How Does Respect for the Environment Affect Final Prices in the Hospitality Sector? A Hedonic Pricing Approach

José Luis Sánchez-Ollero¹, Alejandro García-Pozo¹, and Andrés Marchante-Mera¹

Abstract
Hedonic pricing theory states that the price of a room is determined by a set of characteristics (e.g., structural, location, and environmental) of the establishment. Set within the framework of this methodology, and using raw data from the Quality, Productivity, and Competitiveness in the Hospitality Industry for Andalusia project, this article discusses the impact on room pricing of hotels implementing environmental sustainability measures based on a sample of 232 hotels (3-, 4-, and 5-stars) in Andalusia (Southern Spain). This sample is statistically representative of hotel accommodations in the region. A distinguishing feature of this study is the creation of a variable derived from the replies given by hotel managers to a questionnaire designed by the authors. The questionnaire presented questions about the measures the managers implemented in their establishments to improve environmental sustainability. The use of this variable in the semilogarithmic hedonic model suggests that the prices of hotel rooms are 5.15-percent higher for each environmentally sustainable measure implemented in the hotel; in some cases, the price increase could be as much as 36.05 percent. Other variables that were also introduced in the model yielded estimates consistent with those obtained in previous studies.

Keywords
Andalusia, environment, hedonic pricing, hotel, room rates

Introduction
According to the 2009 Regional Accounts of Spain,¹ the hospitality sector (i.e., hotels, restaurants, and bars) represented 7.1 percent of the nominal gross domestic product (GDP) in Andalusia and employed 7.65 percent of the active population in this region. From the perspective of supply and demand, hotel accommodation figures are also substantial; in 2009, Andalusian hotels offered a monthly average of 244,349 beds (17.91% of the Spanish total) and recorded a total of 40,681,216 overnight stays (16.21% of the total national overnight stays).

The economic relevance of hotel accommodation, not only for Spain and Andalusia but also worldwide (Hernández and León 2013), is shown by the vast and well-known body of research literature that has used widely varying methodological approaches to investigate various aspects of this sector. In our case, using hedonic methodology, we analyze the impact of implementing environmentally sustainable measures and attitudes in hotels on room pricing.

Environmental responsibility is a task fundamentally shared by the local government, companies, and consumers, as well as the media, which are able to exert pressure and change opinions by spreading information that promotes environmental protection (J. A. Mondéjar-Jiménez et al. 2011; Pérez-Calderón, Milanés-Montero, and Ortega-Rossell 2011; Segarra-Oña et al. 2012). For the European Union’s Executive Agency for Competitiveness and Innovation (2013):

Eco-innovation is about changing consumption and production patterns and market uptake of technologies, products and services to reduce our impact on the environment. Business and innovation come together to create sustainable solutions that make better use of precious resources, reduce the negative side-effects of our economy on the environment and create economic benefits and competitive advantage.²

This way of thinking is having an effect on the behavior of consumers and firms. In relation to the demand side of the tourism sector, many authors have shown that the environment is the main factor for tourists—sometimes a decisive one—when making purchasing decisions (Hillary et al.

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2001). Furthermore, client behavior is increasingly influenced by the environmental variable regarding the reasons for traveling and the final choice of destination and service provider (Sánchez-Ollero, García-Pozo, and Marchante-Lara 2012). It is important to pay attention to the notion of “existence value,” which is a concept broadly used in economic as well as in environmental sciences. McConnell (1997, 24) defined the existence value as “a person’s willingness to pay for the preservation, protection, or enhancement of resources for which he or she has no plans for personal use” and analyzes the motives for this consumer behavior. Since Krutilla (1967), many authors have been analyzing the consumer’s willingness-to-pay in connection with people’s ability to obtain utility from resources that they really do not use. Other closely related terms are preservation value (Walsh, Sanders, and Loomis 1985), bequest value (Krutilla 1967; McConnell 1983), and passive-use value (Arrow et al. 1993). Many authors have found evidence of this behavior. As an example, Kostakis and Sardianou (2012) have found a statistically significant relationship that shows how the personal characteristics of the tourists (primarily age) influence their willingness to pay. The importance of age on willingness to pay for renewable energy in hotels was also reported by Dalton, Lockington, and Baldock (2008). In another vein, Buhalis (1999) found evidence that the deterioration of the tourism product and image leads to a lower willingness to pay.

On the supply side, the environmental perceptions of entrepreneurs are included in their approach to management, but, as Peiró-Signes et al. (2013) and Cvelbar and Dwyer (2013) pointed out, the mechanisms with which firms improve their competitiveness through a proactive environmental strategy remain controversial. Currently, changes in client behavior seem to confirm that an increasing environmental awareness of customers has led to a greater demand for goods and services that are environmentally friendly (Ludevid 2000). In this sense, some authors have even suggested the use of the term “green consumer” (Bigné 1997). This highlights the fact that, provided the environmental setting is valued by clients, it becomes a differentiating output that is important in marketing strategies (Dabija and Pop 2013).

Customers can be made aware of environmental improvements in two ways: (1) the firm indicates its commitment to the environment as a quality item, or (2) an eco-label or eco-indicator shows the establishment’s commitment to sustainability. In both cases, environmental compliance may be considered an element that increases the quality of the tourism product and has economic value for the consumer.

Therefore, the environmental variable can be considered an attribute of the service provided by hotels (J. Mondéjar-Jiménez et al. 2013). In this regard, it becomes one of the heterogeneous services that have a set of attributes that determine the behavior of the consumers and establishments alike. Due to this fact, hedonic methodology appears well suited to analyze the impact of environmental variables on the pricing of hotel rooms. Environmental variables can be understood as a differentiating attribute that increases service quality, because these attributes are demanded by consumers and can be directly observed by them (Uriel et al. 2001). Using the database from the research project Quality, Productivity, and Competitiveness in the Hospitality Industry in Andalusia (PO7/SEJ-02889), we investigate whether environmental variables have an impact on room pricing and analyze the relevance of these measures to pricing.

**Hotels and the Environment in the Hedonic Literature**

The fundamental reason for the rise of hedonic pricing models is the existence of goods and services that are well differentiated according to their attributes. The first studies (Court 1939; Hass 1922; Wallace 1926; Waught 1928, 1929) analyzed the price of a given good by investigating the variations in product quality, which would be measured by the product’s attributes and the implicit prices such attributes would have in a hypothetical attribute market. In this way, it is possible to differentiate between price changes due to changes in the subjective assessment of the agents and those due to objective changes in the quality or quantity of the attributes intrinsic to the product.

The first contributions were essentially empirical and ad hoc. Griliches (1961) formalized the method by becoming interested in the effect of quality changes on pricing and measured indexes. His objective was to discover whether there was any relationship between the price of a commodity and its quality.

The first attempts to create a theoretical formulation of the hedonic model were made by Houthakker (1952) and Tinbergen (1956). In the mid-1960s, Lancaster (1966) formulated consumer-behavior theory oriented toward the demand for heterogeneous goods with objectively assessable and identifiable attributes. Finally, Rosen (1974) provided the hedonic methodology with microeconomic fundamentals that made it suitable for formalizing empirical contributions. From that time onward, the model developed by Rosen was widely accepted.

From an analytical point of view, applying Rosen’s model involves obtaining a pricing function that associates the price of the differentiated product $P$ with its attributes $x_1, \ldots, x_k$. Thus, $P = f(x_1, \ldots, x_k)$, where the implicit prices of the attributes would be determined by $\partial P/\partial x_i$, and the values obtained would change depending on the form of the hedonic function chosen. The implicit prices are expressed as the implicit marginal value provided by the buyers and sellers of each attribute (i.e., the price each attribute takes in each implicit market $k$, while everything else remains constant).
This methodology is widely used in many fields of economics to analyze heterogeneous goods and services. In particular, it has been extensively applied to the following fields: the housing market (García-Pozo 2009; Goodman and Thibodeau 2003; Mills and Simenauer 1996; Small and Steimetz 2012); the labor market (Flabbia and Maroc 2012; Goldhaber, Destler, and Player 2010); the incidence of various factors, often related to house pricing, and their impact on the environment (Boyle and Kiel 2001; Kuminoff, Parmeter, and Pope 2010; Nelson 2004); and finally, the tourism sector and its subsectors, which has attracted the interest of many researchers due to its diverse character (including accommodation, catering, passenger transport, travel agents, and leisure). Whereas hotel accommodation has been the type of tourist accommodation most widely analyzed, other types of accommodations, such as campsites, have also been studied using this methodology (García-Pozo, Sánchez-Ollero, and Marchante-Lara 2011).

As we indicated above, because hotel accommodations are characterized as having multiple attributes and values, hedonic pricing analysis provides better results than other techniques for market analysis. As Thrane (2005) pointed out, this methodology attempts to assess the impact of several attributes on implicit prices, the impact of implicit prices on pricing accommodation services, and therefore their impact on individual utility levels of consumers.

The hedonic literature on hotel accommodation has mainly attempted to explain two types of price variable by the presence of different attributes in hotels: on one hand, the pricing of holiday packages using information mainly obtained from printed or online tour operator catalogs (e.g., Aguiló, Alegre, and Riera 2001; Alegre, Cladera, and Sard 2012; Espinet et al. 2003; Papatheodorou 2002; Sinclair, Clewer, and Pack 1990; Thrane 2005); and on the other hand, hotel room pricing using data obtained from tourist agents’ or public bodies’ websites (e.g., Abrate, Capriello, and Fraquelli 2011; Fleischer 2012; Israeli 2002; Thrane 2007; Uriel et al. 2001). The results obtained by these studies show that the attributes analyzed (i.e., location, establishment star-rating, number of rooms, services provided) have a significant influence on pricing. In particular, any attribute that involves an improvement in service has a positive influence on the price of this service. Thus, improvements in service quality not only increase the price of accommodation but also increase the individual utility for consumers.

The level of environmental sustainability of the activities carried out by hotels is an attribute rarely used in hedonic models to explain factors that have an impact on pricing accommodation. Research suggests that implementation of measures that promote care and concern for the local environment will generate an increase in the perceived quality of the service and this may increase consumer satisfaction (Gómez, Lozano, and Rey-Maquieira 2008), and moreover, that care for the environment will be a differentiating attribute over competitors and will lead to competitive advantages (Ladhari 2009).

To our knowledge, Kuminoff, Zhang, and Rudi (2010) are the only researchers who have used an environmental attribute to explain hotel pricing by using a hedonic function. They conducted their research in Virginia (USA) during 2008 and used a dummy variable to represent whether a hotel had green certification granted by the Virginia Department of Environmental Quality. The results obtained using different models of linear regression suggest that the standard room in a “green” hotel was priced between US$17 and US$23 higher than the same room in establishments with no environmental certification.

The model proposed in our article follows the methodology developed in the work of Rosen (1974) and is based on the semilogarithmic relationship between the price of a hotel room and a variable representing the implementation of measures favoring environmental sustainability. The inclusion of this variable is a distinguishing feature of our study. We have also included two control variables (the number of quality certificates or mentions, and the number of environmental quality certifications or mentions awarded to the hotel) to adjust for the effect of the environmental variable on room pricing. Finally, we have included a set of variables that represent structural and location attributes traditionally used in hedonic models of the hotel industry. All these variables are defined in the following section. The estimated equation is as follows:

\[
\ln p_i = \beta_0 + \epsilon_i \epsilon + \sum_{j=1}^{2} \chi_j \psi_j + \sum_{k=1}^{8} \beta_k z_{ki} + u_i, \tag{1}
\]

where \(p_i\) is the price of the room in each hotel, \(\epsilon_i\) is the environmental variable, \(\psi_j\) are the control variables, and \(z_{ki}\) are the structural and location variables. Finally, \(u_i\) represents the disturbance term, with the usual assumptions.

Data and Descriptive Analysis

Sample and Data

As we indicated, the database was created as part of the project *Quality, Productivity, and Competitiveness in the Hospitality Industry for Andalusia* (PO7/SEJ-02889). It includes representative parameters from 232 Andalusian hotels (96 rated as 3-star, 126 as 4-star, and 10 as 5-star) offering a total of 64,036 beds and representing 35 percent of the total beds offered by these types of establishments in Andalusia at the end of 2009. These parameters were obtained from semistructured questionnaires administered to the hotel managers by the researchers. According to SIMA (the System of Multiterritorial Information of Andalusia), which was created by the Institute of Statistics and Cartography of Andalusia, there were a total of 822...
establishments in these categories in Andalusia in 2009, and thus the database provides direct information on 28.2 percent of all hotels in the region. Based on this result, a directory of the hotels to be surveyed was created using the Turespaña Hotel Guide, which lists certified hotels published by the local government of Andalusia (Junta de Andalucía). The final sample size of 232 hotels was achieved after discarding the questionnaires that had not been correctly completed. Fieldwork was conducted in person by researchers from the universities of Malaga, Granada, and Seville during spring and summer 2010.

**Variables and Measures**

The hedonic function that we described above was modeled using the eleven independent variables, defined in Exhibit 1, that were selected from a broad group of potential variables collected in the questionnaire. These formed the basis for building the database. An exploratory analysis of the variables available was performed using a correlation matrix to identify the presence of multicollinearity, which was found between some of the independent variables. These were removed from the model during the first stage, as suggested by Novales (1993), provided that their removal did not modify the structural significance of the model. In addition, it should be emphasized that none of the variables related to the impact of environmental variables on hotel room pricing presented multicollinearity. In a second stage, the variance inflation factor (VIF) was used to detect whether there was severe multicollinearity between the independent variables included in our hedonic model (using the method suggested by Kutner, Nachtsheim, and Neter 2004). In our work, all the independent variables had a VIF value less than 2.6, far less than the value of 5, which according to Kutner, Nachtsheim, and Neter indicates the absence of severe multicollinearity.

As indicated in Exhibit 1, the dependent variable (Price) in the model expresses the mean daily price of a double room with breakfast included during the high season (July 20-26, 2009). The decision to use data from one week in high season was taken to avoid potential problems related to seasonality. To create a more homogeneous value for the dependent variable, the price of the service reported by the respondents was recorded for a full week and the mean daily price was then calculated as an average.

The independent variables were discrete variables. Several of these were dummy variables representing qualitative attributes that had an effect on the price of the reference

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### Exhibit 1: Variable Names and Definitions

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td><strong>Price</strong></td>
<td>The mean daily price for a double room including breakfast, calculated according to the stay occurring in the week, July 20-26, 2009, during the high season (€)</td>
</tr>
</tbody>
</table>
| **Environmental_involvement** | Environmentally sustainable measures adopted by the establishment, calculated according to the manager’s answers to seven questions:  
1. Does the establishment quantify environmental costs and savings?  
2. Does the establishment provide employees with training on environmental issues?  
3. Does the establishment apply “green purchasing” policies?  
4. Is the variable environment used in marketing strategies and campaigns?  
5. Does the establishment apply energy and water saving measures?  
6. Does the establishment recycle waste?  
7. Does the establishment encourage environmental awareness among employees through meetings and advice? |
| **Number_of_Q_certf** | Number of quality certifications or mentions awarded to the hotel |
| **Number_of_environmental_certf** | Number of environmental quality certifications or mentions awarded to the hotel |
| **Star-rating** | The star-rating of the hotels |
| **Coast** | The dummy variable is equal to 1 if the establishment is located on the coast |
| **Capital** | The dummy variable is equal to 1 if the establishment is located in the capital of the province |
| **Inland** | The dummy variable is equal to 1 if the establishment is located far from the coast (reference variable for the other two location variables) |
| **Spa** | The dummy variable is equal to 1 if the establishment offers spa services to its clients |
| **Entertainment** | The dummy variable is equal to 1 if the establishment offers entertainment and leisure activities to its clients |
| **Golf** | The dummy variable is equal to 1 if the establishment offers the opportunity to play golf to its clients |
| **Shuttle_Transfer** | The dummy variable is equal to 1 if the establishment provides shuttle services between the hotel and transport stations and airports |
| **Pool** | The dummy variable is equal to 1 if the establishment has a swimming pool for its clients |
room (i.e., location, services, and structural attributes), whereas others took integer values within defined ranges based on the attribute represented. Note that the discrete variables reflect the impact of the hotel’s environmental involvement and its commitment to quality on pricing. For our analysis, we created the variable Environmental involvement, which represents the commitment of the establishment to introduce measures that encourage environmental sustainability. The value of this variable was obtained by awarding a score of 1 for an affirmative reply to each of seven questions regarding environmental involvement (see Exhibit 1). This approach is similar to the one used by Sinclair, Clever, and Pack (1990); Abrate, Capiello, and Fraquelli (2011); and García-Pozo, Sánchez-Ollero, and Marchante-Lara (2011) to construct explanatory variables on services provision. In this way, we built an index of environmental involvement of the establishment with values ranging from 0 to 7, where a value of 0 applied to establishments that had not implemented any measure to improve sustainability, and 7 indicated any hotel that had implemented all seven measures, indicating a high commitment to environmental sustainability.

Finally, the variables Number_of_Q_certf and Num_of_environmental_certf are used as control variables of environmental involvement. These represent the number of quality certificates or mentions (e.g., Q for tourist quality, ISO 9000 family, Andalusian Award for Hotel Quality) awarded to the establishment and the number of certifications or mentions that acknowledge the establishment’s efforts to implement sustainable measures (e.g., ISO 14001, Eco-Management and Audit Scheme [EMAS], and Biosphere, as well as other specific labels awarded by hotel chains or public administration bodies). The “Q-verde,” awarded by the Spanish Tourist Administration, was especially valued by this sector.

**Descriptive Analysis**

The reference establishment for the entire sample was defined as a hotel where a double room including breakfast would cost €97.01 per day in the high season. This hypothetical establishment would have a rating of 3.64 stars, be located on the coast (36%) or in a capital city (46%), and would not necessarily provide added-value services (as the dummy variables representing these attributes reached just 50%). However, this hotel would have been awarded some quality certifications. Regarding environmental quality certifications, the hotel would have implemented few sustainable measures because the mean value reached by the reference establishment is well below the average index created for environmental involvement (3.5). The number of official certifications awarded for sustainable practices is even lower, as the reference hotel would only have 0.15 certificates. The reason for this may be that environmental certifications are expensive and need to be renewed every year. Many hotels in Spain chose not to renew certification because of economic crisis but maintain their efforts in this field, hence the higher mean of environment involvement.

Exhibit 2 shows the environmentally sustainable measures implemented by the hotels in the sample according to the results of the survey (matching the seven questions in Exhibit 1). While the data show that few hotels in Andalusia implement sustainable measures, Andalusian hoteliers are not alone in this regard. As noted by Butler (2008), the hotel industry in general has been waiting to see an increase in consumer demand and a decrease in costs before fully adopting “green” management. However, the slow introduction of these measures has been shaped by clients’ beliefs that being “green” is not important or that it involves an undesirable increase in hotel prices.

Exhibit 2 shows that the only data of relevance are that most establishments have implemented energy and water saving measures (75.6%) and recycling waste measures (66.9%). However, these two measures are driven by current environmental regulations in Spain that require the application of environmental protocols to obtain planning permission. In a negative sense, the data also show that there has been little effort to introduce measures to evaluate the costs and savings involved in promoting attitudes and actions aimed at encouraging sustainability in hotels (24.6%).

**Results**

The results of estimating equation (1) are shown in Exhibit 3, column (b). Column (a) shows the restricted regression...
Estimated using environmental involvement as the only independent variable. The values for the implicit prices associated with the coefficients estimated for equation (1) are also shown.

The restricted regression shows that implementing sustainable measures generates higher hotel room prices, with an increase of 10.35 percent for each measure introduced.

Control variables were added in the full model to adjust for the estimation of the environmental variable as well as the structural and location variables. All the coefficient estimates had the expected signs and were statistically significant.

Note that when the variables were introduced in the full model, the implementation of each of the seven environmental measures described in the questionnaire had a highly significant impact on room price. In fact, each environmental measure implemented increased the price by 5.15 percent (€4.9974). Thus, any hypothetical establishment that implemented the seven measures would increase its room price by 36.05 percent compared with those that do not. This shows that the costs associated with any investment in environmental sustainability made by hotels are passed onto the customers. As can be derived from the principles of hedonic models, the customers are willing to pay a higher price because they value sustainability.

The certifications variables (number of quality certifications and number of environmental quality certifications or mentions awarded to the establishments) had a similar impact on price, as the room price increased by 5.16 percent for each quality certification and 4.16 percent for each environmental quality certification.

In general, due to the type of tourism attracted to Andalusia, the price of rooms in hotels located on the coast is 8.56 percent higher than the reference value of hotels located in the capital city, and those inland are 10.33 percent lower, when compared with the reference hotels. Like the other dummy variables, the coefficients are interpreted in line with Halvorsen and Palmquist (1980).

The variables providing information on the added-value services offered to customers by the hotel show varying values, ranging from 1.88 percent—increased prices when the hotel offers entertainment activities—to 12.86 percent when swimming pools are available. Our estimates are compatible with the results of studies using similar variables (see Alegre, Cladera, and Sard 2012; Espinet et al. 2012; Kuminoff et al. 2010 for the Spanish economy). However, it should be noted that in some cases, the studies were conducted in different areas and periods, and that the variables used differed from each other.

### Conclusion

The results from the regression analysis presented here show that room prices increase when the quality of hotel services is improved by implementing environmental sustainability measures. According to the hedonic methodology used, this means that consumers positively value the implementation of environmentally sustainable measures.
because, by increasing its utility, they are willing to pay a premium price for the service provided. Note that the willing-
to-pay is the maximum amount that a tourist will pay for a
good or service (Keske, Lohman, and Loomis 2013), and
expresses how much a tourist values a good or service. We
conclude that, despite the potentially high fixed costs of
implementing environmental measures, the positive response
of consumers toward improved environmental quality may
be an incentive to invest in these measures.

However, the coefficient estimates for the variables represen-
ting the additional services provided by the hotel show that
the greatest impact on price comes from having a spa and
swimming pool in the establishment. Together with the fact
that the price is further increased by the hotel being located
on the coast, this suggests that tourism in Andalusia is still largely
focused on sun and beach. This continues to be the case
despite potential customers being exposed to the constant
advertising campaigns by local governments to promote other
types of tourism in Andalusia. Investing in environmental sus-
tainability measures and making them known to potential cli-
ents would help to increase the number of customers. This
would particularly apply to inland hotels, where nature-based
activities are already their main attraction and whose potential
clients positively regard environmental sustainability.

This study’s limitations relate to the environmental infor-
mation available in the database used and the limited num-
ber of structural variables. In addition, our database only
includes hotels located in Andalusia rated as 3 to 5 stars.
Many authors (e.g., Tzschentke, Kirk, and Lynch 2004)
have pointed out that environmental performance decreased
significantly with hotel size, and there is a close relationship
between star-ratings and hotel size. Furthermore, our result
may be a function of a snapshot in time, and the tourist’s
willfulness to pay a surplus for environment could decrease
on the margin if all the hotels implemented the same envi-
ronmental initiatives. Unfortunately, our database only con-
tains data for a single week of a single year. Future research
should include more relevant information and data from
hotels of several regions, including small size and owner-
operated establishments, to better determine the extent to
which the hotel industry is involved in environmental sus-
tainability and its impact on the demand for this service.

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Notes

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