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The influence of internet customer reviews on the online sales and prices in hotel industry

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The influence of internet customer reviews on the online sales and prices in hotel industry

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In this paper, the impact of two service quality metrics (star rating and customer rating) on hotel room sales and prices is investigated. Two of the most popular tourist destinations in the world, Paris and London, are chosen. **It is found that a higher customer rating significantly increases the online sales of hotels. The study results show that a 1% increase in online customer rating increases Sales per Room up to 2.68% in Paris and up to 2.62% in London.** Contrary to expectations, higher stars do not increase the sales. It is also shown that higher customer ratings result in higher prices of the hotel and the prices of high star hotels are more sensitive to online customer ratings.

Keywords: internet customer reviews and ratings; online hotel booking; online hotel price; service quality metrics

Introduction

With the rapid increase of the internet usage in the world, consumers increasingly use e-commerce sites for purchasing products and services. Following this trend, many industries choose the internet as their preferred sales channel. Among these industries, the travel industry is one of the first and successful industries to use the internet for this purpose and studies show that online travel sales keep growing (Grau, 2006). With a 16% share, hotel accommodation is the second largest sales item after air travel among online travel sales, and revenue generated through online hotel booking keeps growing (Marcussen, 2008).

Most customers choose hotels based on recommendations of a friend, and industrial reports show that word of mouth (WoM) is one of the important factors in the hotel selection decision (Barsky & Nash, 2008). Online reviews are considered as the counterpart of the WoM in the cyber world as they share many similarities. However, there are also significant differences between online review and WoM. For instance, while WoM is only effective within people's social network through verbal communication, online reviews can reach all the people having access to the internet. Furthermore, the effect of online reviews does not fade away with time and distance, and it can be more detailed and durable as it reflects the opinions of more than one person in written form (Bhatnagar & Ghose, 2004; Duan, Gu, & Whinston, 2008). Thus, the impact of online reviews can be more powerful than WoM. Milan (2007) indicates that 84% of people reported that

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what they see at the online travel websites affects their hotel choice and travelers find reviews and pictorial cues much more convincing than other features of hotels.

Many studies investigate the effect of online reviews in different e-commerce applications. For example, Liu (2006) and Duan et al. (2008) examine the effect of online reviews in the movie industry. Forman, Ghose, and Wiesenfeld (2008) and Chevalier and Mayzlin (2006) analyze the effect of customer review and rating on the book sales. However, there are significant differences between hotel industry and other industries. For example, there are two quality measures (star and customer rating) used in hotel websites, whereas there is only customer rating as quality measure in movie and book websites. Besides, the determinant of hotel price is important in addition to hotel selection decision of customers as hotels have fixed capacity. However, the research in movie and book industry focusses only on product sales.

The research on online reviews in hotel booking setting is also limited as previous researches in the hotel industry mainly investigate the behavior of customer using the traditional channels for hotel booking. Furthermore, some of the attributes such as online customer ratings are specific to internet, and it is not possible to consider such attributes in researches that focussed on traditional channels for hotel booking. However, online sales of hotel rooms keep growing and the online channel represents a major proportion of hotel sales. In addition to the online sales channel, the internet also provides a platform for a prospective customer to learn of the experience of past customers with the specific hotel. Thus, it becomes more crucial for hotel guests and managers to understand the relationship among online hotel reservation, hotel reviews and pricing of the hotels in the internet. For these reasons, we investigate how customer ratings influence the hotel's online sales and prices in this paper. For these purposes, the only attribute typically available through the internet that we consider as our focus is online booking platforms.

Our analysis starts with the investigation of the importance of the relationship between online customer ratings and sales. By controlling the location, size and price of the hotels and using log linear models, we show that the sales of the rooms are significantly higher for the hotels with higher customer ratings. Contrary to our expectations, the star rating of the hotel does not increase the sales of the hotel rooms. We also analyze the relationship between online customer ratings and prices of hotel rooms, and our empirical results indicate that hotels set higher (less) prices if they have higher (lower) customer ratings and prices of the hotels with higher stars are more sensitive to online customer ratings. Apart from previous studies in the online review literature, this paper presents the significant impact of online hotel reviews on the prices of hotel rooms.

The empirical model presented in this study has practical implications for hotel management. By using the model, a hotel manager can compute the estimated price as the average price of the hotels using online customer ratings and hotel-specific features. They can determine whether the price of hotel room is overpriced or underpriced compared with the competitor hotels using the model. Moreover, hotel managers will be better equipped for the pricing of hotel rooms as it is possible to calculate the impact of the price change on the sale figures. This study also guides customers to evaluate hotels by comparing the average price of the hotel with the actual price charged to the customer.

The remainder of the paper is organized as following. In the next section, relevant studies in the online review literature are summarized. Then, the background of our hypothesis is explained. We describe our data and present the empirical model and estimation results in the following section. Our paper is concluded with the discussion of managerial implications, limitations and extensions.

Literature review

Many recent studies analyze the impact of online reviews on product sales by considering the review volume and review valence measured as customer rating or positive/negative user ratings. (Chen & Jinhong, 2004; Senecal & Nantel, 2004; Zufryden, 2000). These studies in the movie and online book industry show mixed results. Some of the studies show that both the volume and review valence affect future sales. Among the earlier studies, Chevalier and Mayzlin (2006) examine the effect of consumer reviews on relative sales of books at Amazon.com and BarnesandNoble.com, and they find that an improvement in a book's customer rating in the website causes an increase in sales at that site. However, Chen, Shin-yi, and Jungsun (2004) find that the review valence does not affect future sales using the same data set from Amazon.com. In the movie industry, Liu (2006) has found that review volume is the driver of future box office sales. By separating the effect of online review as both the originator and the result of sales, Duan et al. (2008) find that both a sales and review valence significantly leads to higher review volume, and higher review volume, in turn, results in higher sales. In a related study, Dellarocas, Neveen, and Zhang (2007) show that a movie's total revenue can be effectively forecasted through the movie viewers' ratings and movie's revenue trajectory.

Few recent studies investigate the impact of online reviews on consumer's hotel selection decision. By using the consideration set theory, Vermeulen and Seegers (2009) conduct an experimental study to analyze the effect of internet customer reviews to consumer decision making. The consideration set theory (Roberts & Lattin, 1991) states that customer decision making is multi-staged and at each subsequent stage (awareness/consideration/choice stage, respectively), a customer narrows down available alternatives until she makes her final decision. They consider review valence (positive versus negative), hotel familiarity and the reviewer expertise as the construct of their study. They find that both negative and positive reviews enhance consumer awareness for hotels. Furthermore, positive reviews improve the attitudes toward hotels. Consequently, hotel reviews increase consumers' consideration of the hotel, and this result is valid especially for lesser-known hotels as the exposure to reviews have limited effect for well-known hotels. They also show that the impact of reviewer expertise is positive, albeit minor. In an indirectly related study, Hu, Liu, and Zhang (2008) show that customers give better response to reviewers with better reputation and higher exposure by applying transaction cost and uncertainty reduction theories.

One of the most widely used techniques to study the determinant of hotel prices is hedonic pricing. Using hotel attributes as the explanatory variables and hotel room prices as the dependent variable, this method shows how hotel attributes explain the variation in hotel prices. Among the papers that use hedonic pricing as the method for the analysis of hotel room pricing, Espinet, Saez, Coenders, and Fluiva (2003) found significant price difference among four-star hotels and rest of the hotels. It also showed that location, hotel size, distance to the beach and availability of parking place is important determinants of hotel room prices. In a similar study, Israeli (2002) found that while star rating is a consistent predictor of room prices, brand name is not always associated with the premium. The premium charged by brand name hotel is eroded over time with the effects of crises, competition and customers' bargaining power. Recently, Thrane (2005) showed that 70% of the variation in room rates is explained by nine hotel attributes. The important attributes are mini-bar, hairdryer, free parking and distance to downtown.

The importance of the hotel attribute in customer decision making are discussed in Wind, Green, Shifflet, and Scarborough (1989), Lewis (1984), Bell and Morey (1996),

Callan (1998), Lieux, Weaver, and McCleary (1994) and McCleary, Weaver, and Lan (1993), Lockyer (2005) and Dolnicar and Otter (2003). These researches use the survey method to determine the important attribute for the hotel selection decision of the customer. The most frequently used attributes in these papers are location, service, price, room and hotel features, security, reputation and star rating.

Our work differs from previous studies by considering at least one of the following factors. First, most of the papers use survey analysis to determine the importance of the attributes in customer selection decision. This method has shortcomings since it is only possible to evaluate whether the attribute is significant in the customer selection purposes. In addition to the significance of hotel attributes, we can also measure the size effect of the variables on sales in our study. Furthermore, these researches mainly investigate the behavior of customers using the traditional channels for hotel booking. As online booking of hotels represents a major part of hotel sales, we focus on the hotel's online sale and prices in this paper. For this purpose, we consider the attributes that are available only through the internet. In addition, some of the attributes such as online customer ratings are specific to the internet and it is not possible to consider these attributes in researches that focussed on traditional channels for hotel bookings. Moreover, we analyze the effect of these attributes on both room prices and sales. Thus, our analysis is more comprehensive compared with former studies that investigate either the determinant of hotel price or the determinant of hotel selection decision of customers.

This paper contributes to the literature mentioned above as follows. First, we investigate the impact of online customer ratings on hotel room sales and prices by using real historic data extracted from one of the biggest online hotel booking websites. Second, we use two quality metrics (star rating and customer rating) in our study and we compare the effectiveness of these metrics on sales and prices of hotel rooms. Third, the results of this study provide useful tools for hotel managers and potential customers for comparing hotels having different features. Finally, we consider two of the most popular tourist destinations: London and Paris. This allows us to determine the robustness of our results and identify similarities and differences between the hotels in London and Paris.

Background

The aim of a potential online customer is to identify the product that satisfies his/her quality requirements, compare that product with the alternatives having similar attributes and then to purchase the most appropriate product with the lowest uncertainty. In general, uncertainty refers to the costs incurred when unexpected outcomes occur as a result of information asymmetry. Online hotel reservation is also subject to asymmetric information, meaning that the hotel owner knows the hotel's true quality, whereas potential customers do not. Some of the sources of the uncertainties are that the hotel owner is not known beforehand (seller uncertainty) and it is only possible to judge the performance of the hotel after staying at the hotel (product uncertainty) (Ba & Pavlou, 2002). It is also more difficult to sustain quality assurance for the hotel as the higher variability of the input leads to higher variability in output for the service offering (Stevenson, 2007). Akerlof (1970) indicates how this informational asymmetry resulting from uncertainties leads to a sub-optimal market with inferior products. By providing an example from the used car market, he stated that the buyer will offer only the average price of the products in the market if the quality of the product is not observable. Thus, high-quality sellers would be forced to exit the market, thereby resulting in a market of lemon sellers.

One of the solutions to the problem of asymmetric information is the signaling mechanism proposed by Spence (1973) in his seminal article. This theory states that in the case of asymmetric information, the better-informed party sends a signal to the less-informed party to communicate its true characteristics in a credible way. Thus, the less-informed party interprets the signal as an indication of higher quality and adjusts his/her purchasing behavior by offering a higher price in return for the higher quality service. In the next section, we will discuss the presence of two signaling mechanisms in the online hotel market to alleviate the adverse effects of information asymmetry problem: These are traditional ways of star rating and digitized way of online customer ratings.

Star rating

Governments recognize the potential harmful impact of asymmetric information in their local hotel markets. To avoid this problem, national rating agencies have been established by local authorities to evaluate hotels on the basis of their intrinsic qualities and rank them according to a five- or four-star scale.

Star rating is beneficial for the hotel owner since it sends signals to the customer about the hotel's intrinsic quality. This information will give high-star hotels the ability to differentiate themselves from low-star hotels by charging higher prices as a return for higher quality service. Thus, we expect that when other hotel features (customer rating, hotel size and location) are controlled:

H1: Hotels with higher star rating set higher prices compared with hotels with lower star rating.

As the most frequently mentioned quality feature of the hotels, star rating also plays an important role in the customer decision and studies show that every one out of two customer considers stars as the most important attribute in the selection process (Callan, 1998). By signaling that higher star hotels provide better service, a star rating system helps prospective customers to assess what to expect from a hotel with a specific star, and provides guidelines for them to make less risky hotel reservations. Therefore, we construct the following hypothesis, that when price and other hotel features (customer rating, hotel size and location) are controlled:

H2: Hotels with a higher star rating have higher sales of hotel rooms.

We would like to note that *H2* is more obvious than *H1* since *H2* asserts that higher star hotel are preferred to lower star hotels when price and other hotel features are being equal.

Online customer rating

As a quality measure, online customer ratings complement star features by considering subjective quality dimensions, such as how nice hotel staff are, comfort and cleanliness of the hotel room, facilities/services offered to customers and value provided versus the price of the hotel (Figure A1). High customer ratings also signal that the seller is trustworthy since it presents that the online seller fulfills the requirements of the online transaction. In other words, the online seller provides services as presented in the online advertisements.. Thus, customer ratings reduce information asymmetry between the seller and the buyer, and high customer ratings from past customers create a price premium for making online transactions less risky (Ba & Pavlou, 2002). Furthermore, the study conducted by comScore and the Kelsey Group (2007) reported that customers are willing to pay more for a higher rated service in return for higher quality service.

Thus, we expect that when other hotel features (star rating, hotel size and location) are controlled:

H3: An increase in the customer rating of a hotel leads to an increase in the room price of that hotel.

It has been shown that there is a significant positive relationship between the online product rating and successive sale of the product on that site (Chevalier & Mayzlin, 2006; Dellarocas et al., 2007). Moreover, Vermeulen and Seegers (2009) showed that exposure to online review increases both hotel awareness and hotel consideration. Industry report confirms these findings by revealing that 87% of the customers stated that a review generated by a fellow customer had a significant impact on the hotel purchase decision and 40% of the people who consulted an online review of hotels subsequently stayed at that hotel (comScore & the Kelsey Group, 2007).

We also expect that when price and other hotel features are both equal, hotels with higher customer ratings are more likely to be preferred to hotels with a lower customer rating, as a higher customer rating signals that the hotel is more reputable. Therefore, we hypothesize that when price and other hotel features (star rating, hotel size and location) are controlled:

H4: An increase in customer rating of a hotel leads to an increase in the sales of the rooms of that hotel.

While increases in customer rating leads to an increase in the price level in the same segment, there may be significant differences regarding consumers' sensitivity to price information in different segments. For example, Petrick (2005) divides travelers into three segments based on their price sensitivity: high sensitives, less sensitives and the segments of 'moderates'. They find that less (high) price sensitive customers spend more (less) money and they have higher (lower) income. This result implies that less (high) price sensitive customers mostly choose high (low) star hotels. Furthermore, Baker and Crompton (2000) find that customers that value quality higher are willing to pay more for it. For this reason, we expect that less price sensitive customers are willing to pay more for hotels with higher customer ratings. Thus, we construct the following hypothesis:

H5: High star hotels increase their prices more than low star hotels for the same unit increase in their customer ratings.

H5 indicates that hotel managers of higher star hotels are able to generate more revenue using their higher online customer ratings compared with low star hotels when

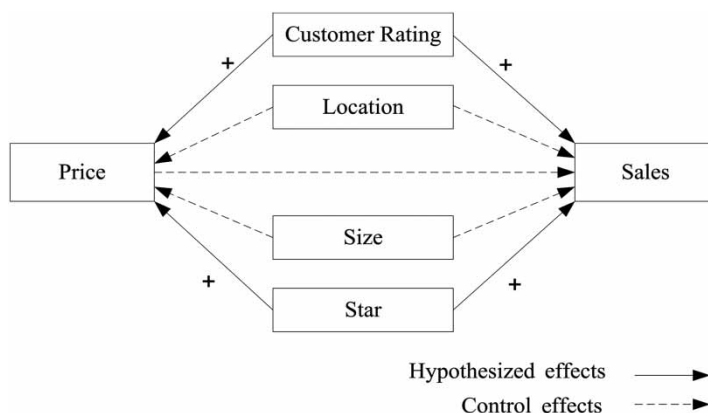


Figure 1. The hypothesized relationship between variables.

other hotel features (hotel size and location) are controlled. Figure 1 graphically displays the hypothesized relationship between variables explained above.

Research methodology

Data

The data are from one of the biggest online hotel web booking sites: www.booking.com. Figures A1–A3 display the snapshot of the website. After customers enter information on location, check-in and check-out dates into the website, available hotels are listed and it is possible to obtain information on hotel star, type and price of hotel rooms and average hotel customer rating in this listing. If a specific hotel's website is clicked, the customer can get further information on sample pictures of hotel rooms and facilities, hotel policies, number of hotel rooms and detailed guest reviews. From these websites, we gathered the information on hotel star, region of the hotel in the city, room price per night, average customer rating, number of hotel rooms and number of customer reviews. Data were collected at the beginning of January 2009 and at the middle of May 2009, and the average values of price and customer rating are computed for the final data set. We used the price of a standard double room as the room price since some hotels do not have the price information for single rooms.

The variable of interest, individual customer rating, is calculated in the following way. First, customers rate hotel quality in terms of hotel staff, services/facilities, and cleanness of hotel room, comfort and value for money. The score in these dimensions can be poor, fair, good or excellent and counts for 1, 2, 3 and 4 points, respectively. All these points are added and divided by 2 for the final individual score of hotel's customer rating. Figure A1 in the appendix illustrates the survey sent to one of the authors by booking.com for the evaluation of the hotel after staying there. Figure A3 also displays a sample of reviews written by the previous customers of the hotel. We used the total number of reviews between 1 January 2009 and 15 May 2009 as a proxy for sales data. The hotel's regional information is obtained based on classifications of booking.com. Table 1 displays the description of each variable and Table 2 present descriptive statistics of the variables used in our study. Table 3 shows the number of hotels based on star rating in London and Paris.

Empirical model and estimation result

The second and fourth hypotheses claim that an increase in customer rating and star increase the sales of hotel rooms. The following log-linear model formalizes these arguments and it is used to test the *H2* and *H4*:

$$\begin{aligned} \ln(\text{Sales per Room})_i = & \beta_0 + \beta_{11} \ln(\text{Price})_i + \beta_{11} \text{CityDummy} \times \ln(\text{Price})_i \\ & + \beta_{21} \text{Customer Rating}_i + \beta_{22} \text{CityDummy} \times \text{Customer Rating}_i \\ & + \beta_{31} \text{Star}_i + \beta_{32} \text{CityDummy} \times \text{Star}_i + \beta_{41} \ln(\text{Size})_i \\ & + \beta_{42} \text{CityDummy} \times \ln(\text{Size})_i + \sum_{k=1}^{N-1} \beta_{k,D} \text{RegionDummy}_i + \varepsilon_i \end{aligned} \quad (1)$$

In order to take into account the size effect, we use Sales per Room rather than sales level as a dependent variable, since we expect that bigger size hotels have higher number of sales. However, sales may not increase proportionally with the size of the hotel as it is

Table 1. Description of each variable.

Sales per Room	The number of sale proxied by the number of hotel review between 1 January 2009 and 15 May 2009 divided by the number of hotel room
Price	Hotel's average price of standard double room between 1 January 2009 and 15 May 2009
Customer Rating	The average value of Customer Rating between 1 January 2009 and 15 May 2009
Size	The number of hotel rooms
CityDummy	Dummy variable which takes the value of 1 if hotel is London(1) or Paris(0)
RegionDummy	Dummy variable which takes the value of 1 if the hotel is in that region and 0 otherwise
Star Dummy	Dummy variable which takes the value of 1 if the hotel has that star rating and zero otherwise

Table 2. Descriptive statistics.

City	Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
London	Number of hotel reviews between January 2009 and mid-March 2009	388	67.06	93.51	1	912
	Average customer rating	388	7.09	0.98	3.95	9.1
	Hotel star	388	3.23	0.92	1	5
	Average room price per night	388	113.03	57.88	29	348.30
	Number of hotel room	388	108.75	137.54	6	1054
	Number of hotel reviews per room	388	1.16	1.45	0.02	9.35
Paris	Number of hotel reviews between January 2009 and mid-March 2009	562	47.27	52.46	2	445
	Average customer rating	562	7.24	0.71	4.85	8.9
	Hotel star	562	2.87	0.72	1	4
	Average room price per night	562	128.04	50.64	36.5	390
	Number of hotel room	562	60.96	92.97	10	1025
	Number of hotel reviews per room	562	1.09	1.13	0.01	12.36

Table 3. The number of hotels based on star rating in London and Paris.

London		Paris	
Star	Number of hotels	Star	Number of hotels
1	11	1	12
2	70	2	150
3	153	3	299
4	127	4	101
5	27		

possible to find rooms most of the time even in the small hotels. Therefore, we also add the number of hotel rooms (Size) as a control variable. Moreover, we assume that the number of hotel reviews is a constant (c) fraction of sales for all the hotels as sales data are not publicly available. Duan et al. (2008) validates this assumption by showing that there is a significant positive correlation between total amount of sales and amount of online

reviews in the movie industry. Furthermore, similar proxies such as log transformation of sales ranking for sales are used by other studies (Chevalier & Mayzlin, 2006; Forman et al., 2008). Thus, room sales can be represented as a function of number of reviews as the following:

Review per room for hotel $i = c \times$ Sales per Room for hotel i

This assumption allows us to write Equation (1) in the following form:

$$\begin{aligned} \ln(\text{Review per Room}) = & \beta_0^N + \beta_{11} \ln(\text{Price})_i + \beta_{12} \text{CityDummy} \times \ln(\text{Price})_i + \beta_{21} \text{Star}_i \\ & + \beta_{22} \text{CityDummy} \times \text{Star}_i + \beta_{31} \text{Customer Rating}_i \\ & + \beta_{32} \text{CityDummy} \times \text{Customer Rating}_i + \beta_4 \ln(\text{Size})_i \\ & + \sum_{k=1}^{N-1} \beta_{k,D} \text{RegionDummy}_i + \varepsilon_i \end{aligned} \quad (2)$$

where $\beta_0^N = \beta_0 - \log c$. Equation (2) implies that using the number of reviews per room rather than number of Sales per Room affects only the intercept term if number of review posted is a constant fraction of number of online bookings. We use a log transformation of sales and price rather than sales and price levels for two reasons. First, it is possible for us to compute elasticities of independent variables with respect to Sales per Room. Second, when we use log transformation of sales and price, the relationship is closer to linear (see Figures A4 and A5 in the appendix). In order to identify city characteristics, we pooled Paris and London data and define price interaction variable as $\text{CityDummy} \times \log(\text{Price})$. The City Dummy(s) takes the value of 1 if the hotel is in London, and zero if the hotel is in Paris. Thus, β_{11} in Equation (2) measures the effect of the change in $\log(\text{Review per Room})$ to the change in $\log(\text{Prices})$ in Paris, whereas $(\beta_{11} + \beta_{12})$ measures the effect of the change in $\log(\text{Review per Room})$ to the change in $\log(\text{Prices})$ in London under the condition that both β_{11} and β_{12} is significantly different from zero. The same logic applies for customer rating and star variables. As we recorded hotel room prices of Paris and London in Euros and Pounds, we took the averages of Pound/Euro exchange rate between 1 January 2009 and 15 May 2009 and converted hotel prices from euros to pounds in Paris.

Before testing the hypotheses, several econometric specifications were checked. We first identify outliers of the log transformation of price and Sales per Room variable in the data set using the Grubbs methodology. Grubbs' (1969) and Stefansky (1972) developed the methodology to detect outliers in a univariate data set. The outlier is removed from the data set and the test is iterated until no outliers are detected. This test is also known as the maximum normed residual test. The multicollinearity of explanatory variables is investigated using the variance inflation factor (VIF). For hotels in Paris, VIF values range from 1.27 to 3.10, whereas VIF values range from 1.63 to 3.32 for London hotels. Since VIF values for both Paris and London hotels are smaller than the recommended value of 10 (Belsley, Kuh, & Welsch, 1980), we conclude that there is no multicollinearity problem in our regression analysis. We estimate the coefficients of the regression equation using OLS, and Table 4 displays the regression results of Equation (2) when the dependent variable is the Sales per Room (proxied by total number of online reviews) for London and Paris. Robust standard errors are displayed in parentheses below the coefficient estimates. One star next to the standard errors denotes that the coefficient is significant at 5% level, while two stars denote that the coefficient is significant at 1% level.

The significance of the coefficients of star and customer rating tests our second ($H2$) and fourth ($H4$) hypotheses. Table 4 shows that, for all of the regression specifications with

Table 4. Analysis of the effect of customer rating on Sales per Room in London and Paris.

Explanatory variable	Column no.				
	1	2	3	4	5
ln(Prices)	−0.91 (0.12)**	−1.32 (0.14)**	−0.90 (0.21)**	−0.81 (0.19)**	−0.87 (0.21)**
London interaction prices	−0.61 (0.16)**	−0.62 (0.20)**	−0.95 (0.28)**	−0.68 (0.27)*	−1.07 (0.29)**
Customer Rating		0.35 (0.08)**	0.35 (0.07)**	0.35 (0.07)**	0.37 (0.07)**
London interaction Customer Rating		−0.05 (0.10)	0.02 (0.10)	−0.01 (0.10)	0.13 (0.10)
Star			−0.28** (0.09)	−0.17 (0.09)	−0.18 (0.09)*
London interaction Star			0.21 (0.13)	0.21 (0.13)	0.19 (0.12)
ln(Size)				0.60 (0.06)**	0.41 (0.07)**
London interaction Size				0.04 (0.08)	0.07 (0.09)
Regional dummies					31 of 36 dummies are significant
Constant	3.89 (0.56)**	3.23 (0.54)**	2.07 (0.68)**	3.64 (0.65)**	7.34 (0.61)**
London dummy	2.52 (0.77)**	2.97 (0.73)**	3.85 (0.94)**	2.42 (0.88)**	Omitted
R ²	0.21	0.24	0.25	0.38	0.46
Number of observations	950	950	950	950	950

*indicates significant at 5% level; **indicates significance at 1% level.

different sets of explanatory variables, the coefficient of the customer rating is significant at 1% and the sign of the coefficient is positive. Thus, the regression results validate our main hypothesis (*H4*) by showing that an increase in the customer rating of a hotel leads to a significant increase in the sales of that hotel rooms. Furthermore, we can also compute the elasticity at the mean level by multiplying the coefficient and mean of the independent variable, when the dependent variable is in the log form and the independent variables are in the levels. Table 5 presents the elasticities of price and customer rating with respect to Sales per Room for Paris and London by using the coefficient estimates of Table 4 with the corresponding columns. These results show that a 1% increase in price decreases Sales per Room ranging from 0.91% to 1.32% in Paris and 1.52% to 1.94% in London, whereas 1% increase in customer rating increases Sales per Room ranging from 2.53% to 2.68% in Paris and 2.48% to 2.62% in London at the mean level of customer rating.

Even though we are able to validate *H4*, we could not find supportive evidence from the regression result for the first hypothesis (*H2*). The regression results show that the coefficient of star variable for both Paris and London hotels is significant with a negative sign. However, this result is consistent with the finding of Ghose (2009) that a high-quality product may sell earlier than low-quality products even after controlling the price.

Table 5. Elasticities of price and customer rating with respect to Sales per Room in Paris and London.

London			Paris		
Column no.	Price elasticities	Elasticities of Customer Rating	Column no.	Price elasticities	Elasticities of Customer Rating
−1	−1.52		−1	−0.91	
−2	−1.94	2.48	−2	−1.32	2.53
−3	−1.85	2.48	−3	−0.9	2.53
−4	−1.49	2.48	−4	−0.81	2.53
−5	−1.94	2.62	−5	−0.87	2.68

Thus, the demand for a low-quality product may be higher even after controlling the price. Our results are different to Ghose's (2009) findings and show that an increase in one of the quality measures (star rating) does not increase hotel sales, whereas increases in the other measure (customer rating) increases hotel sales. One possible explanation of this result is that while star rating and customer rating can be seen as two distinct quality indicators for the hotel owner and priced in that way, customers partially disregard the information in a star rating when considering hotels because they can substitute this information with an online customer rating. These results imply that consumers find online customer ratings more convincing and an objective indicator of intrinsic quality of the hotels as they have additional information in the form of written reviews.

The regression results in Table 4 also show the differences between London and Paris hotels. By looking at interaction variable, we could not find significant differences between Star and Customer Rating variables for London and Paris hotels. However, we observe that the coefficient of London interaction price and the London dummy (constant term) are significantly different for hotels in London and Paris, meaning that constant term and price elasticity are higher in London. These results imply that if everything is being equal, the Sales per Room are higher in London than in Paris for lower price hotels. On the other hand, the Sales per Room decrease more for London hotels as hotel prices increase. We would like to note that we also analyzed the hotels in London and Paris separately and achieved similar results in Table 5 which uses a pooled data set.

Our first and third hypotheses are about the impact of hotel star and online customer ratings on hotel room prices. In these hypotheses, we investigate the question of whether increases in customer ratings and stars result in higher room prices. *H3* and *H5* are tested by estimating the coefficients of the following equation using OLS:

$$\begin{aligned} \ln(\text{Price}) = & \beta_0 + \beta_{21}\text{Customer Rating}_i + \beta_{22}\text{CityDummy} \times \text{Customer Rating}_i + \beta_{31}\text{Star}_i \\ & + \beta_{32}\text{CityDummy} \times \text{Star}_i + \beta_{41}\ln(\text{Size})_i + \beta_{42}\text{CityDummy} \times \ln(\text{Size})_i \\ & + \sum_{k=1}^{N-1} \beta_{k,D}\text{RegionDummy}_i + \varepsilon_i \end{aligned} \quad (3)$$

where N is the number of regions in each city. By using star and customer ratings as an explanatory variable in our regression model, we find the effects of hotel reviews and hotel stars on room prices independent of other explanatory variables about the hotel. Regional dummies are used as control variables.

Table 4 presents the coefficient estimates of Equation (3) for hotels in London and Paris, respectively. The significance of the star and customer rating coefficient tests *H1* and *H3*. Table 4 shows that the coefficient of customer rating is significant at 1% and the sign is positive for all of the regression specifications with different sets of explanatory variables. Table 6 also shows that 1% change in customer rating increases the hotel prices by 1.036% (0.14×7.24) in Paris and 0.993% (0.14×7.09) in London at the mean level of customer rating. Thus, the regression results validate our hypotheses by showing that hotels with higher customer ratings (star) set higher price levels compared with hotels with the same star (customer rating) in the same region. We also observed that interaction variables for customer rating and star are insignificant, meaning that hotel prices in London and Paris show similar responses to the change in variables. In addition, we realized that big size hotels have higher prices. The possible explanation of this result is that large-size hotels are more likely to be better known compared with small-size hotels. Thus, they can charge higher prices over small-size hotels.

Table 6. Analysis of the effect of customer rating on hotel price in London and Paris.

Explanatory variable	Column no.			
	1	2	3	4
Customer Rating	0.32 (0.02)**	0.16 (0.02)**	0.16 (0.02)**	0.14 (0.01)**
London interaction	0.01 (0.03)	−0.03 (0.02)	−0.04 (0.02)	−0.00 (0.02)
Customer Rating				
Star		0.32 (0.02)**	0.32 (0.02)**	0.26 (0.02)**
London interaction		0.00 (0.02)	−0.02 (0.02)	0.01 (0.02)
Star				
ln(Size)			0.02 (0.02)	0.07 (0.02)**
London interaction			0.04 (0.02)*	−0.00 (0.02)
ln(Size)				
Regional dummies				12 of 36 regional dummies are significant
Constant	2.39 (0.14)**	2.55 (0.10)**	2.50 (0.11)**	2.46 (0.08)**
London dummy	−0.07 (0.18)	0.07 (0.13)	0.01 (0.14)	Omitted
R ²	0.41	0.69	0.70	0.76
Number of observations	950	950	950	950

*indicates significant at 5% level; **indicates significance at 1% level.

Our final hypothesis (*H5*) asks the following question: ‘Does the sensitivity of room prices to customer ratings increase with the increase in the star of the hotel?’ In other words, we investigate whether the room prices of higher star hotels are affected more by changes in online customer ratings. In order to test this hypothesis, we need to estimate the effect of customer ratings for each group of hotels having the same star rating. For this purpose, we also define interaction variable as Star Dummy(s) × Customer Rating. The star dummy(s) takes the value of 1 if the hotel has that star rating and zero otherwise. The interaction variable makes it possible to measure separate customer rating coefficients for different groups of hotels with identical stars. By controlling the region that the hotel belongs to, the impact of customer rating and interaction variables on price are tested by estimating the coefficients of the following equation using OLS:

$$\begin{aligned} \ln(\text{Price}) = & \beta_0 + \beta_1 \text{Review Score}_i + \sum_{j=2}^S \beta_j - \text{Star Dummy} \times \text{Customer Rating}_i \\ & + \sum_{k=1}^{N-1} \beta_{k,D} \text{RegionDummy}_i + \varepsilon_i \end{aligned} \tag{4}$$

where *S* is the rating of hotel having the highest star. In Equation (4), β_1 measures the common effect of customer rating for all the hotels and β_j measures the additional effect of customer rating for hotels belonging to specific star. For example, for three-star hotels, the coefficient of Customer Rating is equal to $\beta_1 + \beta_3$. Using this methodology, we can calculate different Customer Rating coefficients for different star hotel groups.

Tables 7 and 8 show the OLS estimates of Equation (4) for hotels in London and Paris, respectively. The regression result in Table 7 shows that all of the interaction variables except two-star hotels are significant, indicating the difference in the coefficient of customer rating with respect to star in London hotels. Furthermore, the coefficient of the interaction variable of the five-star hotels is the largest and the coefficient of the interaction variable of the three-star hotels is the smallest. Specifically, the customer rating coefficient of five-star hotels in London is equal to 0.23 (0.11 + 0.12 from

Table 7. Hotel star sensitivity analysis of the customer rating on price for hotels in London.

Explanatory variable	Column no.			
	1	2	3	4
Customer Rating	0.32 (0.02)**	0.09 (0.02)**	0.08 (0.02)**	0.11 (0.02)**
Two-star hotel interaction variable		0.002 (0.01)	−0.001 (0.01)	−0.003 (0.01)
Three-star hotel interaction variable		0.04 (0.01)**	0.04 (0.01)**	0.03 (0.01)**
Four-star hotel interaction variable		0.09 (0.01)**	0.08 (0.01)**	0.07 (0.01)**
Five-star hotel interaction variable		0.15 (0.01)**	0.14 (0.02)**	0.12 (0.02)**
ln(Size)			0.06 (0.01)**	0.07 (0.01)**
Regional dummies				7 of 16 regional dummies are significant
Constant	2.32 (0.13)**	3.58 (0.12)**	3.4 (0.12)**	3.25 (0.12)**
R ²	0.45	0.73	0.74	0.79
Number of observations	388	388	388	388

*indicates significant at 5% level; **indicates significance at 1% level.

Table 8. Hotel star sensitivity analysis of the Customer Rating on Price for hotels in Paris.

Explanatory variable	Column no.			
	1	2	3	4
Customer Rating	0.32 (0.02)**	0.1 (0.02)**	0.1 (0.02)**	0.08 (0.02)**
Two-star hotel interaction variable		0.04 (0.01)**	0.04 (0.01)**	0.03 (0.01)**
Three-star hotel interaction variable		0.08 (0.01)**	0.08 (0.01)**	0.07 (0.01)**
Four-star hotel interaction variable		0.13 (0.01)**	0.13 (0.01)**	0.1 (0.01)**
ln(Size)			0.01 −0.01	0.06 (0.01)**
Regional dummies				17 of 19 regional dummies are significant
Constant	2.5 (0.13)**	3.55 (0.1)**	3.5 (0.11)**	3.69 (0.11)**
R ²	0.36	0.69	0.69	0.77
Number of observations	562	562	562	562

*indicates significant at 5% level; **indicates significance at 1% level.

column 4) whereas coefficient of three-Star hotels is 0.14 (0.11 + 0.03 from column 4). These figures indicate that one unit increase in customer rating increases the price of a five-star hotel by ($e^{0.23}$) units, while one unit increase in customer rating increases the price of three-star hotel by ($e^{0.14}$) units.

Similarly, the customer rating coefficients of different star hotels are different for hotels in Paris. Table 8 shows that all of the interaction variables are significant, which indicates the difference in the coefficient of customer rating with respect to stars. In addition, the coefficient of the interaction variable increases as the star of the hotel increases. Thus, the coefficient of customer rating is much larger for higher star hotels.

As a result, Tables 7 and 8 validate *H5* by showing that the coefficient of online customer rating is much larger for the higher star hotels. This means that an improvement of customer ratings will cause a much higher increase in the price of higher star hotel. Thus, the room prices of higher star hotels are much more sensitive to online customer ratings compared with lower star hotels and hotel managers of higher star hotels should take into account this finding while determining room prices.

We did not pool the data for Paris and London hotels as there are at most four-star and five-star hotels in Paris and London, respectively. However, the regression results of Tables 7 and 8 show that the coefficients of one and two-star hotel in London are not significantly different and their behavior to the change in variables is similar to one-star hotels in Paris. The coefficients of three-, four- and five-star hotels in London are also similar to the coefficient of two-, three- and four-star hotels in Paris, respectively.

Discussion and conclusions

Many studies like Vermeulen and Seegers (2009) indicate that consumers prefer hotels with higher online customer ratings. We contribute to this literature by using a real world data set rather than experimental analysis. Our empirical results confirm this argument by showing that higher customer ratings significantly increase the online sales of hotels. Specifically, our results show 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. Contrary to our expectations, a higher star does not increase the sales. We also find that improvement in the customer ratings result in not only higher sales but also higher pricing of the hotel rooms. In addition, our results reveal that the star rating of hotels significantly affects the sensitivity of room prices to customer ratings. Specifically, improvement in the customer ratings increases the price of the higher star hotels more. These results suggest that the satisfaction of the less price sensitive customer is more critical than high price sensitive customers, as less price sensitive customers values quality higher.

The results of this paper have many practical implications for hotel managers and consumers. Since hotels have fixed capacities and seasonality is an important factor in the tourism sector, both underpricing and overpricing of the hotels result in significant revenue losses. In addition, the internet substantially reduced search costs of travelers and it is possible to view the price information of most of the hotels through web sites such as booking.com. Thus, fair pricing of hotel rooms over the internet become more important. Although hotel managers can compare the room prices of their own hotels with competitor' prices, hotels can differ in terms of many features such as star rating, online customer rating and location. The empirical model developed in this study makes it possible to compute the average price of the hotels by taking into account hotel-specific features and online customer ratings. The estimated price can be considered as the average price of the hotels with these features. Thus, hotel managers can use our model to make better pricing decisions by determining whether the prices of their hotel rooms are overpriced or underpriced compared with those of their competitors. Moreover, hotel managers are better equipped for the pricing of hotel rooms as we presented the impact of percentage change in price and customer rating to percentage change in sale figures in Table 3. However, we cannot estimate the expected sales as it is not possible for us to compute the intercept term in Equation (2).

Our results also show that the increase in the stars and customer ratings lead to increases in the prices of the hotel rooms. These findings imply that hotel managers consider both star and customer rating as important since these variables are incorporated in the pricing of the hotel rooms. On the other hand, an increase in the customer ratings results in an increase in the sales of the hotel rooms, while increases in the star rating does not lead to increases in the sales of the hotel rooms. These results show that customers find customer ratings more convincing than star features of hotels. Thus, the traditional impact of star rating loses its importance, whereas hotel reviews and ratings become more critical. This is an excellent opportunity especially for the hotels without brand names as customer rating can act as a signal for quality. These results also indicate that

high customer rating can also be a differentiating factor for hotels, by decreasing the fierce price competition among hotels, increasing their profit margin and sales. Thus, hotel managers should focus more on increasing their customer ratings. The breakdown of the customer rating score and written comments can guide a hotel manager about the possible improvement points of hotel services. The models developed in this paper can also help customers in the hotel selection process in order to evaluate hotels by comparing the average price of the hotel with the actual price charged to the customers.

Limitations

Our paper has several limitations. First, online customer review is subject to self-selection bias, meaning that customers having extreme satisfaction or dissatisfaction are more likely to post reviews compared with other past customers. This is more important especially for those hotels having fewer reviews, as limited reviews are more likely to represent the biased estimate of the hotel's true customer rating. Second, our data set does not have a time dimension. Although the cross-section data set we used in this paper is adequate to examine the research questions, many different interesting hypotheses could be tested if we were able to measure the changes in online customer ratings over time. This topic is left for future research, since – to have significant changes in online reviews – a significant amount of time should have passed and collection of that data will take years by definition. By recording the difference in customer ratings over time, it is also worthwhile to investigate whether detailed comments written in the past is taken into account by hotel managers and improve hotel's future quality. Another limitation of this study is the unavailability of sales date. Thus, we approximate room sales as a fraction of the number of reviews. For this reason, the price elasticities calculated in this study are not based on the real sale data.

Several issues can also be explored for further research. One possible extension is to examine whether the information provided by third-party web sites, like tripadvisor.com, affects hotel reservations and create premium price for the hotels. Another possible extension is to take into account the information in written comments and to examine whether the detailed information in written comments has explanatory power on sales and price of hotels. Frequently used words in the written comments can be identified and it has been tested whether these words help in explaining a greater variability in price and sales compared with the analysis of this study. Another interesting extension of the paper is to study the characteristics of the consumers who have made their assessment and explore whether they have influence on sales and prices of the hotels.

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Appendix

■ 2. The hotel

How did you like the hotel on these points...?


	poor	fair	good	excellent
hotel staff	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
services/facilities	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
cleanliness of your room	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
comfort	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
value for money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

■ 3. Your review of the hotel

What did you like during your stay at the **Majestic** ...?

If applicable, was there anything you did not like about the hotel?

Figure A1. The customer satisfaction survey for rating of hotel services.




Hôtel Madison ★★★★★

143 Boulevard Saint Germain, Paris • [Show map](#)

The hotel, a glamorous Parisian 19th century building, is situated in the very heart of the historical Paris Latin Quarter.... [More](#)

Score from [45 reviews](#)
 8

Available Rooms	Persons	Availability	Rate	
Classic Single Room	1	Only 2 rooms left	€ 180	Book now
Privilege Room	2	Only 2 rooms left	€ 355	Book now



Regyn's Montmartre ★★★★★

18 Place Des Abbesses, Paris • [Show map](#)

Located on Place des Abbesses, across from Saint-Jean church and close to the Sacred Heart Basilica, the hotel welcomes you with a renovated rustic decor.... [More](#)

Score from [135 reviews](#)
 7.4

Available Rooms	Persons	Availability	Rate	
Standard Room <small>Last room!</small>	2	Last chance! Only 1 room left	€ 91	Book now
Comfort Room <small>Last room!</small>	2	Last chance! Only 1 room left	€ 101	Book now
Privilege Room <small>Last room!</small>	2	Last chance! Only 1 room left	€ 120	Book now

Figure A2. A sample from featured hotels.



Figure A3. A sample from guest review.

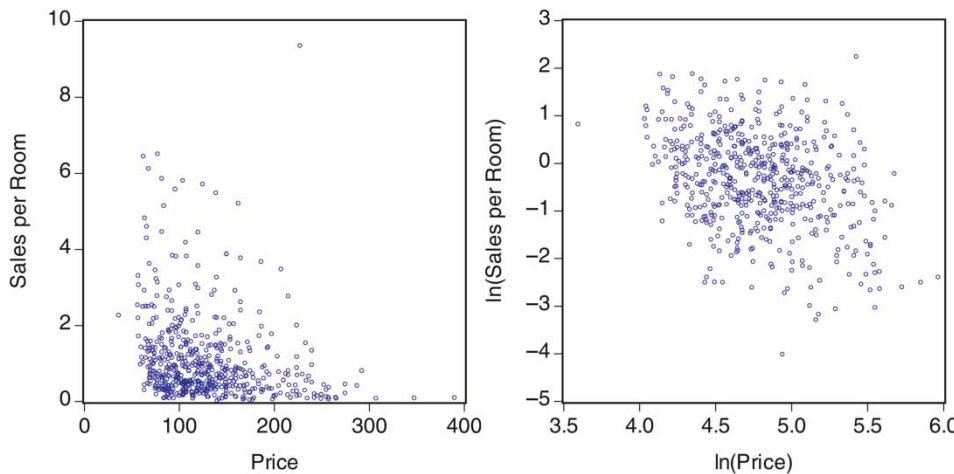


Figure A4. The relationship between Sales per Room (proxied by total number of online reviews) and price in log–log and level forms in Paris.

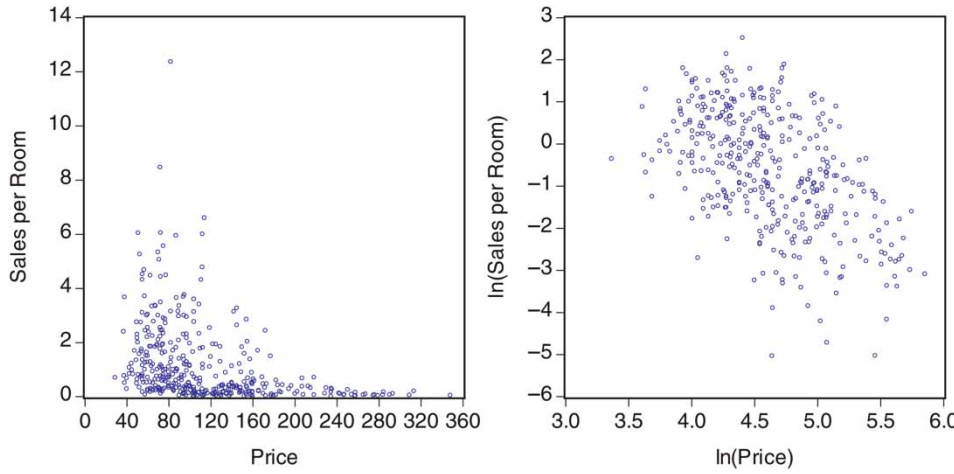


Figure A5. The relationship between Sales per Room (proxied by total number of online reviews) and price in log–log and level forms in London.