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An application of hedonic pricing analysis to the case of hotel rooms in Taipei

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This study investigates the impact of a variety of attributes or 'characteristics' on the rates charged for hotel rooms in Taipei. The authors employ a 'hedonic pricing' method and use data obtained for 73 hotels from an Internet travel agent. The results show that hotel location, the availability of LED TV and the presence of conference facilities have significant effects on both weekday and weekend room rates. By contrast, Internet access and the presence of a fitness centre have significant effects on weekday rates only, while room size has a significant effect on weekend rates only. Of particular interest, given the results obtained in earlier work, is that in Taipei there is a *negative* relationship between proximity to the city centre and room rates, both on weekdays and at weekends.

Keywords: hedonic pricing; hotel room; service attributes; Taipei

The 'hedonic pricing' model views goods and services as collections of 'attributes' or 'characteristics'. The modelling approach can be applied to any market for a differentiated product or service (see Monty and Skidmore, 2003). For example, markets for housing, automobiles and computers, as well as for environmental services (or disservices) such as air pollution, noise and similar externalities, have been widely investigated by means of the hedonic pricing technique. However, there are relatively few examples of applications of the technique to the tourism industry. Of these, the studies by Hartman (1989), Israeli (2002), White and Mulligan (2002), Espinet *et al* (2003), Monty and Skidmore (2003) and Thrane (2007) specifically address aspects of the hospitality sector in general and accommodation in particular.

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Pricing is an issue of paramount importance for practitioners in the hospitality industry. It is the only element in the accommodation marketing mix that impacts directly on revenues. However, by their nature, pricing decisions are complex and are influenced both by internal factors (for example, short-term marketing objectives, longer-term marketing strategy, as well as the costs and mechanisms involved in posting and changing prices) and external factors (for example, market demand and supply conditions, competition and other environmental factors) (see Kotler *et al*, 1999, for a discussion).

While a variety of analytical techniques such as conjoint analysis (Goldberg *et al*, 1984) and latent growth curves (Coenders *et al*, 2003) have been employed, the hedonic pricing approach is the most widely used where studies of hotel room pricing are concerned. The method makes it possible to identify for consumers those attributes for which an 'extra' payment is required, those for which there is a 'discount' and those which are irrelevant in the determination of the room rate. For their part, the producers of hospitality and tourism-related products can use the information as a basis for strategic pricing (Thrane, 2007).

This study is concerned with the effect on room rates of the different attributes or characteristics of various hotels in the immediate vicinity of the Taiwanese capital city, Taipei. In particular, it examines how different attributes explain variations in room rates between weekdays and weekends. To the best of our knowledge, this study represents the first application of the hedonic pricing method to the Taiwanese hospitality industry. We hope by this means to contribute to both the academic literature on hospitality and tourism in Taiwan, as well to provide some understanding of issues that are of interest to practitioners in that country and elsewhere.

Hedonic pricing in hotels

In his seminal article, Rosen (1974) argues that products (or services) can be described as composites of different attributes or characteristics. The essence of the hedonic pricing approach is the idea that the observed price of any such product (or service) is the sum of the unobserved prices of the bundle of attributes associated with it. The objective is to obtain the implicit prices for these individual attributes.

Hotel attributes that affect room rates can, at a simple level, be thought to include location, facilities and amenities, service quality, star rating, atmosphere, etc (Thrane, 2007). Within this broad classification, Monty and Skidmore (2003) identify three variables as being of particular importance in determining rates: location, accommodation-specific attributes and seasonality. As Espinet *et al* (2003) have noted, however, these factors, as well as a rich variety of discounts and supplements, render the analysis of hotel room pricing extremely complex. Moreover, the selection of hotel attributes and evidence of their impact on rates differs from study to study according to the particular features of the case under review. For this reason, there is no agreed basis for approaching the problem.

Hotel room pricing can be studied from both demand-side and supply-side perspectives. In studies of the former type, such as that of Monty and Skidmore (2003), use is made of data obtained from consumers to estimate their

willingness to pay for hotel attributes. Such information contributes both to the understanding of customers' consumption behaviour and to the techniques that managers and marketers might employ in order to enhance efficiency in operations, management and marketing. One problem is that the results rely heavily on consumer 'willingness-to-pay' surveys and are thus potentially of dubious reliability for a number of reasons, including the extent to which they can be considered 'representative'. In this paper, we prefer instead to approach the problem from the 'supply' side.

Methodology

Most hotels in Taiwan appear on the lists of more than one Internet travel agent. Given the nature of the market, and the way in which hotels advertise themselves, price differences between Internet travel agents for any given hotel tend to be negligible. For this reason, we consider it appropriate to gather our data from only one of the major Internet travel agents. Thus, the data for this study were obtained from Eztravel.com (http://www.eztravel.com.tw). These data refer to the month of July 2007 and apply to 73 hotels. We restrict our study to a single month in order to avoid problems due to seasonality. Moreover, although all hotels in Taiwan can be accessed on the Internet, this study focuses exclusively on those in Taipei. This has been done to avoid any risk of heterogeneity induced by 'regional' effect.

The hotels in our sample belong to various categories, including 'luxury', 'budget', 'business' and 'resort'. These are the formal categories used on the Eztravel.com site. For each hotel, information about characteristics such as location, facilities, room types, number of rooms and prices of various room amenities can be found on the Internet. The prices given on the site always reflect the price consumers are expected to be willing to pay rather than the so-called 'rack rate', and in this sense – and for our purposes – they can be taken to reflect the vendor's perception of the implicit price for the hotel's product.

In order to standardize the comparisons, we record only the rate for a one-night stay in a double room, for each hotel. However, the majority of hotels in our sample charge different prices for such a room according to whether the stay is on a weekday or a weekend. The weekday and weekend room rates are therefore treated as two distinct dependent variables. For the independent variables, we selected the hotel attributes used by previous authors (for example, Hartman, 1989; Israeli, 2002; White and Mulligan, 2002; Espinet *et al*, 2003; Monty and Skidmore, 2003; and Thrane, 2007). The information about the attributes of each particular hotel was obtained largely from the descriptions on the Eztravel.com Website, but in some instances, more information was obtained through telephone calls directly to the hotels.

For our analysis, the set of attributes included both quantitative and qualitative components. The quantitative attribute thought to determine room price is the room size, which is measured in square metres. The qualitative attributes include hotel location, amenities and other appropriate features of each hotel. These latter are comprised of location relative to the city centre, whether the hotel has 'international tourist' status, whether it is part of a chain,

Table 1. Descriptive statistics for attribute variables (N = 146).

Variable	Description of variable/attribute	Mean	S.D.
PRICE	Room rate per night (NT$)	3,259.18	1,364.59
LogPRICE	Price, logged	8	0.42
STAR	Hotel is an international tourist hotel (yes = 1)	0.29	0.45
CHAIN	Hotel is associated with a chain (yes = 1)	0.22	0.42
ROOMSIZE	Hotel room size (m^2)	9.43	3.86
LOCATION	Hotel located in city centre (yes = 1)	0.84	0.37
BATH	Bathroom with both bath and shower is present in hotel room (yes = 1)	0.64	0.48
BREAKFAST	Breakfast is buffet type (yes = 1)	0.74	0.44
TV	LED TV is present in hotel room (yes = 1)	0.52	0.5
BUSINESS	Business centre is present in hotel (yes = 1)	0.58	0.46
BAR	Bar/café is present in hotel (yes = 1)	0.3	0.46
INTERNET	Internet access is available in hotel room (yes = 1)	0.94	0.23
SHUTTLE	Shuttle bus is available in hotel (yes = 1)	0.53	0.5
CONFERENCE	Conference facilities are present in hotel (yes = 1)	0.66	0.47
SWIM	Swimming pool is present in hotel (yes = 1)	0.25	0.43
FITNESS	Fitness centre is present in hotel (yes = 1)	0.56	0.49

whether it has a bathroom with both a bath and a shower, whether it offers a buffet-type breakfast, LED TV, a business centre, bar/café, Internet access, a shuttle bus, conference facilities, a swimming pool, a fitness centre, free parking and room service. These amenities are measured on a binary scale involving dummy variables, in which 1 indicates presence and 0 indicates absence. Two attributes – free parking and room service – are present in all the hotels in the sample and are therefore constants in our analysis to be excluded from the set of independent variables.

Table 1 reports the descriptive statistics for the dependent as well as the independent variables considered in this study.

The models and empirical results

We employ a general model in which the 'product' of a given hotel H is the embodiment of a set of attributes (Espinet *et al*, 2003), such that

$$H_i = (q_{i1}, q_{i2}, q_{i3},..., q_{ik},..., q_{im} \quad (1)$$

where $i = 1,\ldots, n$ indexes the hotel and q_{ik} ($k = 1,\ldots, m$), each of its attributes.

The hedonic price function for H_i is then

$$P_i = P(q_{i1}, q_{i2}, q_{i3},..., q_{ik},..., q_{im} \quad (2)$$

where the functional form of P is assumed to be constant across hotels, though the contribution of each attribute may vary from one hotel to another.

Following Rosen's (1974) advice and that of most previous researchers in this area (Trane, 2007), we employ a log-linear specification for the pricing function rather than a linear one. Three regression models, including whole sample

Table 2. Estimated results from the hedonic pricing models.

	Model 1 Whole sample (N = 146)		Model 2 Weekday sample (N = 73)		Model 3 Weekend sample (N = 73)	
	Coefficient	*T*-value	Coefficient	*T*-value	Coefficient	*T*-value
STAR	–0.056	–0.573	–0.089	–0.627	–0.023	–0.157
	(0.098)		(0.141)		(0.148)	
CHAIN	0.179	1.908*	0.192	1.402	0.168	1.193
	(0.094)		(0.137)		(0.141)	
ROOMSIZE	0.018	3.251**	0.010	1.187	0.027	3.167**
	(0.006)		(0.008)		(0.009)	
BATH	0.073	1.223	0.075	0.871	0.071	0.793
	(0.060)		(0.086)		(0.090)	
BREAKFAST	0.075	1.499	0.062	0.834	0.086	1.171
	(0.050)		0.064)		(0.073)	
LOCATION	–0.489	–6.664**	–0.478	–4.524**	–0.501	–4.505**
	(0.073)		(0.106)		(0.111)	
TV	0.178	4.075**	0.180	2.867**	0.175	2.654**
	(0.044)		(0.063)		(0.066)	
BUSINESS	0.006	0.115	0.019	0.233	–0.007	–0.090
	(0.055)		(0.081)		(0.082)	
BAR	0.145	2.313**	0.149	1.648	0.140	1.482
	(0.063)		(0.091)		(0.095)	
INTERNET	0.275	2.737**	0.326	2.258**	0.223	1.469
	(0.100)		(0.144)		(0.152)	
SHUTTLE	0.088	1.958*	0.097	1.48	0.081	1.184
	(0.045)		(0.065)		(0.068)	
CONFERENCE	0.180	3.424**	0.158	2.086**	0.202	2.548**
	(0.052)		(0.076)		(0.079)	
SWIM	0.083	1.269	0.088	0.937	0.077	0.783
	(0.065)		(0.094)		(0.099)	
FITNESS	0.200	2.937**	0.237	2.418**	0.163	0.119
	(0.068)		(0.098)		(0.094)	
Constant	7.414	60.010**	7.416	45.152**	7.413	39.767**
	(0.124)		(0.179)		(0.186)	
F-value	23.731**		11.577**		10.588**	
Adj- R^2	0.703		0.691		0.681	

Note: *$p < 0.05$; **$p < 0.01$.

(Model 1), weekday sample (Model 2) and weekend sample (Model 3), are estimated separately. Model 1 provides a broad overview of the situation, but as we wish to distinguish between weekday and weekend effects, it is Models 2 and 3 that are of special interest.

The results of the three models are reported in Table 2. Overall, the explanatory power of the models is strong, explaining between 68 and 70% of the variations in prices as measured by the adjusted R^2.

Multicollinearity is often an issue in hedonic pricing models. Nonetheless, no definitive rules exist for determining whether multicollinearity is a serious problem in a particular hedonic application (Snyder *et al*, 2006). The variance

inflation factor (VIF) may be a method for detecting the seriousness of multicollinearity. According to Kennedy (1985), a VIF value greater than 10 is an indicator of the presence of such a problem. In our analysis, all VIF values of the independent variables in the three models are less than 5, suggesting that in this study's multicollinearity is not a serious problem.

Our analysis employs both continuous and discrete variables, corresponding to the 'quantitative' and 'qualitative' attributes referred to earlier. While the coefficient on continuous variables can be calculated and interpreted in the conventional way, in order to obtain similarly economically useful information from dummy variables that are being used to represent qualitative attributes in a log-linear hedonic pricing regression, it is necessary to transform the estimated coefficient by $(e^{\beta} - 1)$, where β is the coefficient and e is the base of the natural logarithm. This transformation gives the estimated effect of the dummy in percentage terms. The dollar values can be obtained by multiplying $(e^{\beta} - 1)$ by the average room rate in the sample (Monty and Skidmore, 2003).

Turning to our results, we note from Model 1 (whole sample) that nine variables, including hotels associated with chains (CHAIN), room size (ROOMSIZE), location in the city centre (LOCATION), LED TV (TV), bar/café (BAR), Internet access (INTERNET), shuttle bus service (SHUTTLE), conference facilities (CONFERENCE) and fitness centre (FITNESS), have significant effects on room rates.

In this model, the following five attributes have no effect on room rates: international tourist hotel (STAR), room with both bath and shower (BATH), provision of buffet-type breakfast (BREAKFAST), business centre (BUSINESS) and swimming pool (SWIM).

It is apparent, however, that since Model 1 conflates both weekday and weekend results, it is likely to obscure some of the important relations in our analysis. As we wish to explore in particular the effects of attributes on room rates for weekdays and for weekends, the results of Model 2 (weekday sample) and Model 3 (weekend sample) are, as already indicated, of potentially greater interest.

In Model 2, only five attributes, that is, LOCATION, TV, INTERNET, CONFERENCE and FITNESS, have effects on room rates. The rates for rooms with LED TV are about 19.7% higher than those for rooms without LED TV. The rates for rooms with Internet access are about 38.5% higher than those for rooms without such access. The rates in hotels with conference facilities are about 17.1% higher compared with those in hotels without conference facilities. Rates in hotels with a fitness centre are about 26.7% higher than those in hotels without this amenity. Whilst it is to be expected that the presence of these amenities typically will be an indicator of hotel 'quality', and therefore associated positively with room rates, it is surprising to find that the room size variable has no significant effect on rates. This is likely due to the fact that the target market segment during the week is made up largely of business people, who use the room essentially for accommodation only, and then only at night. It appears, therefore, that from the perspectives of both management and customers, business-related attributes such as conference facilities and Internet access are more important, on weekdays, than room size.

The analysis also yields the surprising (and counter-intuitive) result that rates in hotels located in the city centre are typically about 38.0% *lower* than those

of hotels lying outside of the city centre, *ceteris paribus*. We return to this question below.

Model 3 (weekend sample) suggests some differences in the significance of certain variables when compared with Model 2. While some attributes, such as LOCATION, TV and CONFERENCE, remain significant determinants of room rates, ROOMSIZE (β = 0.027) turns out to be significant but INTERNET (β = 0.223) and FITNESS (β = 0.163) turn out to be insignificant.

One explanation for the difference in the significance of ROOMSIZE in Models 2 and 3 is that, as is to be expected, room size is more important for a weekend leisure customer likely to stay for a longer period than for a weekday business customer requiring the room for one night only. The larger the room, therefore, the higher the room rate in the weekend sample. The reason for the insignificance of the INTERNET and FITNESS variables in Model 3, as compared with Model 2, is that since the weekend customer is typically a leisure traveller, the Internet is likely to be less useful than it would be for a weekday business customer. Moreover, the weekend leisure traveller visiting the city centre typically will wish to spend more time sightseeing than exercising in a fitness facility, while weekend customers visiting hotels outside of the city centre typically will pursue outdoor rather than indoor recreational activities. Rates in rooms with LED TV are about 19.1% higher than in those where LED TV is absent. Moreover, rates in hotels with conference facilities are about 22.4% higher than those in hotels without such facilities. As in Model 2, however, it is again interesting to observe that rates in hotels located in the city centre are about 39.4% lower than those in hotels out of the centre.

The STAR variable has an insignificant effect on rates in both the weekday and weekend models. This is because in Taipei many hotels that do not enjoy 'international star' status nevertheless offer high quality service. This means that customers will often be attracted to such hotels, rather than to those which have such status, and these hotels will be able to exploit this fact by setting rates comparable with the international star establishments. A similar explanation holds in the case of the CHAIN variable: again, any distinction between hotels that are part of a chain and those that are not is obscured to a large extent by the fact that non-chain hotels are often considered to be of comparable quality with those in a chain.

One possible explanation for the strongly negative relationship between LOCATION and rates, which is at variance both with intuition and with results obtained in earlier studies, is that in Taipei it is typically the case that hotels outside of the city are associated with resorts. These hotels offer a wide range of amenities such as hot springs and sports facilities, and this accounts to a large degree for the 'inversion' of rates between city centre and more distant locations. Many of these amenities are provided at a cost which is recovered in the room rate. In addition, the more competitive environment in city centres serves to keep rates lower than might otherwise be the case, given that costs per square metre in city locations are relatively high.

Where the SWIM variable is concerned, we observe that in all three models the association with rates is insignificant. This is because Taiwanese travellers visiting cities like Taipei typically prefer shopping, sightseeing and dining to swimming as a leisure activity. Some variables, such as BATH, BREAKFAST, BAR and SHUTTLE, appear to be insignificant determinants of rates in all

three models. These variables should be interpreted with caution. For the cases of BATH and BREAKFAST, it is difficult to obtain from the Eztravel.com Website sufficiently detailed information to enable us to identify precisely what each hotel is offering. Where BAR is concerned, the existence of numerous outside options diminishes the importance of the 'in-house' amenity from the customer's point of view. Finally, for many hotel customers in Taipei, the existence of a variety of inexpensive transport modes, and the fact that the majority of travellers do not travel by air, implies that few are heavily reliant on airport shuttles.

In order to rank the relative contributions of different attributes to the determination of room rates, we employ standardized or beta coefficients instead of unstandardized coefficients in the hedonic pricing function. Beta coefficients measure the change in the dependent variable that results from a one-standard deviation change in the independent variables. In this way, the non-scaling uniformity problem between the different coefficients (or implicit prices) can be eliminated. We remove the insignificant attributes and re-estimate the hedonic pricing function with significant attributes for both weekday and weekend samples to obtain the beta coefficients. Normalizing betas to add up to one, we illustrate the relative contribution of different attributes in Figures 1 and 2. The results highlight the relative importance of fitness facilities (32%), LED TV (20%), location (20%), conference facilities (17%) and Internet (11%) in the weekday sample. However, for the weekend sample, the corresponding results are: conference facilities (36%), LED TV (23%), room size (22%) and location (19%), respectively.

Conclusion

This paper employs a hedonic pricing model in order to investigate the significance of selected hotel attributes in the determination of room rates in Taipei. We offer results for both 'weekday' and 'weekend' models, and some explanations for these results. While some variables are associated with rates in a predictable way, some, such as hotel location and fitness facilities, are related in a counter-intuitive way. Moreover, it is evident that the relative importance of most explanatory variables changes according to whether it is a weekday or a weekend that is being considered.

For the hotel industry, it is generally the case that price is the only element of the marketing mix that produces revenues, while all others give rise to costs (Kotler *et al*, 1999). Pricing and price competition are problems of central importance to marketing in the industry, but despite this, they remain the least explored and understood. In the literature of tourism studies, little attention has been paid to the application of the hedonic pricing model to the price–quality relationship of products or services, despite the fact that hedonic pricing analysis makes it possible to identify the characteristics that are regarded as important by both hoteliers and customers, and the extent to which they are so (Falk, 2008). Marketers or managers of hotels can utilize information about the price–quality relationship in order to price products and design effective marketing strategies. Information about the role of different attributes in the determination of room rates can also provide an indication of the nature and

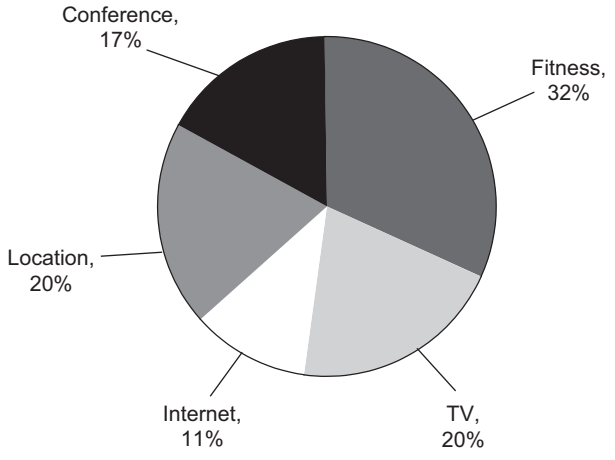

Figure 1. Attribute contributions in the weekday sample.

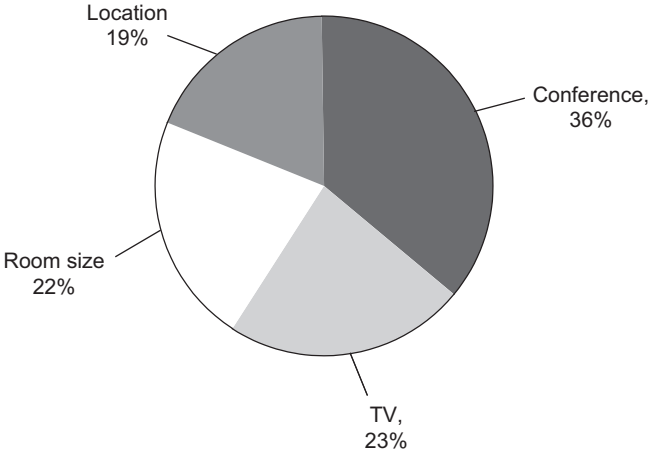

Figure 2. Attribute contributions in the weekend sample.

intensity of price competition in the industry. For these reasons, our results are intended as a contribution both to the literature on applications of the hedonic price approach and to the understanding of aspects of hotel pricing in Taipei.

Our results employ data collected from an Internet travel agent in order to analyse the way in which the price–quality relationship reflects pricing strategies. Future research might usefully explore the consumer's evaluation of this relationship and the implied willingness-to-pay for hotel rooms by using data collected directly from consumers themselves. This may be done by applying a revealed preference model (for example, the hedonic pricing model) or a stated preference model (for example, discrete-choice model or conjoint analysis), which can readily reflect the consumer's perspective.

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