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The business value of online consumer reviews and management response to hotel performance

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ABSTRACT

The business case for investing in online reputation has received increasing scrutiny in recent years. This study identifies the business value of consumer reviews and management responses to hotel performance. We present a panel data analysis of online consumer reviews and management responses of 843 hotels on a hotel review website. The results show that overall rating, attribute ratings of purchase value, location and cleanliness, variation and volume of consumer reviews, and the number of management responses are significantly associated with hotel performance. In addition, variation and volume of consumer reviews moderate the relationship between overall rating and hotel performance. Management responses, together with variation and volume of consumer reviews, moderate the relationship between certain attribute ratings and hotel performance. Implications of utilizing consumer reviews and management responses to leverage hotel business are provided.

1. Introduction

To reduce uncertainty and perceived risks, consumers often search for word-of-mouth (WOM) when making purchase decisions. Prior research has presented extensive evidence showing that WOM is important in purchase decision and choice behavior (Godes and Mayzlin, 2004; Lee and Youn, 2009; Litvin et al., 2008). In the Internet era, the effect of WOM has been further enhanced in the form of electronic word-of-mouth (eWOM) (Litvin et al., 2008). Consumers can make their opinions easily accessible to other Internet users via message boards, twitter, product review websites, or online communities. Meanwhile, consumers are willing to search for the opinions and experiences of peer consumers before purchasing a product. According to findings from a joint research by PowerReviews and the E-tailing Group, about 22% of respondents said that they "always" read consumer reviews before making a purchase, 43% of respondents said that they check consumer ratings and reviews "most of the time", and about 68% read "at least four reviews" before making a purchase (Kee, 2008).

When it comes to experience goods, the impact of eWOM is particularly salient (Lee and Youn, 2009; Litvin et al., 2008). The quality of experience goods, such as hotel services, is often unknown before consumption. Consumers thus have to rely on eWOM to make inferences about the quality of such goods (Wirtz and Chew, 2002). Studies have investigated relevant factors that consumers evaluate in hospitality product consumption, including review valence (Duverger, 2013 for Expedia.com, TripAdvisor.com, and Orbitz.com; Ye et al., 2009 for Ctrip.com), product rankings (Luca, 2011 for Yelp.com; Ghose et al., 2012, 2013 for Travelocity.com), perceived usefulness (Racherla and Friske, 2012 for Yelp.com), expert reviews (Zhang et al., 2010b for Dianping.com), trust in consumer reviews (Ayeh et al., 2013; O'Connor, 2008; Racherla et al., 2012 for TripAdvisor.com), and management responses to consumer reviews (Park and Allen, 2013 for TripAdvisor.com; Ye et al., 2010 for Ctrip.com and Elong.com). Consumers write online reviews to indicate their level of satisfaction with the hotel (Liu et al., 2013) and inform other consumers on the Internet of their hotel stay experience (Park and Allen, 2013). Online reviews have become one of the most important information sources in consumers' lodging decision making (Ye et al., 2011) and are used considerably to inform consumers of accommodation quality (Filieri and McLeay, 2014). Consumers tend not to book a hotel without seeking online reviews (Kim et al., 2011). For example, 53% of travelers would not commit to a hotel reservation until they read online reviews and 77% usually or always refer to online reviews before choosing a hotel (TripAdvisor, 2013). Despite the prevalent use of online reviews by consumers, empirical research investigating the economic value of consumer reviews to hotel businesses still lags in literature (Duverger, 2013).

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Given the critical influence of eWOM on the hospitality industry, especially the hotel segment (Cantallops and Salvi, 2014), online reviews for hotels become a key component of hospitality management (Leung et al., 2013). Hoteliers become increasingly aware of the need to actively communicate with consumers on social media platforms (O'Connor, 2010) and develop strategies to address consumer reviews (Levy et al., 2013). In response to this need, leading hotel review websites such as TripAdvisor.com nowadays feature manager accounts through which hoteliers can interact with reviewers and respond to their reviews (Kim et al., 2011). Management responses make the two-way communication possible, particularly when service-related complaints are expressed in online reviews by consumers (Gu and Ye, 2014). As consistency in service quality is difficult to achieve, service failure is almost inevitable from time to time (Levy et al., 2013). Online complainers can rapidly become the travel opinion leaders of the electronic age (Litvin et al., 2008). Such dissatisfying critics negatively influence future attitudes toward hotels (Vermeulen and Seegers, 2009) and impede the ability of hotels to increase prices (Öğut and Taş, 2012). Thus, management responses to online consumer complaints should be immediately used to address these critics (Mattila and Mount, 2003). Management responses that can address service-related issues and recover the service failure will likely increase the consumer's likelihood of recommending the hotel (Barsky and Frame, 2009). However, prior studies on management responses mostly focus on the stand-alone impact of management response (e.g., Park and Allen, 2013; Ye et al., 2010), shedding little light on the interaction between consumer reviews and management responses. Because of the simultaneous engagement of consumers and hoteliers on social media, consumers' purchase decisions are often influenced by both user-generated reviews and management responses (Levy et al., 2013). Without considering the interrelated effect of consumer reviews and management responses, the literature lacks a rigorous quantification of the value of online commutation between consumers and marketers on social media platforms. Therefore, it is strategically important for hotel managers to understand how management responses can moderate the influence of consumer reviews on hotel performance. However, how to use management responses to address consumer reviews and maximize hotel performance remains a less researched question in the hospitality industry (Kim et al., 2010).

Our study aims to address the knowledge gaps in hospitality literature by presenting a rigorous quantification of the economic value of online reviews on hotel performance in the current social media context where consumer reviews and management responses coexist. Our research questions are two-fold: (1) What is the effect of consumer reviews on hotel performance and (2) How do management responses moderate the relationship between consumer reviews and hotel performance? To answer our research questions, we collect time-series consumer reviews and management responses of 843 hotels on TripAdvisor.com on a daily basis, and match the data with the quarterly hotel performance information provided by a local revenue comptroller office at a disaggregated individual hotel level. Our econometric specification models hotel performance as a function of consumer review factors and management responses, controlling for relevant hotel characteristics such as hotel age, size, and quality segmentation.

2. Background and hypotheses

2.1. Electronic word-of-mouth

Litvin et al. (2008) define eWOM as all informal communications related to the usage, characteristics, or sellers of particular goods and services initiated by consumers through Internet-based technology. Bronner and de Hoog (2010) state that eWOM refers to the consumer comments posted on the Internet about products and services. eWOM includes a variety of media forms, such as online reviews, online recommendations and online opinions (Cantallops and Salvi, 2014). The most prevalent example is online consumer reviews (Chatterjee, 2001), which are considered more effective in influencing consumer behavior than traditional advertising (Yang and Mai, 2010), information provided by product providers, or promotion messages of third-party websites (Gretzel and Yoo, 2008; Zhang et al., 2010b). Studies find that online consumer reviews play a key role in influencing the product performance in the hospitality industry (Cheng and Loi, 2014). For example, Ye et al. (2011) show that a 10% increase in traveler review ratings can boost hotel online bookings by more than 5%. Zhang et al. (2011) find that an incremental star (on a 5-point scale) in customer rating of hotel rooms is linked to a 21% increase in price in New York. Öğut and Taş (2012) report that a 1% increase in online customer ratings increases sales per room up to 2.68% in Paris and up to 2.62% in London.

Despite the importance of eWOM, Godes and Mayzlin (2004) point out the difficulty in measuring eWOM given its various forms on the Internet. For online consumer reviews, it is generally agreed that three review-related factors are important, i.e., the valence of reviews (Chevalier and Mayzlin, 2006; Chintagunta et al., 2010; Clemons et al., 2006; Cui et al., 2012; Dellarocas et al., 2007; Duan et al., 2008; Liu, 2006; Sun, 2012; Tirunillai and Tellis, 2012; Wu et al., 2013; Ye et al., 2011; Zhang et al., 2010b, 2013; Zhu and Zhang, 2010), the volume of reviews (Chevalier and Mayzlin, 2006; Chintagunta et al., 2010; Cui et al., 2012; Dellarocas et al., 2007; Duan et al., 2008; Liu, 2006; Wu et al., 2013; Zhu and Zhang, 2010), and the variation of reviews (Chintagunta et al., 2010; Godes and Mayzlin, 2004; Markopoulos and Clemons, 2013; Park and Park, 2013; Sun, 2012; Wu et al., 2013; Ye et al., 2009; Zhu and Zhang, 2010). An average rating measure most frequently represents valence. Statistical variation measures dispersion in ratings and the number of posted ratings represents volume most commonly (Lee, 2012). Jang et al. (2012) further suggest that consumers often pay close attention to these three factors when referring to online product reviews in their purchase decision process. To enhance the readability of review information, many leading product review websites such as Tripadvisor.com present not only valence and volume of reviews, but also the distribution of ratings showing the dispersion of consumer ratings from the average (see Fig. 1). Following prior research, we use review valence, review volume, and review variation as measures of consumer reviews in this study.

2.2. eWOM and business performance

As consumers post their recommendations and opinions about a product on social media, they attempt to persuade other consumers to see their point of view and thus influence their decision-making (Chu, 2009). Previous research has found that the valence of consumer reviews has a statistically positive relationship with product sales. For example, Moe and Trusov (2011) demonstrate that consumers' buying behavior is significantly affected by previous positive ratings from other users. Chevalier and Mayzlin (2006) and Sun (2012) find that online consumer ratings significantly influence book sales and that a high average rating on Amazon.com drives book sales. Similarly, online ratings have an impact on movie sales (Dellarocas et al., 2007) and beer sales (Clemons et al., 2006). In the context of hospitality, Ye et al. (2009) find a significantly positive relationship between online consumer ratings and hotel performance. Verma et al. (2012) report that customer ratings have a strong positive effect on customers' willingness to book a hotel. Öğut and Taş (2012) suggest that a higher customer

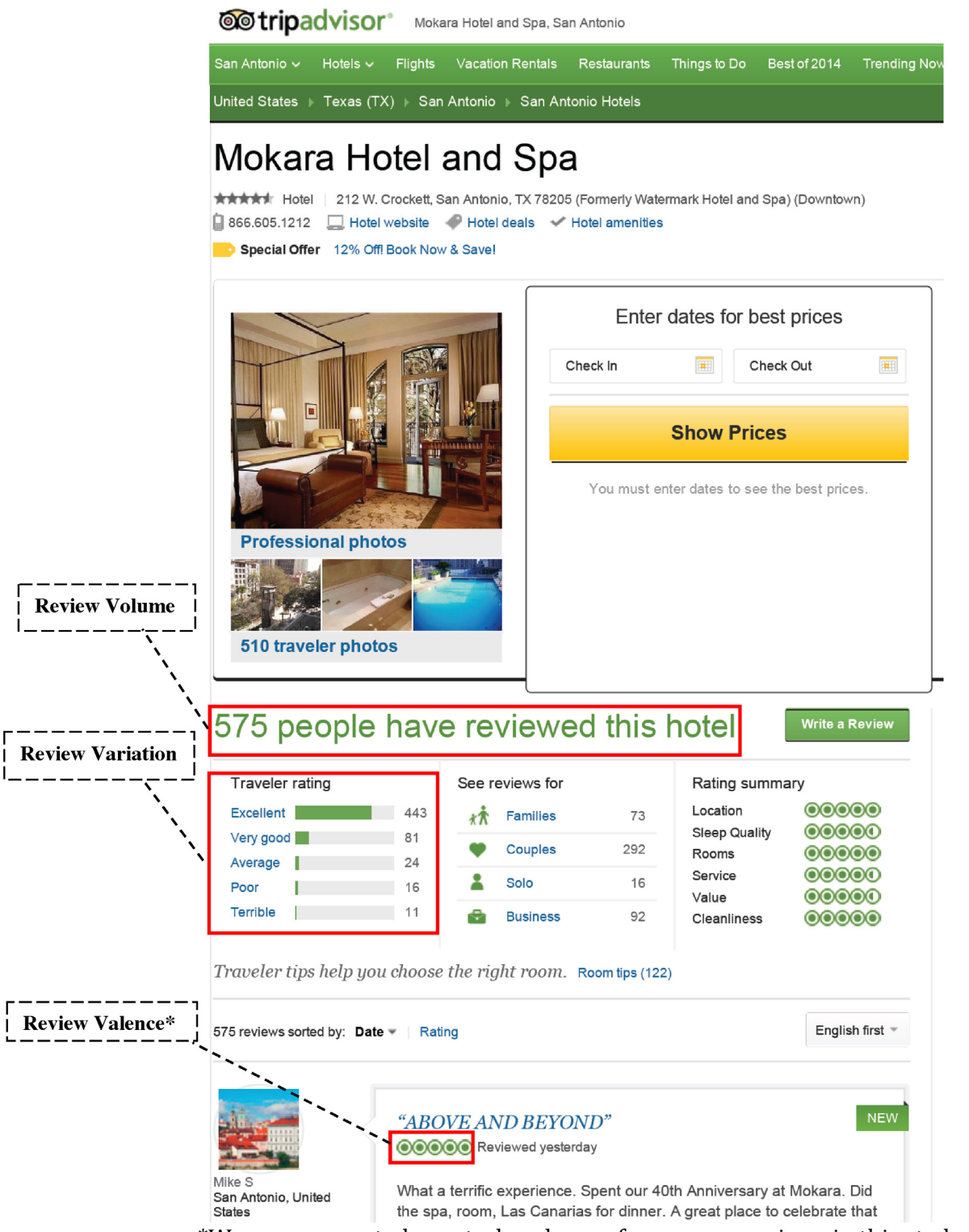

Fig. 1. Valence, volume, and variation of online reviews.

rating significantly increases the online sales of hotels. Therefore, we hypothesize,

H1. Review valence has a positive impact on future hotel performance.

Besides of the overall ratings, sub-ratings (or attribute ratings) on hotel specific attributes such as service, location, price, room, and cleanliness are visible to customers on social media platforms and are commonly taken into account when customers evaluate a hotel (Choi and Chu, 2001; Liu et al., 2013; Lockyer, 2005; Ramanathan and Ramanathan, 2011; Zhang et al., 2011). To examine the customer valuation of specific hotel attributes, we include ratings on services, location, price, room, and cleanliness in parallel to overall ratings in our study. Thus, we explore the impact

of ratings of hotel attributes on future hotel performance, as well as the moderating effects of review volume, review variation, and management responses on the relationship between attribute ratings and hotel performance. Since overall ratings and sub-ratings of specific hotel characteristics are arguably similar in hypothesis development, we keep brevity by omitting the hypotheses of sub-ratings throughout this study.

The variation or the dispersion of online reviews signals the heterogeneity in consumer opinions (Sun, 2012; Zhu and Zhang, 2010). There is relatively scant literature that examines the impact of review variation on firm performance, and the findings are truly mixed. For example, Ye et al. (2009) find that review variation of a hotel has a negative impact on hotel sales. Chintagunta et al. (2010) show that review variation does not explain opening-day movie box office revenues. However, the effect of high variation in consumer ratings is not necessarily considered negative, since high variation signals both great risk and great reward (Zhu and Zhang, 2010). Clemons et al. (2006) examine the relationship between online reviews and the success of new product campaigns in the craft beer industry. The results show that the variation of reviews plays a positive role in determining which new product grows fastest in terms of sales. Martin et al. (2007) survey individuals choosing between two movies with pre-given consumer ratings, and find that consumers prefer the movie with high-variation review ratings. In a similar vein, Park and Park (2013) suggest that high-variation reviews are more likely than low-variation ones to enhance the evaluation of a high-expectation product. The mixed findings imply that a high variation may be a double-edged sword: on one hand, it reflects the inconsistency and uncertainty of perceived product quality. On the other, it communicates to consumers that the product may be perceived high quality by some consumers while not by others. Although some people hate it, others love it. Based on these arguments, we hypothesize,

H2. Review variation has a positive impact on future hotel performance.

The impact of the volume of consumer reviews on product sales is related to several factors. First, consumers are likely to follow the opinion of others as a result of pressure to conform to a peer group (Zhang et al., 2010b). Miniard and Cohen (1983) point out that consumers' behavior is influenced by concerns over what others might think of them or how others might act toward them as a function of their product choice and usage. A large number of reviews can lead consumers to rationalize their purchase decisions by telling themselves that many other people also bought the same product (Park et al., 2007; Zhang et al., 2010b). Second, the number of consumer reviews may signal the popularity of a product (Zhang et al., 2013; Zhu and Zhang, 2010). The more consumer reviews are written for a specific product, the more consumers tend to be aware of this product (Dellarocas et al., 2007; Godes and Mayzlin, 2004), and thus they make more purchases. Many studies provide support to the positive relationship between volume of eWOM and product sales (Dellarocas et al., 2007; Duan et al., 2008; Liu, 2006). For example, Duan et al. (2008), in their study of the movie market, find that box office sales are significantly influenced by the volume of online postings. Cui et al. (2012) indicate that the volume of reviews has a greater impact on sales of experience products than on sales of search products. Zhang et al. (2013) show that the volume of reviews has a positive effect on the number of buyers of a restaurant deal. Therefore, we hypothesize,

H3. Review volume has a positive impact on future hotel performance.

Recent studies find that the interplay among review factors influences consumer purchase. For example, Sun (2012) reports that the interaction of valence and variation of online reviews is a determinant of product sales. In particular, a higher standard deviation of ratings will increase the book's relative sales on Amazon if and only if the average rating is low. Although most people give the product a low rating, the high variation would signal the polarized opinions and secure the purchase made by consumers who extremely like the product. In a similar approach, we hypothesize that the variation of online reviews moderates the relationship between review valence and hotel performance and examine how review valence impacts hotel performance when review variation varies at different levels (high and low).

It is argued that consumers will psychologically weigh negative reviews more than positive reviews (Chevalier and Mayzlin, 2006; Cui et al., 2012; Papathanassis and Knolle, 2011). Herr et al. (1991) examine the effects of WOM communication on product judgments, showing that negative WOM tends to be more diagnostic or informative than positive or neutral WOM in a way that negative attributes strongly imply products of low quality, whereas positive or neutral WOM is ambiguous and associated with products of mixed quality (high, medium, and low). In particular, Papathanassis and Knolle (2011) find that negative reviews are more likely to be utilized for holiday product purchases than positive ones. According to these studies, negative reviews tend to have a greater impact than positive ones. Assume that the review valence of Hotel A and Hotel B are both 3 stars, but Hotel B has a larger review variation than Hotel A. Since negative reviews would have more salient influence on consumers' perceived quality, the "perceived" review valence of Hotel B that has more negative reviews tends to be more negative than 3 stars. In contrast, the "perceived" review valence of Hotel A that has a lower review variation is likely to remain psychologically equal to 3 stars. As we have discussed in Hypothesis 1, review valence is likely to associate with future hotel performance. Thus, we conjecture that review valence together with low variation would result in higher future hotel performance than that with high review variation. We then hypothesize,

H4. Review variation negatively moderates the influence of review valence on future hotel performance.

The interaction between review valence and review volume can be important in quantifying the eWOM effect (Chintagunta et al., 2010). Zhu and Zhang (2010) examine how product popularity moderates the influence of review valence on product sales using data from the video game industry. They find that review valence is more influential for sales of less popular games that receive fewer consumer reviews. Because consumer reviews often convey a huge amount of product information, Zhu and Zhang (2010) explain that the persuading role of review valence becomes more salient in an environment in which alternative means of information acquisition are relatively scarce. In other words, the products which receive fewer online consumer reviews are likely to be less known to consumers than those products which receive more reviews, and that the influence of review valence may be greater for the former than for the latter. Therefore, we hypothesize a greater effect of review valence on hotel performance when review volume is lower.

H5. Review volume negatively moderates the influence of review valence on future hotel performance.

2.3. Management responses to consumer reviews

Customer relationship management is a strategic approach to create relationships with key customers and segments (Payne and Frow, 2005). It refers to a marketing process with the aim of maintaining a positive relationship with customers in order to increase customer satisfaction, incubate customer loyalty, and improve customer retention (Lo et al., 2010). Studies often report that, on

average, retaining current customers is more viable and profitable than attracting new customers (Petrick, 2004). In fact, an increase of 5% in the customer retention rate could result in a rise of long-run profit by 25–95% (Reichheld et al., 2000).

In the hotel industry, online management responses are a new form of customer relationship management (Gu and Ye, 2014). Management responses to a specific praise in a positive consumer review show that hotel managers are listening, expressing appreciation, and reinforcing positive reviews from customers. Most often, management responses are used to address customer complaints in negative reviews. The management response with an action plan of service failure recovery can increase customer satisfaction by influencing customers' perceptions of justice and fairness (Mccoll-Kennedy and Sparks, 2003). For example, Gu and Ye (2014) examine the impact of management responses on customer satisfaction using online review data of 5831 hotels across 48 cities in China on the travel guide website Ctrip.com. Their results show that the satisfaction level of consumers who made the complaints in their reviews increases after they received management responses. Guest satisfaction is usually positively associated with a hotel's profitability (Sun and Kim, 2013), financial performance (Chi and Gursoy, 2009), and revenues per guest room and growth rates in room revenues (O'Neill and Mattila, 2004). Making an immediate response to reviews indicates that hotel managers monitor guests' perceptions and hold with a pro-active management style to ensure that hotel staff is prepared to provide efficient service. Responding to reviews is becoming popular as the market, now saturated with hotels relying more and more on Internet booking, continues to reach customers seeking the most satisfying hotel experience. It is therefore reasonable to assume,

H6. Management responses have a positive impact on future hotel performance.

Management responses to a customer's review can be publicly seen by other customers because of the transparency on the Internet. The reaction to customer reviews can be more telling than the review itself (Rancourt, 2013). It can effectively show both writers and readers of online reviews how much the hotel manager cares. On one hand, customer complaints of service failure are traditionally addressed in private between complaining customers and hotel managers. When complaints come to the Internet, consumers tend to post negative reviews for the hotels. Management responses to negative reviews from unsatisfied customers who give low ratings to the hotel can improve the satisfaction level of these consumers and consequently increase return purchase. Specifically, effective communication between customers and managers can reveal the source of complaints, restore customer satisfaction, and prevent customers from switching to alternatives (Maxham, 2001). For example, Gu and Ye (2014) find that online management responses can change the mindset of customers who give hotels low ratings of 1 and 2 (on a 5-point scale). On the other, although hotels tend to respond more frequently to negative than positive reviews (Park and Allen, 2013), responding to the latter is also something worthy of consideration. It will establish a warm human connection with reviewers, which allows hoteliers to learn from, and build goodwill with, most vocal customers. Consumers will thus interpret hotels' management responses to both negative and positive reviews as an appreciation for their customers or part of hotels' customer relationship management strategies (Wei et al., 2013). Hence, management response could reduce the effect of unfavorable reviews and enhance the effect of favorable ones on hotel performance.Therefore, we hypothesize,

Table 1
Variable definitions.

Variable	Definition
REVPAR	The average revenue per available room per hotel
RATEOVERA	The average of overall ratings for a hotel, i.e., 1 "terrible", 2 "poor", 3 "average", 4 "very good", and 5 "excellent"
VARIATION	The standard deviation of review ratings for a hotel
VOLUME	The number of reviews for a hotel
RESPONSE	The number of management responses posted by managers for a hotel
RATEVALUE	The average rating of value for money for a hotel, i.e., 1 "terrible", 2 "poor", 3 "average", 4 "very good", and 5 "excellent"
RATELOCA	The average rating of hotel location for a hotel, i.e., 1 "terrible", 2 "poor", 3 "average", 4 "very good", and 5 "excellent"
RATEROOM	The average rating of hotel rooms for a hotel, i.e., 1 "terrible", 2 "poor", 3 "average", 4 "very good", and 5 "excellent"
RATECLEAN	The average rating of cleanliness for a hotel, i.e., 1 "terrible", 2 "poor", 3 "average", 4 "very good", and 5 "excellent"
RATESERVI	The average rating of employee service quality for a hotel, i.e., 1 "terrible", 2 "poor", 3 "average", 4 "very good", and 5 "excellent"
AGE	The number of years since a hotel first appears in the Texas Comptroller's Office database
SIZE	Logarithm of the number of guest rooms
SEGMENT	An indicator variable that equals 3 for luxury and above average hotels, 2 for full service and mid-market economy hotels, and 1 for budget traveler hotels[a]

[a] Please refer to HospitalityEducatores.com for a more detailed description of what the crown ratings are (http://www.hospitalityeducators.com/articles/20110215_4#.UcUsPJwyj64).

H7. Management responses moderate the influence of review valence on future hotel performance.

3. Methodology

3.1. Data and sample

We collect review data from TripAdvisor.com, a major hotel review website which offers access to more than 150 million reviews and opinions covering more than 3.7 million accommodations and related products (TripAdvisor, 2014). Consumer reviews, management responses and hotel information are auto-parsed from TripAdvisor.com using two crawlers that are developed by Ruby.[3] Specifically, for each hotel in our sample, we extract every single consumer review, which includes the overall rating and hotel attribute ratings (i.e., ratings of value for money, location, rooms, cleanliness, and employee services) on a scale of 1–5 (1 = terrible to 5 = excellent). We also gather the number of management responses to consumer reviews as well as hotel characteristics such as the number of guest rooms, hotel age, address, and service segmentation.[4] In addition, we obtain multi-quarter, archival data of hotel revenue per available room (RevPAR) matched to the Texas Comptroller's Office database.

The above datasets are then merged to create one dataset at the "Hotel × Quarter" level. By doing this, we safeguard against the common method bias (Podsakoff et al., 2003). The sample consists of 4994 observations of 843 individual hotels in five major hotel markets (San Antonio, Houston, Austin, Dallas, and Fort Worth) of the Texas State in US over ten quarters (2009Q1–2011Q2).

[3] We develop two crawlers using Ruby (1) to download automatically the webpages of hotel reviews and other hotel information from TripAdvisor.com and (2) to remove the HTML formatting from the text and then transform text into XML files that separate the data into records (the review) and fields (the data in each review).

[4] TripAdvisor.com provides service segmentation information about each hotel being reviewed. It uses service segmentation schemes generated by Northstar Travel Media (company website: http://www.northstartravelmedia.com/) which classifies hotels using "Crowns".

Table 2
Sample distribution by city.

City	Observations	Hotels
San Antonio	1459 (29.22%)	241 (28.59%)
Houston	1447 (28.97%)	272 (32.27%)
Austin	928 (18.58%)	135 (16.01%)
Dallas	777 (15.56%)	123 (14.59%)
Fort Worth	383 (7.67%)	72 (8.54%)
Total	4994 (100%)	843 (100%)

Note. Mean values are shown in the table; percentages of the sample are shown in parenthesis.

Unlike most previous studies that tend to focus on either large or chain hotels, our sample includes both large and small, independent and chain hotels. To the best of our knowledge, this is the largest and most comprehensive panel data that has been used to study the consumer reviews/hotel performance relationship. Table 1 presents the definitions of the variables in this study.

3.2. Summary statistics

We present the sample distribution by city in Table 2. San Antonio is the largest hotel market, in which 1459 observations have been included in our sample, followed by Houston ($N = 1447$), Austin ($N = 928$), Dallas ($N = 777$), and Fort Worth ($N = 383$). We also present changes in variables by quarter and summarize descriptive statistics of variables in Table 3. The time-series variability in our variables enables us to apply panel data estimation techniques to data analysis effectively.

As shown in Table 4, the RevPAR of the higher-tiered hotels is higher than that of the lower-tiered hotels. The overall ratings decrease as the service segmentation moves down, indicating that consumer ratings in general are reliable reflection of the hotel service quality (Riegner, 2007). The overall ratings are most dispersive for mid-market economy hotels (SD = 1.27) but more consistent for luxury hotels (SD = 0.58). Attribute ratings follow a pattern similar to that of the overall ratings. Higher-tiered hotels seem more popular with a larger volume of consumer reviews. For example, there are 6.57 reviews for luxury hotels and 12.37 reviews for above average hotels. The average age of our hotel sample exceeds 15 years.

4. Model estimation

We use a linear regression model to examine the relationships among consumer reviews, management responses, and hotel performance. The dependent variable is RevPAR, which has been used in the hospitality industry as a measure of hotel performance because it captures the supply-and-demand dynamics in one index (Ismail et al., 2002). The independent variables include consumer review factors, namely, overall rating, attribute ratings, review variation, review volume as well as the number of management responses. Following the approach in earlier research (e.g., Duan et al., 2008; Godes and Mayzlin, 2009; Trusov et al., 2009), we use earlier consumer reviews and management responses in the regression model because consumers often refer to peer reviews and management responses published in past periods to make purchase decisions. As a result, WOM effects often carry over for several weeks (Trusov et al., 2009). The resulting equation capturing the effect of consumer reviews and management responses on the performance of hotel i is developed:

$$\mathrm{REVPAR}_{it} = \beta_0 + \beta_1 \mathrm{RATEOVER}A_{it-1} + \beta_2 \mathrm{VARIATION}_{it-1} + \beta_3 \mathrm{VOLUME}_{it-1} + \beta_4 \mathrm{RESPONSE}_{it-1} + \Gamma X_i + \varepsilon_{it} \quad (1)$$

where X_i comprises of the hotel-specific control variables that might influence hotel performance such as AGE, SIZE and SEGMENT. ε is a random error term.

To further examine how ratings of attributes affect hotel performance, we include review ratings of value, location, rooms, cleanliness and services in Eq. (2). As we are also interested in the moderation effects of review variation, review volume, or management responses on the relationship between review ratings and hotel performance, the resulting equation is:

$$\begin{aligned}\mathrm{REVPAR}_{it} = {} & \beta_0 + \beta_1 \mathrm{RATEOVERA}_{it-1} + \beta_2 \mathrm{RATEVALUE}_{it-1} \\ & + \beta_3 \mathrm{RATELOCA}_{it-1} + \beta_4 \mathrm{RATEROOM}_{it-1} + \beta_5 \mathrm{RATECLEAN}_{it-1} \\ & + \beta_6 \mathrm{RATESERVI}_{it-1} + \beta_7 \mathrm{MODERATOR}_{it-1} + \beta_8 \mathrm{RATEOVERA}_{it-1} \\ & * \mathrm{MODERATOR}_{it-1} + \beta_9 \mathrm{RATEVALUE}_{it-1} * \mathrm{MODERATOR}_{it-1} \\ & + \beta_{10} \mathrm{RATELOCA}_{it-1} * \mathrm{MODERATOR}_{it-1} + \beta_{11} \mathrm{RATEROOM}_{it-1} \\ & * \mathrm{MODERATOR}_{it-1} + \beta_{12} \mathrm{RATECLEAN}_{it-1} * \mathrm{MODERATOR}_{it-1} \\ & + \beta_{13} \mathrm{RATESERVI}_{it-1} * \mathrm{MODERATOR}_{it-1} + \Gamma X_i + \varepsilon_{it} \end{aligned} \quad (2)$$

where MODERATOR denotes the moderating variables (i.e., VARIATION, VOLUME, and RESPONSE), which take dummy values of 0 (low level) and 1 (high level) in the interaction terms to indicate the level effect.

5. Results and findings

As shown in Table 5, we first estimate Eq. (1) and present the results of the effect of consumer review factors and management responses on hotel performance in Model 1. Next, we report the estimation results for Eq. (2) where we include the overall rating and attribute ratings, and their interaction terms with review variation, review volume and management responses in Models 2–4. Hotel characteristics including AGE, SIZE and SEGMENT are control variables in the models.

5.1. Effect of overall rating, variation, volume and management responses on hotel performance

As Model 1 presents, overall rating (4.033, $p = 0.000$), review variation (3.507, $p = 0.000$), and review volume (0.142, $p = 0.017$) are positively associated with hotel performance. In terms of the coefficient magnitude, overall ratings are perceived as the most important factor that influences the hotel performance, followed by review variation and the amount of reviews posted. However, management responses are negatively related to hotel performance (-0.410, $p = 0.030$). This finding implies that the number of management responses of the sampled hotels is not effective in improving hotel performance. Overall, the model fits the data well with an adjusted R^2 of 0.427, indicating that 42.7% of the variation in the hotel performance is explained by the variables.

5.2. Moderating effect of variation, volume and management responses on hotel performance

Models 2–4 present the estimation results for Eq. (2) which examines the moderation effects of review variation, review volume, and management responses, respectively, on the relationships between review ratings and hotel performance.

Model 2 estimates the moderation effect of review variation. The coefficients of the interaction terms, review variation and the overall rating (6.151, $p = 0.002$), review variation and attribute ratings of location (5.416, $p = 0.000$) and cleanliness (4.261, $p = 0.058$), are significantly positive. The findings indicate that, the impact of overall ratings, ratings of location, and ratings of cleanliness on

Table 3
Summary statistics by year-quarter.

Summary statistics of variables by quarter ($N = 4994$)

	2009Q1	2009Q2	2009Q3	2009Q4	2010Q1	2010Q2	2010Q3	2010Q4	2011Q1	2011Q2
	66.70	61.83	56.66	53.84	59.69	61.66	55.72	55.05	65.91	65.64
REVPAR	(63.73)	(57.61)	(52.73)	(48.85)	(54.31)	(58.53)	(50.84)	(49.32)	(61.22)	(61.17)
	[35.69]	[31.98]	[29.62]	[31.02]	[35.31]	[34.39]	[32.13]	[35.63]	[40.19]	[37.35]
Review variables										
	3.53	3.70	3.61	3.72	3.58	3.64	3.45	3.64	3.52	3.59
RATEOVERA	(4.00)	(4.00)	(3.90)	(4.00)	(3.92)	(4.00)	(3.79)	(4.00)	(3.78)	(4.00)
	[1.21]	[1.14]	[1.15]	[1.21]	[1.14]	[1.05]	[1.16]	[1.05]	[1.13]	[1.12]
	0.56	0.56	0.63	0.52	0.60	0.63	0.70	0.68	0.71	0.72
VARIATION	(0.45)	(0.50)	(0.53)	(0.00)	(0.50)	(0.58)	(0.66)	(0.59)	(0.71)	(0.71)
	[0.66]	[0.65]	[0.72]	[0.65]	[0.68]	[0.66]	[0.68]	[0.69]	[0.68]	[0.65]
	2.92	3.45	3.57	3.74	4.35	4.57	5.21	4.90	5.11	6.46
VOLUME	(2.00)	(2.00)	(2.00)	(2.00)	(2.00)	(2.00)	(3.00)	(3.00)	(3.00)	(3.00)
	[3.02]	[4.15]	[4.11]	[4.33]	[10.86]	[8.86]	[9.68]	[8.16]	[8.67]	[10.89]
	0.19	0.29	0.38	0.47	0.59	0.78	0.93	0.99	1.25	2.00
RESPONSE	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	[0.77]	[1.05]	[1.27]	[1.56]	[1.81]	[2.84]	[3.26]	[2.63]	[3.08]	[5.28]
	3.38	3.56	3.47	3.43	3.41	3.56	3.40	3.57	3.52	3.50
RATEVALUE	(0.36)	(4.00)	(3.73)	(3.71)	(3.67)	(3.75)	(3.60)	(3.83)	(3.75)	(3.74)
	[1.31]	[1.29]	[1.34]	[1.38]	[1.34]	[1.15]	[1.24]	[1.17]	[1.12]	[1.20]
	3.58	3.78	3.66	3.63	3.56	3.77	3.64	3.74	3.74	2.37
RATELOCA	(4.00)	(4.00)	(4.00)	(4.00)	(4.00)	(4.00)	(4.00)	(4.00)	(4.00)	(2.50)
	[1.15]	[1.16]	[1.26]	[1.32]	[1.22]	[1.06]	[1.11]	[1.12]	[1.06]	[1.46]
	3.42	3.56	3.39	3.37	3.33	3.56	3.38	3.50	3.48	2.21
RATEROOM	(3.85)	(4.00)	(3.67)	(3.75)	(3.50)	(3.91)	(3.60)	(3.86)	(3.67)	(2.11)
	[1.28]	[1.32]	[1.33]	[1.42]	[1.30]	[1.17]	[1.25]	[1.21]	[1.19]	[1.41]
	3.69	3.85	3.61	3.63	3.60	3.81	3.60	3.71	3.72	3.71
RATECLEAN	(4.00)	(4.20)	(4.00)	(4.00)	(4.00)	(4.00)	(4.00)	(4.00)	(4.00)	(4.00)
	[1.28]	[1.28]	[1.39]	[1.42]	[1.28]	[1.15]	[1.25]	[1.22]	[1.19]	[1.23]
	3.45	3.67	3.55	3.50	3.46	3.67	3.49	3.64	3.59	3.59
RATESERVI	(3.75)	(4.00)	(4.00)	(4.00)	(3.80)	(4.00)	(3.80)	(4.00)	(3.90)	(3.89)
	[1.35]	[1.33]	[1.35]	[1.47]	[1.37]	[1.19]	[1.25]	[1.22]	[1.19]	[1.21]
Hotel characteristics										
	19.26	17.66	17.36	17.46	18.42	18.06	18.42	18.13	18.18	18.13
AGE	(14.00)	(13.00)	(13.00)	(13.00)	(14.00)	(14.00)	(14.00)	(14.00)	(14.00)	(14.00)
	[13.05]	[12.75]	[12.72]	[13.17]	[13.01]	[12.78]	[13.28]	[13.35]	[12.95]	[13.15]
	4.94	4.93	4.93	4.96	4.91	4.92	4.90	4.92	4.89	4.88
SIZE	(4.87)	(4.87)	(4.87)	(4.89)	(4.86)	(4.87)	(4.82)	(4.86)	(4.83)	(4.83)
	[0.77]	[0.74]	[0.72]	[0.73]	[0.72]	[0.71]	[0.69]	[0.71]	[0.71]	[0.70]
	2.72	2.70	2.68	2.74	2.69	2.69	2.61	2.69	2.68	2.69
SEGMENT	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)	(3.00)	(2.50)	(3.00)	(3.00)	(3.00)
	[1.11]	[1.06]	[1.08]	[1.04]	[1.04]	[1.05]	[1.07]	[1.05]	[1.02]	[0.98]
Observations	390	434	447	450	503	523	556	533	558	600

Summary statistics of variables

	Mean	Median	Std. Dev.	Min	Max
REVPAR	60.30	55.45	34.93	0.00	323.45
RATEOVERA	3.59	4.00	1.14	1.00	5.00
VARIATION	0.64	0.58	0.68	0.00	2.83
VOLUME	4.55	2.00	8.16	1.00	189.00
RESPONSE	0.85	0.00	2.88	0.00	61.00
RATEVALUE	3.48	3.73	1.25	0.00	5.00
RATELOCA	3.52	4.00	1.27	0.00	5.00
RATEROOM	3.30	3.53	1.35	0.00	5.00
RATECLEAN	3.69	4.00	1.27	0.00	5.00
RATESERVI	3.56	4.00	1.29	0.00	5.00
AGE	18.11	14.00	13.03	0.00	63.00
SIZE	179.60	129.00	172.46	8.00	1840.00
SEGMENT	2.50	3.00	1.03	0.00	5.00

Note. Mean values are shown in the table; median values and standard deviations are shown in parentheses and brackets, respectively.

hotel performance at a higher level of review variation is larger than at a lower level of review variation. In contrast, the coefficient of the interaction term, review variation and ratings of purchase value (-6.986, $p = 0.001$), is negative, suggesting that review variation has a negative moderating effect on the relationship between ratings of purchase value and hotel performance. Overall, the results indicate the complementarities between certain attribute ratings (i.e., location and cleanliness) and review variation, as manifested in their interaction effect, in driving hotel performance.

In Model 3, we find that the interaction terms of review volume and the overall rating (7.642, $p = 0.006$), review volume and location rating (10.343, $p = 0.000$), and review volume and cleanliness rating (9.210, $p = 0.009$) are positively associated with hotel performance. The findings indicate that review volume complements the overall rating, ratings of location and cleanliness in driving hotel performance. In contrast, the interaction term of review volume and value rating (-19.204, $p = 0.000$) is negatively associated with hotel performance. The result indicates that the impact of ratings

Table 4
Summary statistics by service segmentation.

CROWN	SEGMENT	REVPAR	RATEOVERA	VARIATION	VOLUME	RESPONSE	RATEVALUE	RATELOCA	RATEROOM	RATECLEAN	RATESERVI	AGE	SIZE
5	Luxury	150.33	4.34	0.80	6.57	0.53	3.65	4.05	4.04	4.45	4.30	18.49	5.34
		(28.89)	(0.58)	(0.57)	(3.55)	(1.63)	(0.61)	(0.78)	(0.83)	(0.59)	(0.62)	(12.28)	(0.41)
4	Above average	104.09	3.93	1.04	12.37	2.90	3.45	3.89	3.58	4.07	3.80	23.85	5.79
		(34.03)	(0.62)	(0.46)	(15.58)	(6.26)	(0.74)	(0.82)	(0.84)	(0.65)	(0.72)	(14.89)	(0.74)
3	Full service	67.79	3.79	0.73	4.82	0.91	3.60	3.61	3.47	3.88	3.75	18.22	5.15
		(23.15)	(0.92)	(0.64)	(7.61)	(2.22)	(1.12)	(1.16)	(1.21)	(1.07)	(1.11)	(13.16)	(0.56)
2	Mid-market economy	40.19	3.46	0.46	2.23	0.28	3.52	3.39	3.15	3.53	3.46	15.26	4.49
		(18.73)	(1.27)	(0.69)	(2.57)	(1.27)	(1.38)	(1.40)	(1.50)	(1.42)	(1.44)	(11.23)	(0.46)
1	Budget traveler	23.69	2.14	0.62	2.00	0.06	2.41	3.01	1.93	2.33	2.22	29.82	4.26
		(12.51)	(1.12)	(0.84)	(1.59)	(0.31)	(1.37)	(1.47)	(1.27)	(1.35)	(1.35)	(9.69)	(0.37)

Note. Mean values are shown in the table; standard deviations are shown in parentheses.

of purchase value on hotel performance decreases when review volume increases.

The interaction effect of management responses and review ratings is estimated in Model 4. Management responses moderate the relationship between hotel performance and ratings of hotel location and cleanliness. Specifically, the interaction effect of management responses and rating of location is positively associated with hotel performance (3.172, $p = 0.056$). This finding shows that management responses to reviews on location play a positive role in driving hotel performance. In contrast, response from hotel managers to reviews on cleanliness has a negative effect on hotel performance (−3.837, $p = 0.092$), suggesting that hotel managers should be selective when addressing specific consumer reviews.

Comparing across Models 2–4, we observe that ratings of location and cleanliness positively influence hotel performance, and ratings of purchase value are negatively associated with the performance. The findings indicate that hotel location, cleanliness and value are three important attributes for hotel performance. Meanwhile, incorporating the interaction term does not have a big impact on the estimated effect of non-review variables such as AGE, SIZE and SEGMENT.

6. Discussion and implications

As a result of the increasing popularity of the Internet, online reviews have become a major source of information affecting travelers' decision-making of hotel bookings (Cheng and Loi, 2014; Sparks et al., 2013). Previous research has examined the effect of online reviews on behavior outcomes such as hotel trust and booking intentions (Sparks and Browning, 2011; Verma et al., 2012; Ye et al., 2011). However, there is limited research that investigates the effect of online reviews from a hotel performance perspective. Our study extends previous research by testing the combined effects of online review factors and management responses on hotel RevPAR, which is one of the most recognized and used performance measures in the hospitality industry.

In terms of direct effect of consumer eWOM on hotel performance, our findings are generally consistent with those in previous research which state that the review valance, variation and volume positively predict product performance (Dellarocas et al., 2007; Duan et al., 2008; Liu, 2006; Martin et al., 2007; Öğut and Taş, 2012; Zhang et al., 2013). In a hotel context, ratings of purchase value, location and cleanliness are three important attribute ratings that can influence hotel performance. Specifically, the negative impact of ratings of purchase value on hotel performance suggests that low price may make good purchase value for money, while it may also reduce sales revenue. Furthermore, management responses have a negative impact on hotel performance, which is in line with the study of Mauri and Minazzi (2013) which reports that the presence of hotel managers' responses to consumer reviews has a negative impact on purchasing intentions. A possible explanation is that most management responses tend to immediately follow negative consumer reviews about service complaints, which may lead consumers to have management responses associated with negative reviews. Another reason might be that if management responses could not effectively address consumer concerns, it is likely to be perceived negative and thus hampers consumer purchase intention.

In addition to explaining direct effects of consumer reviews and management responses, we also show the moderating effects of variation, volume, and management responses on hotel overall rating and attribute ratings. Unexpectedly, it is discovered that, for hotels with high rating variation, the positive influence of overall rating, location rating and cleanliness rating on hotel performance is larger than for hotels with low rating variation. Research

Table 5
Effects of consumer reviews and management responses on hotel performance.

Variable	Model 1	Model 2	Model 3	Model 4
RATEOVERA	4.033***	5.820***	6.092***	6.984***
	(0.000)	(0.000)	(0.000)	(0.000)
VARIATION	3.507***	−15.605***		
	(0.000)	(0.001)		
VOLUME	0.142**		−20.537***	
	(0.017)		(0.003)	
RESPONSE	−0.410**			0.180
	(0.030)			(0.971)
RATEVALUE		−10.377***	−10.437***	−12.478***
		(0.000)	(0.000)	(0.000)
RATELOCA		3.375***	3.556***	4.718***
		(0.000)	(0.000)	(0.000)
RATEROOM		2.400	1.644	1.159
		(0.136)	(0.224)	(0.431)
RATECLEAN		4.060***	4.522***	5.982***
		(0.000)	(0.000)	(0.000)
RATESERVI		−0.770	−0.968	−1.275
		(0.517)	(0.337)	(0.249)
RATEOVERA*VARIATION		6.151***		
		(0.002)		
RATEVALUE*VARIATION		−6.986***		
		(0.001)		
RATELOCA*VARIATION		5.416***		
		(0.000)		
RATEROOM*VARIATION		−3.148		
		(0.220)		
RATECLEAN*VARIATION		4.261*		
		(0.058)		
RATESERVI*VARIATION		−0.570		
		(0.776)		
RATEOVERA*VOLUME			7.642***	
			(0.006)	
RATEVALUE*VOLUME			−19.204***	
			(0.000)	
RATELOCA*VOLUME			10.343***	
			(0.000)	
RATEROOM*VOLUME			−1.542	
			(0.706)	
RATECLEAN*VOLUME			9.210***	
			(0.009)	
RATESERVI*VOLUME			−0.953	
			(0.749)	
RATEOVERA*RESPONSE				−0.498
				(0.805)
RATEVALUE*RESPONSE				−0.047
				(0.984)
RATELOCA*RESPONSE				3.172*
				(0.056)
RATEROOM*RESPONSE				1.576
				(0.563)
RATECLEAN*RESPONSE				−3.837*
				(0.092)
RATESERVI*RESPONSE				0.118
				(0.956)
AGE	−0.232***	−0.220***	−0.213***	−0.212***
	(0.000)	(0.000)	(0.000)	(0.000)
SIZE	−7.272***	−7.987***	−8.149***	−7.185***
	(0.000)	(0.000)	(0.000)	(0.000)
SEGMENT (Class 2)	27.767***	25.275***	25.602***	25.692***
	(0.000)	(0.000)	(0.000)	(0.000)
SEGMENT (Class 3)	70.241***	60.824***	57.644***	63.918***
	(0.000)	(0.000)	(0.000)	(0.000)
Constant	64.870***	67.612***	69.150***	62.114***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	3363	3288	3288	3288
R^2	0.427	0.474	0.482	0.464

Note. Coefficients are shown in the table; *p*-values are shown in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.
Segmentation Class 3 for luxury and above average hotels and Class 2 for full service and mid-market economy hotels, respectively.

has suggested that effects of positive message and negative message on persuasion and product evaluation are complicated. For example, Maheswaran and Meyers-Levy (1990) reveal that positive messages are more persuasive when there is little emphasis on detailed processing, but negative messages are more persuasive when detailed processing is emphasized. Zhang et al. (2010a) find that consumers who evaluate products associated with promotion consumption goals perceive positive online reviews to be more persuasive than negative ones (i.e., a positivity bias). Conversely, consumers who evaluate products associated with prevention consumption goals perceive negative online reviews to be more persuasive than positive ones (i.e., a negativity bias). Hotel review information generally does not need detailed processing (Sparks and Browning, 2011), and hotel purchase is a desirable outcome or promotion consumption. Thus, consumers may weigh positive reviews more than negative reviews in hotel judgment. All things being equal, for hotels with higher review variation, there are more positive and negative reviews. As positive reviews are more weighted, the perceived rating may be increased compared to the real one, and this relationship leads to an enhanced impact of the review valance on hotel performance. Along this line, ratings of purchase value originally have a negative impact on hotel performance, and our findings suggest that higher review variation enhances the negative impact of ratings of purchase value on hotel performance.

Online consumer reviews could be more influential for hotels with a larger volume of reviews. That is, a large volume of reviews will enhance the positive influence of quality ratings (i.e., overall rating, location rating and cleanliness rating) and the negative influence of value rating on hotel performance. There are several possible reasons for this phenomenon. Firstly, a large number of online reviews make such reviews seem more trustworthy (Zhu and Zhang, 2010). As Kirby (2000) explains, a consumer may not trust just one nonexpert, but if 9 out of 10 nonexperts agree, it's probably worth buying. Therefore, consumers may perceive that plentiful reviews of popular hotels could more accurately reflect hotel quality and thus could be more influential. Secondly, a large amount of reviews can lead consumers to reinforce the idea that they should book the hotel which has been booked by many other travelers. Thirdly, a large volume of reviews could have a stronger impact on consumers' decisions because they are exposed to such reviews more frequently. Existing studies show that mere exposure is sufficient to produce a favorable feeling for an object (Zajonc, 1968) and can lead a preference for this object when subsequently encountered (Baker, 1999). As a result, consumers may be more likely to approach and finally book a hotel that has an exposure advantage.

It is interesting to note that management responses have a positive impact on the relationship between location rating and hotel sales, while management responses have a negative impact on the relationship between cleanliness rating and hotel sales. The geographic location of a hotel is the most unchangeable attribute that cannot be changed or improved by the staff once the property has been built. In contrast, hotel cleanliness most lies in employee initiatives and hotel management. Our findings suggest that if a hotel provides reasonable explanations about its location, it will positively influence the relationship between location rating and future hotel performance. Nevertheless, if a hotel makes too many explanations about its hygiene condition, it will decrease consumers' perceptions of cleanliness ratings. Overall, how to make online consumer reviews a viable marketing channel remains a challenge. We argue that hotel managers should "listen-in" on the online conversation in an attempt to preserve their market share (Yu, 2010). Meanwhile, managers should identify important review components that should be deliberately manipulated. For example, response to review ratings on certain quality aspects such as location is highly encouraged because management responses can complement such consumer reviews. At the same time, management responses to ratings on certain quality aspects (e.g., cleanliness) may not help build online success of a hotel. While most social media platforms have allowed service providers to directly address consumer reviews, our findings show that management responses should be used strategically in order to complement review ratings and ultimately drive hotel performance.

7. Conclusion and limitations

The social media frenzy has taken the world by storm in the last few years, and the trends will shape the hotel industry in the future (Deloitte, 2010). The business case for investing in social media has received increasing scrutiny in recent years. Websites such as TripAdvisor.com are often the hotel managers' first point of call. Understanding whether and how online reviews affect hotel performance is vitally important for hotels that rely on eWOM to disseminate information about their experienced products and services. This study drills deeper into hospitality analytics data to quantify the effect of consumer reviews and management responses on hotel performance. The findings provide implications for researchers and the industry in light of the increased interest in social media marketing.

Our research has established a relationship between eWOM information and offline hotel performance. However, we did not directly observe how eWOM affects consumers' choices and purchasing decisions. One important and interesting extension of our research will be to investigate the consumer's decision under the influence of WOM information, especially in the digital environment. In addition, not all WOM is equal. Consumers need to distinguish the "true" and "honest" opinions from all kinds of feedback and recommendations on the web. Under such circumstances, how consumers choose their information source and the mechanisms that help them to find trusted information sources will be of particular interest for future research. Moreover, further study to characterize and identify the impact of eWOM information from different resources and formats as well as the recency effect of consumer reviews would also be beneficial to the understanding and design of online feedback and information systems.

With respect to management responses, this study examines how management responses can be used to synergize consumer reviews toward an increase in hotel performance. However, we only focus on the effect of quantity of management responses without looking into the effect of response quality. Future research can utilize computer-enabled sentimental analysis or content analysis approaches to investigate how hotel managers handle online reviews. For example, how do managers respond to consumer reviews? Do hotel managers have any policies or processes in place? How are hotel brands different or similar in their approaches to managing online reviews? By answering these questions, we are able to identify effective strategies that hotel managers can utilize to co-create value with consumers in online review platforms.

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