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THE INFLUENCE OF HOTEL CHARACTERISTICS ON ROOM RATES: A CASE OF VIETNAM

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Abstract. The effect of hotel characteristics on hotel room rates has not been adequately studied in the extant literature. The purpose of this study was to use the hedonic pricing method to measure and compare how different factors of hotels affect room rates. After collecting the data on hotel features that consumers use to make lodging decisions on the TripAdvisor website, a hedonic price model with Box-Cox transformations was built with 23 hotel characteristics. The findings indicate that hotel managers can devise strategies to improve the hotel's attractiveness and service quality, and to change and optimize hotel room rates.

Keywords: hedonic pricing model, hotel, room rate, hotel characteristic

1 Introduction

To date, many travelers book their accommodations through social media. Travelers can benefit from social media at all stages of their decision-making process [1]. TripAdvisor, the world's largest travel site and public social media platform, is one such website that allows travelers to socialize their opinions on various aspects of hotels. According to the evidence, 60% of users in the United States used TripAdvisor to select accommodations for their trip plans [2]. TripAdvisor, a key component in travel marketing, is used by travel agencies to expand and market hotel accommodation products and businesses. This platform makes use of recommender system technologies to assist the user with trip destination tasks. Users rate hotels based on several factors, including service, value, and cleanliness. Additionally, TripAdvisor users can leave hotel reviews. It has a comprehensive rating system that allows users to provide feedback on the hotels. Furthermore, TripAdvisor contains specific hotel information that can be used to match hotel services with customer demands.

In the case of Vietnam, according to the Vietnam National Administration of Tourism, in 2019, the tourism industry contributed over 9.2% to the country's GDP, creating 2.9 million jobs, including 927 thousand direct jobs. For only the year 2019, the tourism industry welcomed over 18 million international visitors (an increase of 16.2%), served 85 million domestic visitors (an increase of 6%) and the total tourism revenue reached 755 trillion VND, a rise of 18.5% compared to 2018. Those results are awe-inspiring when the growth of international visitors to

Vietnam in 2019 is much higher than the global average (3.8%) and Asia and Pacific region (4.6%). However, in 2020, as the world is facing an unprecedented global health, social and economic emergency with the COVID-19 pandemic, travel and tourism is among the most affected sectors in Vietnam. To overcome the challenges posed by the Covid-19 pandemic, Vietnam's tourism industry must quickly implement digital transformation to reach more customers, provide better customer service, reduce costs, and increase business efficiency. Hotel managers and marketers can effectively interact with their customers via social networking sites [2] such as Facebook, Twitter, and TripAdvisor by sharing information about products and brands. Big data mining is one of the avenues in the digitization process. Big data contains information and knowledge that can be used to improve service quality, reduce costs, and reach more customers.

In this field of research, the hedonic price model (HPM) estimates the prices of goods and services as groups of attributes or characteristics [3]. Any market for a differentiated product or service can benefit from the modelling approach. Housing, automobile, and computer markets, for example, as well as markets for environmental services. Because hotel products have a bundle of characteristics or attributes that are inseparable and cannot be sold separately, HPM has been widely used to analyze the hotel market. As a result, each hotel has unique hotel characteristics. The implicit price of a specific hotel attribute as revealed by the sale price of a hotel room is then referred to as a hedonic price. In other words, it is concerned with the relationship between the price of a hotel room and its hotel characteristics, as estimating price-characteristic relationships provides useful information for hotel market studies [4]. For those reasons, this study employs a dataset crawled from TripAdvisor and HPM to analyze the hotel attribute that influences significantly the hotel's room rate.

2 Literature review

HPM can be used to determine how much of a hotel's activity and extrinsic factors explain room prices. The resulting data could provide an answer to the question of how much hotel room rates are determined by destination characteristics, as discovered in a study on guest satisfaction conducted by [5]. HPM attempts to estimate implicit prices by disentangling the attributes of a good. The standard assumption in hedonic price functions for real estate goods is that the price or rent is a function of various attributes, which are usually classified as structural attributes, neighborhood attributes, and accessibility attributes. Individual buyers or renters try to maximize or satisfy their expected utility while working within various constraints such as their financial and time budgets.

The implicit price of each attribute can be estimated using regression techniques. A linear function implies that the marginal implied prices are constant. The price of an additional unit of an attribute in non-linear models is determined by the quantity already supplied and, in the most common specifications, by the number of other attributes. The assumption of constant marginal

implicit prices is only plausible if production yields constant returns to scale or if repackaging of two or more bundles is costless [6]. Because these conditions in real estate markets are unrealistic, economists typically employ non-linear models. Log-linear and semi-logarithmic functions are two of the most popular functional forms, as they are consistent with the principle of Occam's razor or using the simplest function from among the set of realistic functions. This paper's analysis employs a combination of semi-logarithmic and log-linear functions. The geographical extent of the market is one of the most difficult questions concerning hedonic price functions. A statistical consideration for empirical studies is that if the assumed market is larger than its true size, we can expect a biased parameter coefficient. When the assumed size is reduced, parameter estimates with lower precision result [7]. In hedonic studies, variable multicollinearity can lead to insignificant parameter estimates. Researchers then tend to omit some of the original variables, causing the remaining variables to subsume parts of the effects of the omitted variables, which can lead to interpretation issues [8]. However, an empirical study of multicollinearity problems revealed that the only cases of potentially degrading multicollinearity occur between neighborhood attributes and between different mathematical transformations of the same variable [9].

A review of the literature for the current study on the hotel market revealed that attributes can be classified based on hotels' degree of control over these features [10], including internal and external factors [11]. Although the first category is unbounded, its inclusion in most studies has resulted in a fairly well-defined profile of what hotels can control. Identifying external factors, on the other hand, is a difficult task [12]. This is due to the large number of attributes that can be considered depending on the specific objectives pursued by researchers, as well as hotels' reliance on external factors.

Based on a review of research on the lodging sector using hedonic price models, including all those identified by Assaf and Tsionas [13, 14], external factors were defined as all those conditions influencing prices over which hotels have no control. These factors can include macroeconomic conditions in tourists' homes and destination countries, tourism regulations, levels of competition, and the life cycles of destinations. Other considerations include the assets that the general public associates with specific hotels. These can be tangible assets like infrastructure or physical and natural heritage, or intangible assets like security, destination brand, destination capacity to attract visitors, tourism service quality, or high-impact events. As a result, the current study assumed that no other variables other than those listed by TripAdvisor significantly influence prices.

HPM was chosen for a variety of reasons. The first was, as previously stated, the difficulty in comparing hotels. Hotel features, on the other hand, can be measured in a homogeneous and easily comparable manner that excludes the unique characteristics of each hotel, resulting in equivalent models in terms of functional form and parameters. The second reason was that

hedonic pricing literature has primarily focused on hotel features. As a result, the impact of hotel attributes can be measured more easily in a wider range of hotel classes. If the analyses focused on hotel attributes, the results of this study could be more easily compared with others in the literature.

The prices used were extracted from the price range listed for each hotel on TripAdvisor to maximize the number of hotels included in the hedonic regression. In this way, the use of hotel data was not dependent on the specific date of the search or the availability of rooms on a specific day. These prices were thus equivalent to the list prices used in several previous hedonic pricing studies [15–17]. Rack rates can be used as indicators of quality or brand images generated by hotels—positioning hotels in the industry and among consumers. Second, the prices are assessed individually and concurrently, so that no price is directly influenced by another hotel's advertisements and promotions. However, as Israeli [15] points out, list prices are frequently criticized for failing to reflect true market prices. TripAdvisor's price range, on the other hand, is based on current market prices. This has three advantages: (1) it shows the selected hotels' market position based on real-world actions, (2) it maximizes the number of hotels in the sample because their data does not depend on room availability at a specific time, and (3) it reflects market prices. The disadvantage of using this type of price is that it does not distinguish between weekday and weekend rates or take the booking margin into account.

The number of rooms in a hotel was used as a proxy for its size in this study. The latter variable has yielded conflicting results in the literature. Israeli and Mario Raal [15, 18] find a positive correlation. Saló and Soler [19, 20] discovered a negative correlation, whereas Agmapisarn [21] discovered no significant correlation. These disparities reflect the effect of destinations on tourists' willingness to pay. That is, while hotel size is purely an internal decision, the destination in question, and more specifically, the characteristics of the visitors, condition their willingness to pay for these attributes.

Both hoteliers and users on TripAdvisor can upload photos of their properties. Professional photos are included in the best hotels, and customers are encouraged to upload photos of their accommodations to help them build their online reputations. Other hotels limit or pretend to delete photos, claiming that they are inaccurate. As a result, the current study also included the number of photos posted by hotels and customers on their TripAdvisor profiles. Finally, information on the most important facilities and services used by consumers to filter hotels was gathered [18, 21, 22].

3 Research Methods

The main advantage of Rosen's (1974) model is that it is based on real-world market data [23]. Rosen's (1974) model assumes no significant transaction costs and perfect competition, though

the latter is not required if the first part meets certain other criteria [24]. The model also assumes that buyers have complete knowledge [25].

The starting point is the assumption that the price P_i of the hotel i is a function of a fixed number, say M, are number of internal and external characteristics of the hotel measured by "quantities" I_{im} . The general function expression of this is given as:

$$P_i = f(I_{i1}, \dots, I_{iM}, \varepsilon_i)$$

where ε_i is a random error term (white noise). To be able to estimate the marginal contributions of the characteristics using standard regression techniques, equation (1) has to be specified as a parametric model.

The general expression of this is given as Eq. (1):

$$P_i = \alpha + \sum_{m=1}^{M} \beta_m I_{mi} + u_i \quad (1)$$

in which P_i is the price of a room at hotel i, α is the constant (i.e., intercept), I_{mi}, E_{ni} represents the different internal and external attributes m, n for each hotel i, and β_m, γ_n are their respective associated coefficients. However, some authors recommend changing the price using the natural logarithm to improve the model's explanatory power [26], based on Eq. (2):

$$Ln\ P_i = \alpha + \sum_{m=1}^{M} \beta_m X_{mi} + u_i \quad (2)$$

The data collected for this study aided in the selection of the functional form for the hedonic price function [24]. The use of Box-Cox models to transform the variables improved the overall explanatory power of the hedonic models, particularly the price variable [27]. Following in the footsteps of Abrate [28] and other authors, the appropriate adjustment of different functional forms framed within Box-Cox models was verified, easing the selection process in the logarithmic transformation of prices. The current study Box-Cox transformation models are based on this process:

$$\frac{P_i^{\lambda} - 1}{\lambda} = \alpha + \sum_{m=1}^{M} \beta_m \frac{X_{mi}^{\lambda} - 1}{\lambda} + u_i \quad (3)$$

The Box-Cox transformation model (3) is built around an exponent, lambda (λ), which ranges from *-2* to *2*. All values of λ are considered, and the best value for your data is chosen; the "best value" is the one that produces the best approximation of a normal distribution curve. The linear Box-Cox transformation model, according to Cropper [29], is the best and performs well in the hedonic price study. As a result, the linear Box-Cox transformation model is also used in this study to determine the factors influencing hotel room rates in Vietnam.

4 Dataset

In June 2022, all data were collected from the Vietnamese version of the TripAdvisor website (www.tripadvisor.com.vn). The information was gathered for all 28,822 hotels in Vietnam for which TripAdvisor had information. However, because some hotels only provide a small entry sheet on TripAdvisor and others do not provide price information, the study's final number of hotels was reduced. Thus, the data for Vietnam included 1,330 hotels with complete information and variable descriptions. Aside from prices, nearly all of the variables available on the website were collected and used in the form that best fits each variable.

The dependent variable in the study was the hotel room rate, and the independent variables were the total number of reviews (x_1), the number of very good reviews (x_2), the number of average reviews (x_3), the number of excellent reviews (x_4), the number of poor reviews (x_5), the number of terrible reviews (x_6), the number of photos taken by hotel staff (x_7), the number of photos taken by travelers (x_8), the number of photos taken in pool or beach (x_9), the number of photos taken (x_{17}), number of languages used in hotels (x_{18}), the average rating for all services (x_{19}), the average rating for cleanliness (x_{20}), the average rating for location (x_{21}), the average rating for service (x_{22}), the average rating for value (x_{23}). The descriptive statistics for the variables are as follows:

Table 1. Descriptive statistic for study variables (N = 1,330)

Variable	Description	Minimum	Maximum	Mean	Standard Deviation
y_1	Max room price based on average room rates for a standard room (VND)	250,000	38,909,092	1,727,751.2	2,294,080.0
y_2	Min room price based on average room rates for a standard room (VND)	227,273	8,363,636	776,657.6	673,250.9
y	The average room rate extracted from the standard room price range (VND)	250,000	19,863,637	1,252,204	1,356,894
x_1	Total number of reviews	9	4,488	400.7	623.8
x_2	Number of very good reviews	1	1,328	97.9	162.7
x_3	Number of average reviews	1	432	32.6	47.9
x_4	Number of excellent reviews	1	3,596	248.9	455.4
x_5	Number of poor reviews	1	147	11.6	15.3
x_6	Number of terrible reviews	1	124	9.7	12.1
x_7	Number of photos taken by hotel staff	0	586	67.5	94.6

Variable	Description	Minimum	Maximum	Mean	Standard Deviation
x_8	Number of photos taken by the traveler	1	3,469	258.2	462.5
x_9	Number of photos taken in pool or beach	1	1,157	63.5	109.0
x_{10}	Number of photos taken in the room, suite, or meal	1	596	37.4	74.9
x_{11}	Number of attraction places within 0.5 km	1	604	46.6	66.2
x_{12}	Number of restaurants within 0.5 km	6	1,408	190.8	207.7
x_{13}	Grade for walkers	36	100	83.1	17.2
x_{14}	Number of rooms	1	1,260	73.7	97.1
x_{15}	Number of rooms features	1	44	10.1	7.6
x_{16}	Number of hotel property amenities	3	108	25.8	14.5
x_{17}	Number of room types	1	9	2.7	1.5
x_{18}	Number of languages used in hotels	1	4	2.0	0.9
x_{19}	The average rating for all services (scale from 1 to 5)	2	5	4.1	0.6
x_{20}	The average rating for cleanliness (scale from 1 to 5)	2	5	4.3	0.5
x_{21}	The average rating for location (scale from 1 to 5)	1	5	4.3	0.5
x_{22}	The average rating for service (scale from 1 to 5)	2	5	4.2	0.6
x_{23}	The average rating for value (scale from 1 to 5)	2	5	4.2	0.6

Table 1 shows that the maximum room price for a standard room based on average rates ranges from 250,000 VND to 38,909,092 VND, with a mean room rate of 1,727,751 VND. The minimum room price ranges from 227,237 VND to 8,363,636 VND, with an average of 776,657 VND. The average room rate calculated from the standard room price range (y) is 1,252,204 VND.

The total number of reviews for each hotel ranges from 9 to 4,488, with an average of 400. The majority of the reviews are excellent, with approximately 250 reviews accounting for 62.5% of the total reviews. The ratings for good, average, poor, and terrible are 97.9, 32.6, 11.6, and 9.7, respectively.

Four variables represent the number of photos: x_7, x_8, x_9, and x_{10}. In that, x_7 and x_8 represented the number of photos taken by hotel staff and travelers, respectively, with mean

values of 67.5 and 325.7. The average number of photos taken at the pool or beach (x_9) is 63.5, nearly double the average of 37.4 photos taken in a room, suite, or meal (x_{10}).

Three external factors that may influence hotel room rates are the number of attractions (x_{11}), the number of restaurants (x_{12}), and the walking index (x_{13}). The number of attractions within 0.5 kilometers ranges from 1 to 604, with the average number of attractions being 46.6. Similarly, 190.8 is the average number of restaurants within 0.5 kilometers of the hotel. The grade for walkers is a *0 - 100* scale index that measures how good the walkers are. The higher the rating, the easier it is for visitors to find restaurants and activities within walking distance. The mean grade for walkers in Vietnam's hotels remains at level of 83.1.

The number of rooms in the hotel ranges from 1 to 1,260, with an average of 73.7 rooms in Vietnam's hotels. The room features range from one to 44. A hotel room has 10 features on average, such as air conditioning, a flat-screen TV, a minibar, and a refrigerator. The average number of hotel amenities is 25.8. Free wifi, breakfast, a pool, free parking, airport transportation, and a kitchenette are examples of popular hotel property amenities. The average hotel room type is 2.7, and the average number of languages spoken is 2.

The average rating for all services, cleanliness, location, service, and value is 4.2, with a standard deviation of about 0.6. On a scale of 1 to 5, the hotel service received a high rating. The majority of tourists are pleased with the service provided by Vietnam's hotels.

5 Estimation and Empirical Results

According to the results in Figure 1, the best-fitting transformed parameter λ was -0.22222. It was 95% statistically significant. A Box-Cox transformation converts non-normal dependent variables into normal shapes. Many statistical techniques rely on the assumption of normality; if your data isn't normal, using a Box-Cox means you can run more tests. The Box-Cox transformation is defined by an exponent, lambda (λ), which ranges from *-2* to *2*. All values of λ are considered, and the best value for your data is chosen; the "best value" is the one that produces the best approximation of a normal distribution curve. The Y transformation is as follows:

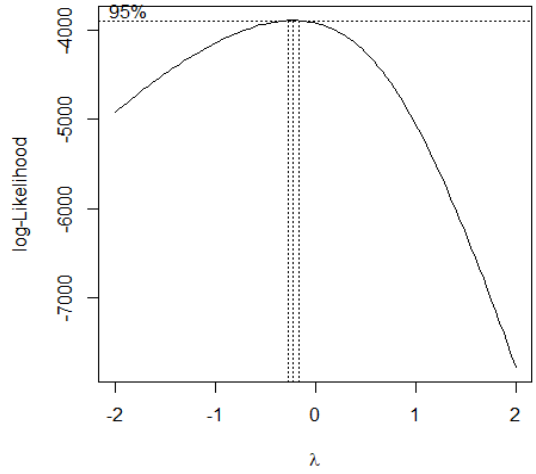

Figure 1. The profile log-likelihood for Box-Cox transformations

In Table 2, 23 variables were entered into the Box-Cox model, with 17 having a positive relationship and 6 having a negative relationship with the hotel room rate. Furthermore, 12 independent variables were statistically highly significant (0.05), while 11 variables were not.

At a significance level of 0.05, the number of very good reviews has a positive relationship with the room rate. The room rate price would rise by 0.7% if the number of very good reviews increased by 1%. However, at a significant level of 0.01 and 0.05, the number of average reviews and the number of excellent reviews have a negative relationship with the room rate. If the number of average or excellent reviews increases by 1%, the room rate price drops by 0.75% and 0.89%, respectively. The total number of reviews, the number of bad reviews, and the number of terrible reviews all have an impact on room rates, but it is minor.

The number of photos taken by hotel employees and guests has a positive relationship with the room rate. However, the number of photos taken by travelers has a highly significant effect on room rates with a three-star significant code. The room rate rises by 2.3% for every 1% increase in the number of photos taken by travelers. The number of photos taken in the pool, beach, room, suite, or meal has no bearing on the room price.

At the 0.05 level of significance, the attraction locations have a positive relationship with the room rate. If the number of attractions increases by 1%, the room rate price increases by 0.39%. In contrast, at a 0.01 level of significance, the grade for walkers has a negative relationship with the room rate. When the walkers' grade falls by 1%, the room rate rises by 2.6%. The number of restaurants near the hotel has a positive effect on the room rate, but this effect is not statistically significant.

Table 2. Estimation results of the Box-Cox Hedonic model

Residual standard error: 0.02284 on 1306 degrees of freedom
Multiple R-squared: 0.4959,
Adjusted R-squared: 0.4859
F-statistic: 49.61 on 23 and 1306 DF, p-value: < 2.2e-16

	Estimate	Standard Error	t value	Pr(>|t|)	
(Intercept)	4.1805281	0.0366998	113.911	< 2e-16	***
x1	0.0002813	0.0078476	0.036	0.97142	
x2	0.0069506	0.0031451	2.210	0.02730	*
x3	-0.0075066	0.0023110	-3.248	0.00119	**
x4	-0.0088567	0.0044188	-2.004	0.04527	*
x5	0.0002403	0.0018236	0.132	0.89518	
x6	-0.0004217	0.0015446	-0.273	0.78491	
x7	0.0012438	0.0013972	0.890	0.37356	
x8	0.0232422	0.0028441	8.172	7.87e-16	***
x9	0.0007730	0.0017108	0.452	0.65149	
x10	0.0006494	0.0010910	0.595	0.55183	
x11	0.0039014	0.0018011	2.166	0.03050	*
x12	0.0007484	0.0034783	0.215	0.82968	
x13	-0.0260198	0.0100509	-2.589	0.00975	**
x14	0.0217547	0.0020575	10.574	< 2e-16	***
x15	0.0010352	0.0020801	0.498	0.61882	
x16	0.0217762	0.0042611	5.110	3.76e-07	***
x17	0.0016537	0.0018472	0.895	0.37084	
x18	-0.0114351	0.0021570	-5.301	1.37e-07	***
x19	0.0403988	0.0178157	2.268	0.02354	*
x20	0.0258824	0.0109137	2.372	0.01788	*
x21	0.0010917	0.0087730	0.124	0.90099	
x22	0.0054511	0.0143973	0.379	0.70504	
x23	-0.0573903	0.0105256	-5.452	6.07e-08	***

Significant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

At the 0.001 significant level, the number of rooms in the hotel or the size of the hotel has a strong positive relationship with the room rate. For every 1% increase in the number of rooms, the room rate will rise by 2.18%. Furthermore, at the 0.001 significant level, the number of hotel property amenities has a strong positive relationship with the room rate. If the hotel's amenities rise by 1%, the room rate will rise by 2.18%. The number of hotel property amenities and the

number of room types, on the other hand, have the same positive relationship with the room rate. It is not statistically significant, however, because its p-values (0.62 and 0.37) are greater than the standard significance level of 0.05. In contrast, at a 0.001 significance level, the number of languages spoken in the hotel has a negative relationship with the room rate. Each 1% increase in the number of languages used in the hotel results in a 0.11% decrease in the room rate.

Three variables, average rating for all services, cleanliness, and value, have a statistically significant effect on the room rate in the group of variables for the average rating (x_{19}, x_{20}, x_{21}, x_{22}, x_{23}). Except for the average rating for the value variable, the majority of the variables in this average rating group have a positive relationship with the room rate. Each 1% increase in the average rating for all services and the average rating for cleanliness results in a 4.04% and 2.59% increase in the room rate, respectively. In contrast, for every 1% increase in the average rating for the value variable, the room rate will decrease by 5.74%.

6 Conclusion and Discussion

This study is an attempt to use the linear Box-Cox transformation technique to determine the hotel characteristics that influence a hotel room rate in Vietnam. A likelihood test on the Box-Cox transformation models revealed that the best-fitting functional form should statistically be at -0.222. Furthermore, perfect marketing is one of the most important assumptions for employing the hedonic pricing model. In this manner, the customer can obtain complete information about the hotels and decide what type of hotel room they desire. The dataset for this study was retrieved from the TripAdvisor website. This website contains the actual room pricing of almost all of the world's major e-travel agents, including booking.com, agoda.com, expedia.com, trip.com, and hotels.com. Furthermore, the customer can freely select hotels and compare room pricing on various e-travel agency websites. Furthermore, customers will get a multi-dimensional view and perfect information about the hotel they intend to book for their trip by referring to the feedback of travelers who have experienced hotels. As a result, the dataset used in this study meets the requirements of the hedonic pricing model.

The empirical findings suggest that the following recommendations would be beneficial to hotel managers and travelers. Hotel managers can improve the hotel's quality and services to meet the preferences of travelers while increasing profits. For example, the hotel manager could create a marketing campaign to increase the number of photos taken by the traveler, increase the number of very positive feedback, add more hotel property amenities, or focus on the cleanliness service to satisfy the traveler and increase the hotel room price. The results can assist travelers in understanding how the impact of the characteristics on room rates in Vietnam. The hotels had more property amenities or were located in a good walking area or a location with many attractions. It can assist travelers in estimating room rates when traveling around Vietnam.

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