consistent with the bandwagon reasoning that shows previous consumers' high demand implies less risk (Herpen *et al.*, 2005; Worchel *et al.*, 1975). As prevention-focused consumers have been shown to be more sensitive to perceived risk and tend to minimize the risk in their decision-making process (Higgins, 2012), it is reasonable to postulate that the positive effect of online review volume will be more pronounced for prevention-focused consumers than for promotion-focused consumers.

For promotion-focused consumers, research has shown that these consumers typically show higher levels of need for uniqueness (Ku *et al.*, 2012). This desire for uniqueness makes consumers avoid bandwagon behavior, which is also known as a snob or a reverse bandwagon effect (Cheema and Kaikati, 2010; Granovetter and Soong, 1986). For example, Ku *et al.* (2012) showed that promotion-focused consumers' purchase intention is positively impacted by supply-related scarcity messages and negatively impacted by demand-related scarcity messages. Because demand-related scarcity is an indication of popularity while supply-related scarcity implies exclusivity, promotion-focused consumers are more likely to seize the latter. In addition to being drawn to uniqueness, promotion-focused consumers are also optimists that focus on maximizing gains and achievements instead of avoiding mistakes and negativities (Higgins, 2012), and tend to be more persuaded by positive outcomes (Aaker and Lee, 2001). As review valence signals a more positive outcome with the purchase, promotion-focused individuals are more likely to pay closer attention to such information. Taken together, the above discussion suggests that the positive valence of online reviews should have a stronger effect on promotion-focused consumers than on prevention-focused consumers. The following hypotheses summarize the moderating effect of regulatory focus on the impact of review valence and volume:

H1a. The effect of online review valence on purchase likelihood will be more pronounced for promotion-focused consumers than for prevention-focused consumers.

H1b. The effect of online review volume on purchase likelihood will be more pronounced for prevention-focused consumers than for promotion-focused consumers.

Product disposition of regulatory focus. Not only can review valence and volume effects vary across consumers, they can differ from product to product too. For example, both Gu *et al.* (2012) and Floyd *et al.* (2014) showed that the effects of both review volume and valence are significantly stronger for high involvement products compared to that of low involvement products. You *et al.* (2015) further concluded that compared to non-durable products, online review volume has a positive impact on the sales of durable products. There has also been evidence that the consumers' perception of online reviews varies by product type, such that consumers are more reliant on peers' comments for experience goods but are more trusting of expert reviews for search goods (Bae and Lee, 2011).

Previous empirical studies have shown that products can be classified into promotion-focused versus prevention-focused products (Ku *et al.*, 2012; Mourali *et al.*, 2007; Zhang *et al.*, 2010; Zhou and Pham, 2004). For example, Mourali *et al.* (2007) found that when consumers shop for products with a promotion orientation, they mainly look for positive outcomes. However, when they shop for a product with a prevention orientation, they try to minimize

negative outcomes and avoid any uncertainty associated with it. Consistent with the idea, Zhou and Pham (2004) showed that in the financial decision-making domain, consumers tend to associate maximizing gains with common stocks and to associate avoiding financial losses with certificates of deposit. This suggests a more promotion focus for common stocks and a more prevention focus for certificates of deposit.

The above discussion suggests that, regardless of consumers' chronic regulatory focus, the consumption goal typically associated with a product category can temporarily shift consumers' motivational focus and approach. This can subsequently influence consumers' processing of online review information. If a product's primary consumption goal is to achieve a positive outcome such as enjoyment and monetary gain, the associated purchase decision will likely focus on maximizing gains. Similar to consumers with a chronic promotion focus, these situations should warrant more attention to how good a product is as reflected by the valence of online reviews and less so to the reliability of information as indicated by review volume. However, if a product's primary consumption goal is to avoid a negative outcome such as preventing monetary loss or averting sickness, consumers' focus will be more on avoiding risks and minimizing the probability of making mistakes. As review volume attests to the popularity of the product and the reliability of review information, it should become more salient for these prevention-focused products. Formally stated:

H2a. The effect of online review valence on purchase likelihood will be more pronounced for promotion-focused products than for prevention-focused products.

H2b. The effect of online review volume on purchase likelihood will be more pronounced for prevention-focused products than for promotion-focused products.

Study 1
Study 1 was conducted to test the moderating role of individuals' chronic regulatory focus in online review valence and volume effects (*H1a* and *H1b*). Individuals from Amazon Mechanical Turk (MTurk) participated in the experiment for monetary compensation and completed a series of choice tasks online. Numerous empirical evidence exists in the literature that indicates the reliability of results from MTurk to be equivalent to that of results from consumer panels (Goodman *et al.*, 2013; Goodman and Paolacci, 2017).

Study 1 pretest. A pretest was used to figure out the main product and various levels of online review volume and valence to be applied in the main study. In the pretest, 56 participants (mean age = 31, 55% female; see Table 1 for further details) recruited from MTurk were asked to imagine that they are shopping online for six different product categories: digital cameras, USB flash drive, music albums, hotel rooms, vitamins and dietary supplements and shoes. Then for each product category, the participants indicated what minimum star rating the product needs to have for them to consider it as having low, medium and high valence, respectively. Participants were also asked to indicate how many reviews a product in each of the six categories needs to have for them to consider the

	Sample size	Gender composition of the sample	Average age	Region
Table 1.				
Sample composition	Pretest 1	56 participants	55% Female, 45% Male	31 years old	USA
in pretest 1 and 2 and	Study 1	126 participants	48% Female, 52% Male	36.9 years old	USA
Study 1	Pretest 2	100 participants	48% Female, 52% Male	35.36 years old	USA

product as having a lot of or only a small number of reviews. Finally, to gauge the general importance of online consumer reviews in the purchase decision, participants reported how likely they will search for reviews before making a purchase decision in each of the product categories (11-item scale, 0 = Never, 10 = Always). Among the six different product categories, consumers were most likely to search for online reviews when buying a digital camera. This was used as the product for our main study. Based on the results of this pretest, three levels of online review valence and two levels of review volume were also selected for the main study, as described below.

Main study design
Study 1 used a 2 (volume: high/low) * 3 (valence: high/medium/low) within-subject experimental design. One hundred twenty-six MTurk workers (mean age= 36.9, 48% female; See Table 1) participated in the study for monetary compensation. After being briefed about the study, participants were asked to imagine that they are shopping for a digital camera online and were told that the e-retailer's website offers information on online review volume and valence (on a five-star rating system). They were asked to choose their more desired option within different pairs of digital cameras and to rate their purchase intention for each chosen camera.

Next, participants were presented with 12 binary choices, each containing the online review valence and volume information of the focal product. The 12 choices were organized in three blocks based on the valence levels (High, Medium and Low). There was some variation in valence in each block to disguise the true goal of the study. The variation of valence in each block was as follows: 4.1, 4.3 and 4.5 in the high valence block, 3.5, 3.7 and 3.9 in the medium valence block, and 2.1, 2.3 and 2.5 in the low valence block.

As mentioned above, in each block, respondents were presented with four choices. Three of those choices included a tradeoff between valence and volume, while the fourth choice was a decoy for attention check (i.e. high volume/high valence against low volume/low valence). The tradeoffs in each block were between the three levels of valence variation in that block, and a random selection of volume (low [3, 5, and 7] versus high [248, 316, and 420]).

The 12 choice tasks were presented to participants in random orders. After seeing the options in each pair, participants were asked to indicate which option in the pair they would select and to report their purchase intention for the chosen option. After the 12 choice tasks, participants completed the regulatory focus scale (Lockwood *et al.*, 2002). Finally, they answered attention check and demographic questions and were thanked for their participation.

Measures
We adapted the regulatory focus measure from previous research (Lockwood *et al.*, 2002). This scale had 14 items, half of which measured promotion focus and the other half measured prevention focus. Following Lockwood *et al.* (2002), the responses for each set of seven items were first averaged to create each participant's prevention focus rating (Cronbach's α = 0.85) and promotion focus rating (Cronbach's α = 0.90). We then subtracted the prevention focus rating from the promotion focus rating to arrive at each participant's regulatory focus score. That is, a higher score reflected a stronger promotion focus and a weaker prevention focus.

Following previous research, we measured purchase intention using a one-item scale (Bickart and Schindler, 2001; Garbarino and Strahilevitz, 2004). It asked participants if they

had the need to buy a digital camera right now, how likely it is that they would buy the chosen camera above (0 = Extremely unlikely, 10 = Extremely likely).

Data analysis and results
Our key outcomes of interest were consumers' tradeoff decisions and purchase intention ratings. Based on our hypotheses, we should see a higher regulatory focus score (i.e. a stronger promotion orientation) to be associated with a stronger effect of review valence and a weaker effect of review volume. Generally, consumers with a promotion focus should be less likely to tradeoff valence for volume than consumers with a prevention focus.

As a preliminary test of *H1(a)* and *H1*(b), a mixed-effects logit model was used to analyze the interaction between participants' regulatory focus and their trade-off choices at the individual by block level (i.e. high/medium/low). The dependent variable was the percentage of volume-dominant trade-offs an individual made in a single valence block, calculated as the percentage of non-decoy choices within the block that favored the higher-volume option over the higher-valence option. We modeled this percentage as a logit function of the individual's regulatory focus, the block's valence level and their interactions. Two valence dummies were used to identify the high and low valence blocks, with medium valence serving as the baseline. To reduce collinearity, the regulatory focus variable was mean-centered. We included age and gender in the model as control variables. Furthermore, a random individual effect was added to the model to capture unobserved individual heterogeneity and to allow choice outcomes within the same person to correlate with each other.

The results of the analysis are presented in Table 2. The adjusted pseudo-R^2 for the model was 0.57, suggesting a reasonably good fit. Results showed a significant negative effect of regulatory focus ($\beta_{RF} = -0.34$, $SE = 0.12$, $p < 0.006$). Given the logit specification, this means that each one-point increase in regulatory focus toward the promotion direction reduced the odds of trading off valence for volume by 28.82% for the baseline (medium valence) block, consistent with our hypotheses. As the interaction between regulatory focus and the high-valence dummy was not statistically significant ($\beta_{RF*High\ Valence} = -0.007$, $p = 0.47$), it suggests a similar decreasing tendency to tradeoff valence for volume in the high valence block when regulatory focus becomes more promotion oriented. There was a significant positive interaction between regulatory focus and the low-valence dummy however ($\beta_{RF*Low\ Valence} = 0.34$, $p < 0.0001$). The simple slope of regulatory focus on the tradeoff decision was no longer significant for the low-valence block (simple slope = −0.0008,

Variables	Model estimate (S.E.)
Intercept	3.42*** (0.88)
RF	−0.34** (0.12)
Val.Low	−1.96*** (0.23)
Val.High	0.18 (0.25)
Gender	−0.58 (0.39)
Age	−0.0008 (0.01)
RF * Val.Low	0.34** (0.003)
RF * Val.High	−0.007 (0.13)
Model Fit	*Adjusted Pseudo R^2 = 0.57*

Table 2.
Study 1, Mixed-effect logit model results

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

$p = 0.99$). At low valence levels, a high review volume was no longer a positive signal for the product and therefore even prevention-focused individuals were equally less likely to choose the higher-volume product within each pair. Supporting this view, our model showed a significant negative effect of the low valence dummy ($\beta_{\text{Valence-Low-Dummy}} = -1.96$, $p < 0.0001$), suggesting a general reluctance to choose the high-volume option under low valence conditions. None of the two control variables, age and gender, had a significant effect on the tradeoff decision ($\beta_{age} = -0.0008$, $p = 0.98$; $\beta_{gender} = -0.58$, $p = 0.13$).

Purchase intention analysis. The above investigation provided general support for our hypotheses. But it did not allow us to test *H1(a)* and *H1(b)* separately. To more formally test *H1(a)* and *H1(b)*, we examined consumers' purchase intention using a mixed-effect panel model, with purchase intention as the dependent variable and numeric review valence, volume, their respective interaction with regulatory focus, and their interaction with each other as independent variables. The volume numbers were log-transformed to reflect the diminishing effect of volume on purchase intention as volume becomes large and to make the scale of volume and valence more similar to each other. Age and gender were included as control variables. Finally, an individual random effect was added to the model to capture unobserved individual heterogeneity.

The model estimates are presented in Table 3. To assess the fit of this mixed-effect model, Nakagawa and Schielzeth's (2013) approach was followed, which breaks down the variance explained into a marginal R^2 and a conditional R^2. Marginal R^2 shows the variation in the model that is explained by the fixed factors, whereas conditional R^2 shows the variation of the model that is explained by both random and fixed factors. In our case, the marginal R^2 was 0.47 and the conditional R^2 was 0.73, suggesting that individual unobserved heterogeneity explained a significant portion of the variance.

The model results showed a significant positive interaction between regulatory focus and online review valence ($\beta_{\text{Valence*RF}} = 0.03$, $p = 0.06$). Supporting *H1(a)*, individuals with a higher chronic promotion orientation (i.e. with higher regulatory focus scores) cared more about the valence of online reviews. In the meantime, the interaction between regulatory focus and online review volume was significantly negative ($\beta_{\text{Volume*RF}} = -0.03$, $p = 0.02$). Consistent with *H1(b)*, the impact of review volume on purchase intention increased as individuals were more predisposed toward a prevention orientation (lower regulatory focus scores). We also found a significant positive interaction between valence and volume

Variables	Model estimate (S.E.)
Intercept	5.63*** (0.59)
Valence	2.23*** (0.04)
Volume	0.20*** (0.02)
RF	−0.07 (0.06)
Age	−0.01 (0.01)
Gender	0.53* (0.27)
Valence *Volume	0.06* (0.02)
Valence * RF	0.03* (0.02)
Volume * RF	−0.03** (0.01)
Valence *Volume * RF	−0.01 (0.01)
Model fit	*Marginal R^2= 0.47 Conditional R^2= 0.73*

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$

Table 3.
Study 1, results of hierarchical linear model

($\beta_{Valence*Volume} = 0.05$, $p = 0.06$), suggesting a synergistic effect between the two attributes. For the two control variables, gender was a marginally significant positive predictor of purchase intention ($\beta_{gender} = 0.53$, $p = 0.05$), indicating that female participants had a higher purchase intention. Age did not have a significant effect ($\beta_{age} = -0.01$, $p = 0.24$).

In sum, the results of Study 1 showed that the effect of online review volume and valence on purchase intention was moderated by consumers' regulatory focus. Specifically, for consumers with a promotion focus, the role of review valence in decision-making was stronger compared to consumers with a prevention focus. At the same time, consumers with a prevention focus were more influenced by review volume in their decision-making than those with a promotion focus. The results of Study 1 thus provide support for *H1(a)* and *H1 (b)*.

Study 2

Study 1 investigated the interaction between online review characteristics and regulatory focus as an individual disposition. This study extends the previous one by investigating the role of regulatory focus as triggered by the product category under consideration, which is the focus of *H2(a)* and *H2(b)*.

Study 2 pretest. A pretest was conducted to determine the two product categories with different regulatory orientations. One-hundred participants (mean age= 35.36, 48% female) from MTurk participated in the pretest for monetary compensation. Following previous research that has used prevention versus promotion focused product categories (Ku *et al.*, 2012; Mourali *et al.*, 2007; Zhang *et al.*, 2010), participants were asked to rate twelve product categories (fabric stain remover, mouthwash, breath freshener, teeth whitening, dental floss, perfume, air freshener, fabric protector, fabric deodorizer, fabric softener, weed killer and fertilizer) on two seven-point scale anchored at very enhancing/not enhancing and protecting/not very protecting, adapted from Zhang *et al.* (2010).

To ensure that the participants properly understood the meaning of the measurement items, they were told that "enhancing products are products that increase fun in life; these are things you like to have in order to feel good/happy", and "protecting products are products that increase safety in life; these are things you need to have to avoid negative consequences." These descriptions were taken from Zhang *et al.* (2010). The dental floss and the teeth whitening categories received the most different ratings on both of the measurement items. A paired comparisons *t*-test showed that participants considered the teeth whitening category to be more enhancing (promotion-focused) compared to dental floss ($M_{Whitening-Enhancing} = 5.37$, $M_{Floss-Enhancing} = 4.25$; $t = 5.68$, $df = 99$, $p < 0.0001$). Participants also considered dental floss to be more protecting(prevention-focused) compared to teeth-whitening ($M_{Floss-Protecting} = 5.67$, $M_{Whitening-Protecting} = 3.69$; $t = 9.14$, $df = 99$, $p < 0.0001$). Therefore, dental floss was chosen to be the prevention-orientated product and teeth whitening the promotion-oriented product.

Study 2 data. In lieu of an experimental design, Study 2 data were collected from the US Amazon.com website. Amazon sells a wide variety of products and services and is a great resource for online reviews. It has been used in a number of studies on online reviews (Powell *et al.*, 2017). Using an automated web crawler, we collected information on all products sold by Amazon.com in the teeth whitening and the dental floss categories at daily intervals for five weeks during Fall 2019. Some products were never available and/or did not have review information during the entire time period and therefore were excluded from the analysis. In the final sample, we had 1,108 products in the teeth whitening category and 1,657 products in the dental floss category.

Model and variable operationalization
To test our hypotheses, we used fixed-effects panel regression, which modeled sales rank as a function of lagged product review characteristics and other control variables (Kübler *et al.*, 2018), as shown in the equation below:

$$y_{it} = \beta_0 + \beta_1 X_{i(t-1)} + \alpha_i + \varepsilon_{it}$$

In the model, y_{it} represents the log-transformed Amazon sales rank of product i on day t. The log transformation was done as previous research using Amazon.com data shows that product sales is a linear function of log-transformed sales rank (Chevalier and Mayzlin, 2006); $X_{i(t-1)}$ represented a vector of lagged independent and control variables in the model. Specifically, we included log-transformed review volume, review valence (i.e. average review rating), product regulatory orientation (1 = promotion and 0 = prevention) and its respective interaction with valence and volume as our key variables of interest. We also controlled for lagged list price and actual product price, product title word count, product feature list word count, product description word count, number of answered questions, presence of a scarcity message such as "only 5 left in inventory" (dummy-coded; 1 = yes, 0 = no), product being out-of-stock (dummy-coded; 1 = out of stock, 0 = in-stock), presence of a promotional message such as "Amazon's choice" (dummy-coded; 1 = yes, 0 = no), and whether the product is sold and fulfilled by Amazon (two dummy variables; 1 = yes, 0 = no). We also included the product's lagged log-transformed sales rank to control for any potential carryover effect. The α_i term in the model reflects the fixed-effect for product i, which captures the influence of unobserved product characteristics. Finally, ε_{it} represents the random error not explained by the other terms in the model.

Hypothesis testing and results
The Hausman test (Hausman, 1978) was used to test the suitability of a fixed-effect model versus a random-effect panel regression model. Results indicated that a fixed-effect model was preferable to a random-effect model (χ^2 = 20,066, df = 18, $p < 0.001$), providing evidence that the adopted model in this study was appropriate. The results from the fixed-effects panel regression are shown in Table 4. The R^2 for the model was 0.37, suggesting reasonable model fit. Note that as a lower sales rank means higher sales, a negative coefficient in the model would translate into a positive impact of the corresponding variable on sales. The model results showed a significant negative interaction between review valence and product regulatory orientation ($\beta = -0.026$, $p = 0.047$). As shown in Figure 2, further spotlight analysis following Spiller *et al.* (2013) revealed that the effect of review valence on sales rank was significantly stronger in the promotion-oriented product category (i.e. teeth whitening; $\beta = -0.068$, $p < 0.001$) than in the prevention-oriented product category (i.e. dental floss; $\beta = -0.042$, $p < 0.001$). Therefore, *H2(a)* was supported. Furthermore, consistent with *H2(b)*, there was a significant positive interaction between review volume and product regulatory orientation ($\beta = 0.043$, $p = 0.006$), suggesting that volume was less impactful for a promotion-focused product than for a prevention-focused product. As shown in Figure 2, review volume significantly improved product sales in the prevention product category (i.e. dental floss; $\beta = -0.054$, $p < 0.001$) but did not have a significant effect in the promotion product category (i.e. teeth whitening; $\beta = -0.011$, $p = 0.38$). The current model also showed a significant negative interaction between review valence and volume ($\beta = -0.021$, $p = 0.002$). Similar to Study 1, valence and volume showed a synergistic effect.

Regarding the control variables, the result showed that higher list price ($\beta = 0.078$, $p < 0.001$) and actual price ($\beta = 0.060$, $p < 0.001$), the presence of a scarcity message ($\beta = 0.003$,

Variables	Model estimate (S.E.)
Volume	−0.054*** (0.009)
Valence	−0.042*** (0.008)
Lagged sales rank	0.594*** (0.002)
Actual price	0.060*** (0.01)
Word-title	−0.021*** (0.006)
Featured	−0.055*** (0.008)
Description	−0.011* (0.005)
Answered questions	−0.018** (0.009)
List price	0.078*** (0.004)
Availability (i.e. stock-out)	0.021*** (0.001)
Promoted by Amazon	−0.005*** (0.001)
Scarcity message	0.003** (0.001)
Fulfilled by Amazon	−0.021*** (0.002)
Sold by Amazon	−0.018*** (0.002)
Volume * Valence	−0.021*** (0.006)
Volume * Category	0.043*** (0.01)
Valence * Category	−0.026** (0.01)
Volume * Valence * Category	−0.01 (0.01)
Model fit	R^2: 0.37 F (18, 86,058) = 2859.54, $p < 0.0001$

Table 4.
Study 2, Fixed-effect panel regression results

Notes: ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$, Category: 1= Promotion (Teeth-whitening), 0 = Prevention (Dental Floss)
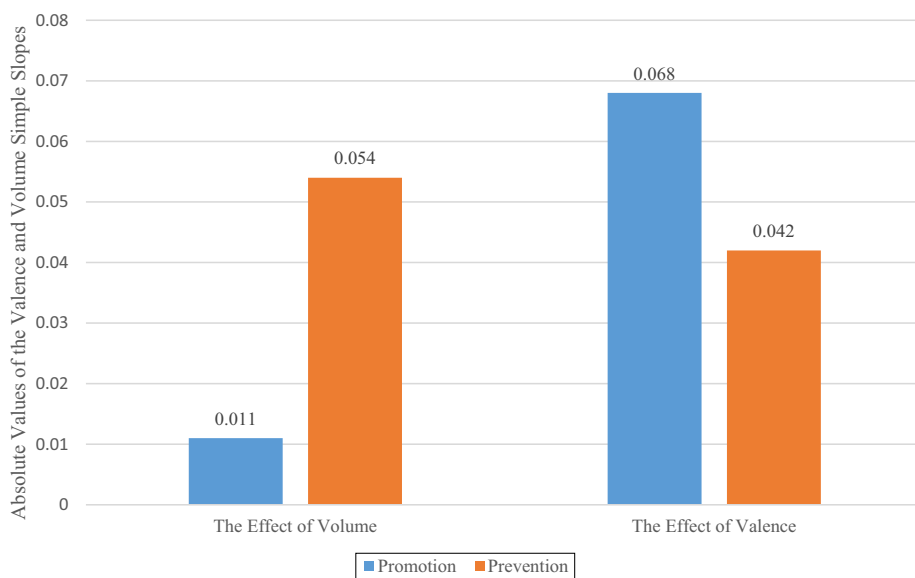

Figure 2.
The effects of online review valence and volume under different product regulatory focus in Study 2

Note: As a higher sales rank indicates lower sales, a negative coefficient for valence/volume indicates a positive effect on sales. For ease of interpretation, we used absolute values of the coefficients here

$p = 0.01$) and an out-of-stock message ($\beta = 0.021$, $p < 0.001$) negatively affected product sales. In contrast, the number of answered questions ($\beta = -0.018$, $p = 0.047$), product title word count ($\beta = -0.021$, $p = 0.002$), product feature list word count ($\beta = -0.055$, $p < 0.001$), product description word count ($\beta = -0.011$, $p = 0.066$), the presence of a promotional message ($\beta = -0.005$, $p < 0.001$), being sold by Amazon ($\beta = -0.018$, $p < 0.001$) and fulfillment by Amazon ($\beta = -0.021$, $p < 0.001$) all significantly improved sales. Finally, there was a significant sales carryover effect, as indicated by the significant positive coefficient of the lagged log-transformed sales rank variable ($\beta = 0.594$, $p < 0.001$).

Discussion
The fast growth of online retailing over the last decade necessitates a better understanding of consumers' online shopping activities. Among all the factors that can influence consumers' online purchase decisions, the importance of online reviews has been well-established in the literature. Although numerous previous studies have investigated the impact of online reviews, the findings have been inconsistent, especially in terms of the relative impact of review valence versus volume. The current research attempts to explain some of these inconsistencies by investigating both chronic and product-induced contextual regulatory focus as a moderator of valence and volume effects. Our online experiment (Study 1) found that online review valence is more impactful for consumers with a promotion focus than for consumers with a prevention focus. The opposite was true for review volume effects, where consumers with a prevention focus were influenced more by volume in their decision-making compared to consumers with a promotion focus. Using secondary data from Amazon.com, Study 2 showed that the pattern of results we found in Study 1 also applied to situational regulatory focus induced by the product category. The positive effect of review volume on sales rank was stronger for prevention-oriented products, whereas the effect of valence was stronger for promotion-oriented products.

Managerial implications
The rising competition in the online environment requires companies to think about better ways of marketing their products and services. One way to do so is to effectively manage online consumer reviews, as such information can significantly influence consumers' purchase decisions (Fox *et al.*, 2018). Often companies proactively encourage consumers to post online reviews about their products by appealing to past buyers or by providing a small financial incentive (e.g. a $5 coupon or future discount). Such actions are predominantly targeted at increasing the volume of online reviews. But the quality of these incentivized reviews can vary widely, and frequently the gain in quantity is obtained at the sacrifice of review quality and favorability. Our research findings suggest that such actions may be shortsighted. While review volume is indeed important in some product categories and for some consumers, review valence can be more important in other situations.

The focus of consumer review management needs to be adapted to the product and to the type of consumers one is trying to reach. For products mainly used to promote positive outcomes or more likely to be sold to promotion-focused individuals (e.g. vacations, entertainment products and luxury goods), more efforts should be devoted to maintaining and increasing the favorability of consumer reviews. This can be achieved for example by timely monitoring of consumer reviews and addressing any dissatisfaction expressed in such reviews. In the long run, companies should leverage the insights gained from consumer reviews to fundamentally improve their products and services. In the meantime, for products that target more of a prevention-focused mindset (e.g. insurance, preventive health

care and home protection devices), a concerted effort to increase review volume while maintaining a decent review rating may be more desirable.

The findings from the current research also have important implications regarding marketing campaigns. Firms often use consumer testimonials in their advertising campaigns. Understanding the regulatory orientation of the firm's offerings can help optimize the design of such messages. For offerings with a promotion focus or for target markets that have a strong promotion focus (e.g. younger, variety-seeking consumers), the emphasis should be on highlighting the positivity of consumer comments and testimonials. In comparison, for offerings with a prevention focus or for prevention-driven target markets (e.g. risk-averse consumers), the emphasis in the message should be on how many people may have spoken positively about the product and on conveying the impression of mass. Furthermore, marketers have an opportunity to prime certain regulatory orientation in their target market depending on their offerings' relative strength in valence versus volume. Previous research has shown that regulatory foci can be momentarily primed among consumers (Pham and Avnet, 2004). The findings of our research indicate that priming a promotion regulatory focus may be advantageous for a new product that has very positive ratings but has not accumulated many reviews. In contrast, for an incumbent product that has the strength of a large quantity of reviews, priming a prevention regulatory focus will increase the effect of review volume on consumers' purchase decisions.

Our findings also have substantial implications for multinational marketers. Previous research has shown that nationals from different countries perceive online review information differently (Christodoulides *et al.*, 2012) and may be more predisposed to different regulatory orientations. For example, people in middle-eastern countries are known to be more prevention focused (Lee *et al.*, 2000). Consequently, managing online marketing and consumer reviews in those countries needs to focus more on amplifyingreliability and risk-reduction signals. Taken together, our research points to the importance of understanding consumers' motivational approaches in optimizing online marketing efforts.

Limitations and future research
The current research hasseveral limitations that need to be addressed in future research. First, our two studies only covered a limited number of product categories: digital camera, teeth whitening products and dental floss. All three products can be considered search goods and utilitarian products. Future research needs to expand the categories to include more experiential and hedonic products, both to test the generalizability of the current research findings and to identify their boundary conditions. Second, our first study was an online experiment involving hypothetical choices, while the second study used real-world data but only covered a short period. We were also not able to test the underlying processes. Future research should leverage field experiments in combination with consumer self-reports to generate deeper insights.

Third, in the tradeoff tasks in Study 1, consumers were asked to choose very large variations of volume (10 vs a few hundreds) against very small variations of valence (typically within 0.4 points apart). This led to a large percentage of choices favoring trading off valence for volume. Participants might have behaved differently if the valence values were further apart or if the volume levels were closer between the two options. This issue is partly addressed in Study 2 data by having a wider range of review valence and volume. However, the exact differences that would trigger a tradeoff one way or the other remain an interesting unanswered question that should be explored in future research. Fourth, although we used a multi-method approach to

address the relative advantages and disadvantages of controlled lab experiments versus secondary data, we acknowledge that the analysis of Amazon data in Study 2 may be subject to endogeneity issues (Chevalier and Mayzlin, 2006). Furthermore, there may be other influences in the retailer's environment that we are not aware and cannot control. Future research needs to address these issues by replicating our findings in a more controlled lab environment. Finally, in Study 2, we did not have actual product sales information and had to rely on sales rank as a proxy. Furthermore, we only gathered data from a single retail website. Future research should look into other websites and should combine actual sales figures to test the robustness of the current findings.

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About the authors

Elika Kordrostami, PhD is an Assistant Professor of Marketing at Rowan University. Dr. Kordrostami's research interests are in digital marketing, consumer decision-making, and brand relationships. Her publications have appeared in *European Journal of Marketing, Journal of Retailing and Consumer Services, Journal of Product & Brand Management*, among others. Elika Kordrostami is the corresponding author and can be contacted at: Kordrostami@rowan.edu

Yuping Liu-Thompkins, PhD, is a Professor of Marketing and Director of Loyalty Science Lab at Old Dominion University. Dr Liu-Thompkins' research focuses on the intersection among marketing, technology and consumer psychology. Her main research areas are customer loyalty, habit, and digital marketing. Dr Liu-Thompkins' research publications have appeared in *Journal of Marketing, Journal of Interactive Marketing, Journal of Advertising, Journal of Advertising Research, Marketing Letters*, among others. She is currently an Associate Editor for *Journal of Business Research*, and she serves on the editorial review board of *Journal of Marketing, Journal of Advertising, and Journal of Marketing Communications*. More information about Dr Liu-Thompkins can be found at www.yupingliu.com

Vahid Rahmani, PhD, is an Assistant Professor of Marketing at Rowan University. His research interests include pricing, persuasion knowledge, and digital marketing.