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An Analysis of Spanish Hotel Efficiency

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Abstract

Using data envelopment analysis, this paper investigates operational efficiency drivers for 166 Spanish hotels divided into medium and upper chain scale groups from 2000 through 2009. For the sample as a whole, the analysis indicated a strong relationship between quality levels and efficiency; resort hotels were more efficient than other types of properties, and large hotels were more efficient than smaller properties. The effects of star rating were shown in diverse findings regarding intangible investment and group membership. Midscale hotels belonging to a hotel group were more efficient, but that was not true of upscale properties. Quality represented a boost for midscale hotels but not for upscale properties. However, upscale properties had gained efficiency from investments in intangibles (such as information systems), while the midlevel hotels had not made those investments.

Keywords

hotel management; operations; competitive strategy; strategy formulation; strategy implementation; strategy and organizational performance; strategic management

Given the importance of tourism and the hotel industry to Spain's economic development, we wanted to investigate the factors that contribute to (or impede) the efficiency of Spanish hotels as a means of increasing their competitiveness. Economic efficiency is a primary issue in hotels' competitiveness. In this case, we analyze economic efficiency, which is understood as a property of resource allocation that attempts to maximize the surplus received by members of an organization (Pestana and Almeida 2006).

Differences in economic efficiency in the hospitality industry may stem from a number of factors, such as the establishment's size (Anderson et al. 1999), capital accumulation and innovation rate (Barros and Alves 2004), quality (Brown and Ragsdale 2002), and market segment (Claver, Molina, and Pereira 2007; Cool and Schendel 1988). Thus, we wanted to understand how these factors drive the efficiency of Spanish hotels. Although there have been empirical studies on Spanish hotels, they have used relatively small samples, targeted a particular sector, or compared the factors that drive hotels' levels of efficiency within their local or provincial market. We thought it would be more effective to study hotels' efficiency in the context of the overall economic situation of the Spanish hotel sector and the drivers of efficiency levels. In this paper, we provide an assessment of Spain's hotel industry based on the drivers of economic efficiency and suggest actions to improve performance.

Our analysis uses frontier models based on data envelopment analysis (DEA) to estimate the efficiency of hotels in the sample. Then, we run a regression analysis to determine the dependence between the results for efficiency and the hypothesis of the explanatory variables to answer the following questions:

1. Which drivers of efficiency are significant in the Spanish hotel industry, and what are their respective strengths?
2. Which specific factors should be targeted to eliminate the inefficiencies and enhance the competitiveness of ineffective hotels?

Contextual Setting

Spain is ranked second among the world's most visited countries, behind France (World Tourism Organization [UNWTO] 2010). The Spanish hotel industry employs 2.5 million workers, representing 10.8 percent of all active workers in the nation, and 15.9 percent of all employees in Spain's service sector work for hotels (Instituto de Estudios Turísticos [IET] 2009). There are currently more than 1.6 million hotel beds in Spain, distributed among 16,389 hotels, with a cumulative average of over 77 million guests per year. Approximately 53 percent of these establishments are rated between one and five stars. Approximately 62

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Exhibit 1:
Determinants of Efficiency in the Hotel Industry.

Variable	Measure	Study	Predicted sign
Quality (QLT)	Quality certificate number	Camisón (1996), Costa (2004), Fine (1983), Ghobadian and Gallear (2001), Ingram and Daskalakis (1999), McCracken and Kaynak (1996), Poon (1993), Wheelwright (1981).	+
		Ingram and Daskalakis (1999), Joubert (1998), Kanji (1998), Nield and Kozak (1999), Quazi and Padibjo (1998), Singels, Ruël, and Van de Water (2001), Yahya and Goh (2001)	−
Belonging to a group (CHN)	Chain hotel	Ingram (1996), Ingram and Baum (1997), Israeli (2002), Israeli and Uriely (2000), Lin (2011), Mathews (2000), Pine and Phillips (2005)	+
Intangibles (INT)	Intangible assets	Camisón (1995), Claver, Molina, and Pereira (2007), Kim (2011); Namasivayam, Enz, and Siguaw (2000), Nemec and Mihalic (2007), Roubi (2004), Siguaw, Enz, and Namasivayam (2000)	+
		Jerman, Kavcic, and Kavcic (2009), Siguaw, Enz, and Namasivayam (2000)	−
Market segment (SGM)	Zone of destination	Claver, Molina, and Pereira (2007), Cool and Schendel (1988)	+
Size (SIZ)	Log total assets	Baum and Mezias (1992), Brown and Dev (1999), Pine and Phillips (2005), Sanjeev (2007)	+
		Jones and Siag (2009), Tsaur (2001)	−

Source. The Authors (2013).

percent of all overnight stays were booked by foreigners (Instituto nacional de Estadística [INE] 2010).

The Spanish hotel industry has recognized the need to further develop and modernize the tourist infrastructure. These changes include improving energy savings and service quality, upgrading facilities, and reducing acoustic and light pollution. In addition, a wide range of public funds is available to promote the use of new technologies in the sector. Improving the offerings and conditions of complementary tourist services are increasingly considered a requirement for developing the hotel sector. In the midst of this revolution, we suggest that hoteliers will benefit from an understanding of the sources of efficiency and competitive advantage.

Literature Review

With its DEA methodology, this paper contributes to the existing literature on the efficiency of the hotel industry. A limited number of papers have measured hotels' efficiency, as we discuss below, although several studies have suggested structural variables that could be used to explain efficiency, such as size, service quality, membership in a group, the availability of intangible resources, and the strategic structure of the market segment (see Exhibit 1).

Among these variables, the level of service quality offered by hotels has received considerable attention (Brown and Dev 1999; Gomez, Yasin, and Lisboa 2007). Research has reflected the hotel industry's growing concern about service quality owing to its potential impact on operations (Antony, Antony, and Gosh 2004; Johns 1995; Rust, Zahorik, and Keiningham 1995) and efficiency (Camisón 1996; Ghobadian and Gallear 2001). Wheelwright (1981) and Fine (1983) argue that, according to the quality learning curve, increasing service quality while reducing the direct unit costs of production is feasible. Improving service quality is a good means of increasing a hotel's competitiveness (Costa 2004; H. Ingram and Daskalakis 1999; Poon 1993). The study by McCracken and Kaynak (1996) confirms this conclusion, as these studies found a positive relationship between quality and productivity, including labor, materials, and capital. Therefore, a negative relationship between quality and production cost is predicted. Despite this finding, the literature also identifies a number of disadvantages connected with service quality improvement (Joubert 1998; Kanji 1998; Quazi and Padibjo 1998; Singels, Ruël, and Van de Water 2001; Yahya and Goh 2001), primarily the time and expense incurred in obtaining an official certification of quality and the resulting operational overhead (H. Ingram and Daskalakis 1999; Nield and Kozak 1999).

Several researchers have examined the relevance of size in explaining efficiency (Baum and Mezias 1992; Sanjeev 2007). Pine and Phillips (2005) argue that larger hotels have better performance and occupancy levels, and those researchers identified a positive relationship between star ratings and occupancy levels, as did Brown and Dev (1999). While Jones and Siag (2009) have shown that the relationship between size and capital productivity is not significant, this relationship is significant for several indicators of labor productivity. In addition, Tsaur (2001) suggests that hotels can improve their efficiency by reducing the number of rooms and spaces dedicated to catering.

Some studies have shown that hotels belonging to a group (i.e., a chain) have an improved probability of survival (P. Ingram 1996; Lin 2011) and that belonging to such a group provides many advantages, such as greater commercial capacity, better service quality, the capacity to offer more services to clients, and increased financial capacity to engage in investment projects (P. Ingram and Baum 1997; Israeli 2002; Israeli and Uriely 2000; Mathews 2000; Pine and Phillips 2005).

Studies of the strategic landscape of a hotel's market segment, which refers to the type of products and services offered (Cool and Schendel 1988), have produced limited conclusions due to using overly homogeneous samples that only include hotels within a certain zone or city. Therefore, future lines of investigation for this proposed variable must include univariate groups (Claver, Molina, and Pereira 2007).

Finally, a thread of studies has identified the strategic importance of intangible assets as they relate to hospitality efficiency, but so far no definition of intangibles has been globally accepted (Kristandl and Bontis 2007). IAS 38.8 defines intangible assets as identifiable non-monetary assets lacking physical substance. Several studies have associated intangibles with intellectual capital, but a study by Jerman, Kavcic, and Kavcic (2009) on hotels in Croatia, Slovenia, and Austria suggests that the hospitality industry has not yet invested heavily in intangible assets. That said, Nemec and Mihalic (2007) and Kim (2011) demonstrated that intellectual capital has a significant impact on hotels' financial performance.

Studies on another type of intangible, new information and communication technologies, have found increased efficiency (Camisón 1995; Claver, Molina and Pereira 2007). A study by Siguaw, Enz, and Namasivayam (2000) on hotels in the United States showed that the use of information technology increases productivity, for instance. Their results showed that the use of information technology in establishments belonging to a group was greater than in independent hotels. In addition, the study of the United States by Namasivayam, Enz, and Siguaw (2000) documented differences in the adoption of technologies to improve efficiency among a range of hotel service processes.

DEA Analysis

Measuring efficiency using DEA was proposed by Farrell (1957) and expanded by Charnes, Cooper, and Rhodes (1978). Charnes et al. (1982) used a mathematical programming approach to construct production frontiers with an input orientation, assuming constant returns to scale (CRS). Input orientation attempts to obtain a maximum proportional reduction in the input vector while holding the level of outputs constant. Therefore, a production unit is not efficient if it is possible to minimize any input without changing its outputs. However, the CRS hypothesis refers to the returns to scale that are typical of production technology, that is, the way production factors or inputs are combined to obtain products or outputs, which in this case are assumed to be obtained as constant returns.

DEA has been used to study efficiency in hotels, using a number of inputs and outputs. Morey and Dittman (1995) used seven inputs and four outputs to analyze fifty-four hotels belonging to a North American chain; Hwang and Chang (2003) used DEA to evaluate the efficiency strategies employed by hotels in Taiwan from 1994 to 1998; and Barros and Mascarenhas (2005) applied DEA to analyze efficiency in small Portuguese hotels in 2001.

Our analysis uses an output orientation to measure technical efficiency (Barros and Dieke 2008), where the efficiency of each company or unit is characterized by its ability to increase outputs without increasing inputs. The DEA approach generally assumes that all of the establishments in a given sample have access to the same technology when transforming a vector of N factors (inputs), denoted as x, into a vector of M products (i.e., outputs), denoted as y. It is assumed that technology T can be characterized by the set defined as follows:

$$T = \left\{ (x, y) \in R^N \times R^M : x \in R^N \quad if\ R^M R \right\}. \tag{1}$$

The distance from each unit's real value to the frontier is taken as a measurement of inefficiency. Following Barros and Dieke (2008), we used an output orientation to estimate the technical efficiency (ET) of the j units analyzed by solving the following mathematical program:

$$\mathrm{ET}\left(x^j, y^j\right) = \max\left\{0 : \left(x^j, y^{j0}\right) \in T\right\}. \tag{2}$$

In practice, T is unobservable and can be replaced by a DEA estimator (τ):

$$\tau = \{(x, y) \in R^N \times R^M \tag{3}$$

This estimator must also fulfill the following constraints:

$$\sum_{k=1}^{n} L_k Y_m^k \geq Y_m \quad m = 1, \ldots, M \tag{4}$$

$$\sum_{k=1}^{n} L_k X_i^k \leq X_i \quad i = 1, \ldots, N \tag{5}$$

$$L_K \geq 0 \quad K = 1, \ ,\} \tag{6}$$

Under the output orientation used, Equation 4 requires that the set of results optimized by model (Equation 3) and represented by k has a number of outputs ($L_k\, y_m^k$) greater than or equal to those already existing (y_m). Equation 5 limits the solution to the non-increase of inputs, and Equation (6) defines the non-negativity of the intensity variable with which program L_k is optimized.

Once the DEA results are obtained, they must be applied to the regression analysis to determine the dependence between these results and the hypothetical explanatory variables. For this purpose, we use a binomial logistic regression, which is a suitable method for identifying the differences between two groups with a known distribution (Kennedy 2003). This also works because most of the variables used in this paper are discrete rather than continuous. Even variables that are nominally continuous, such as quality, are measured discretely, in this case by a dummy variable based on the number of quality certificates. As explained further, the dummy variable is set to zero if the hotel has one certificate or none at all. Likewise, intangible investment, which is relatively scarce for many hotels, can be better calculated using a discrete variable.

The logistic regression model is based on the quotient of probability, representing the probability of success compared with the probability of failure. This quotient is expressed as follows:

$$\frac{P(E)}{(1-P(E))} \tag{7}$$

where $P(E)$ is the probability of success. In addition, the logit model can be expressed as a linear function of different independent variables as follows:

$$\log\left\{\frac{P(E)}{(1-P(E))}\right\} = \beta_0 + \beta_1 X_1 + \quad + \beta_n X_n \tag{8}$$

where β_0 is the intercept coefficient for the function, β_i represents the coefficients of the independent variables, and X_i represents the values of these variables.

The estimated values of the dependent variable can be interpreted as a predicted probability with values ranging between zero and one. Therefore, by calculating the value of $P(E)$ in Equation 8, the predicted probability of efficiency is defined as follows:

$$P(E) = \frac{e^y}{1+e^y}.$$

where e is the natural logarithm base.

$$y = \beta_0 + \beta_1 X_1 + \cdots + \beta_n X_n. \tag{9}$$

We classified the establishments as either "efficient" or "inefficient" by using the logit value (y) of the model in (Equation 9), where establishments with a $P(E)$ less than or equal to 0.5 are classified as "inefficient" hotels. Hotels whose values are greater than 0.5 belong to the "efficient" group.

Based on the foregoing, our analysis model takes the following structure:

$$\mathbf{EF}_j = \beta_0 + \beta_j \mathbf{Z}_j + \varepsilon_j, \tag{10}$$

where $\mathbf{EF}_j$ is the vector of efficient observations to be estimated, β_0 is the constant term, $\mathbf{Z}_j$ is the vector of observations of the variables specific to each establishment under analysis, β_j represents the coefficients of these explanatory variables, and ε_j is the error term of the regression.

Our purpose was to test whether the efficiency of the Spanish hotels in the sample (EF) is determined by the different independent variables described in the literature. The model in (10) was used with the following specification:

$$\begin{aligned} \mathrm{EF}_j = {} & \beta_0 + \beta_1 \mathrm{QLT}_j + \beta_2 \mathrm{SIZ}_j + \beta_3 \mathrm{CHN}_j \\ & + \beta_4 \mathrm{INT}_j + \beta_5 \mathrm{CAT}_j + \beta_6 \mathrm{SGM}_j + \varepsilon_j, \end{aligned} \tag{11}$$

where EF_j is the dependent variable efficiency. This construct is calculated using a dummy variable that takes a value of 1 when the hotel j has a level of efficiency equal to or greater than the sample mean (efficient hotels) and a value of 0 when the hotel j has an efficiency level below the sample mean (inefficient hotels). The variable QLT is another dummy variable that measures the level of quality according to the number of certificates held by each establishment (this takes a value of 0 when the hotel has fewer than two quality certificates and 1 otherwise). SIZ refers to the size of the establishment according to total assets based on their balance sheet; CHN is a dummy variable that reflects whether the hotel belongs to a chain (0 if the hotel is independent, and 1 if it is connected with a chain); INT measures the investment in intangibles according to the amount recorded in the balance sheet; CAT is a dummy variable that has a value of 0 when the hotel has two stars or three stars and a value of 1 when it has four stars or five stars; and SGM is a dummy variable that has a value of 1 when the hotel is oriented toward the vacation segment, 2 for the city segment, and 3 for the cultural segment. Finally, ε represents the residual error.

Data and Results

To estimate the production frontier and obtain statistically relevant results, we used data from 166 Spanish corporate hotels for the period 2000 to 2009, selected as described below. The study's aims necessitated the combination of data from different statistical sources on financial and economic variables. Both types of variables are needed to identify the efficiency levels of the establishments and determine the main drivers of efficiency. The absence of a database of Spanish hotels that combines financial and economic variables, such as the star rating, number of rooms, or environment quality certificates, led us to construct one from the sources listed below.

The financial variables were obtained from the annual accounts that companies provide to the Commercial Registry Offices. The Registries are official bodies that publish the compulsory accounting statements of Spanish companies.

Exhibit 2:
Descriptive Outputs and Efficiency Inputs.

Variables	Units	*M*	Median	*SD*
(a) Total establishments (*n* = 166)				
Outputs				
Sales	Revenue (10^3 €)	4,429.92	2,591.68	5,991.34
Inputs				
Physical capital	Number of rooms	65.52	127.50	138.26
Employment	Number of workers	67.22	40.00	80.17
(b) Medium-category establishments (*n* = 92)				
Outputs				
Sales	Revenue (10^3 €)	2,645.64	1,108.51	3,574.44
Inputs				
Physical capital	Number of rooms	133.59	84.00	131.65
Employment	Number of workers	40.22	18.00	49.79
(c) High-category establishments (*n* = 74)				
Outputs				
Sales	Revenue (10^3 €)	6,591.97	4,801.78	7,587.75
Inputs				
Physical capital	Number of rooms	205.23	182.50	136.82
Employment	Number of workers	97.54	72.00	95.77

The annual accounts include the main financial data of the company (balance sheet, losses and profits, and annual reports) for the year under study and meet the accounting standards required by the European Union.

In the case of economic variables, we drew data from the Official Guide of Spanish Hotels (Turespaña, 2009), which provide information on the number of rooms and the star rating of all the Spanish establishments. This annual guide is published by the Spanish Tourism Institute, which is a body belonging to the Spanish Ministry of Industry, Tourism and Trade. Finally, data regarding environment quality certificates and hotel group membership were obtained from the corporate information provided by each establishment.

The hotels in the sample were drawn randomly from the total population of Spanish hotels active in 2009 and divided into two groups (Exhibit 2), depending on their star rating as described in the analysis specifications above. Thus, two- and three-star hotels were classified in the medium category, and four- and five-star hotels were classified in the high category. The sample was stratified by Spanish regions, with a sampling error <2% (95% confidence interval). For the 204 hotels in the initial sample, we selected companies whose corporate information offered details of their establishments. Only 166 met the information requirement (80.90% of the total).

Descriptive Analysis

The DEA indicator, which was considered to be an ad hoc indicator of the efficiency of the hotels in the sample, was constructed using total sales (Barros and Dieke 2008; Chen 2011; Lin 2011; Ting and Huang 2012).

We used two indicators to measure inputs. The first was the number of rooms, which refers to physical capital. This indicator has been used by Anderson et al. (1999) and by Brown and Ragsdale (2002). The other input was the number of workers. This represents the level of employment and has also been used by other authors (Anderson et al. 1999; Barros and Alves 2004; Hwang and Chang 2003).

As shown in Exhibit 2, the total mean sales from the hotels in the sample were 4.4 million Euros for the period 2000-2009. With an average turnover of 2.6 million Euros per year, the ninety-two medium-category hotels had much lower turnover than high-end hotels and were generally smaller than the seventy-four high-level hotels, which had mean sales of 6.5 million euros. Medium hotels averaged 133 rooms and forty workers per establishment, while high-end hotels had a mean of 205 rooms and ninety-seven workers.

The selection of independent variables was based on two criteria: a review of the literature and the data available. The characteristics of these variables are shown in Exhibit 3. The quality level of the hotels, QLT, measured by the number of quality certificates held by the establishment, has a mean value of 0.37 for the whole sample, which indicates that a substantial number of the hotels do not demonstrate their quality by the use of quality certificates. (Note that we treated number of certificates as a dummy variable in the DEA analysis.) The size of the hotels was measured by the SIZ variable, which used total assets, reaching a mean of

Exhibit 3:

Characteristics of the Variables in the Spanish Hotel Sample.

Variables	Units	*M*	Median	*SD*
(a) Total establishments (*n* = 166)				
QLT	Number of quality certificates	0.37	0.01	0.73
SIZ	Total assets (10^3 €)	11,172.11	3,892.41	18,382.25
INT	% intangibles over total assets	2.64	0.11	7.34
CHN Hotels belonging to a group: 44.57%				
SGM (vacation: 36.14%; city: 44.58%; cultural: 19.28%)				
(b) Medium-category establishments (*n* = 92)				
QLT	Number of quality certificates	0.31	0.01	0.70
SIZ	Total assets (10^3 €)	6,208.96	1,973.23	11,625.31
INT	% intangibles over total assets	2.36	0.01	6.51
CHN Hotels belonging to a group: 27.65%				
SGM (vacation: 31.52%; city: 45.66%; cultural: 22.82%)				
(c) High-category establishments (*n* = 74)				
QLT	Number of quality certificates	0.44	0.01	0.76
SIZ	Total assets	17,351.32	9,252.82	22,847.00
INT	% intangibles over total assets	2.98	1.81	8.26
CHN Hotels belonging to a group: 65.75%				
SGM (vacation: 41.89%; city: 43.24%; cultural: 14.87%)				

Note. Period: 2000-2009. Number of business in the sample: *n* = 166. Number of observations: 1,660.
QLT = quality; CHN = belonging to a group; SGM = market segment; SIZ = size; INT = intangibles.

Exhibit 4:

Binomial Logit Regression (Equation 11; Dependent variable: Efficiency).

Variable	M "1"	M "2"	M "3"
Constant	0.420*(0.098)	−2.726**(0.000)	1.731**(0.000)
Quality (QLT)	−0.676**(0.003)	1.391**(0.003)	−2.080**`(0.000)
Intangibles (INT)	0.044 (0.760)	−0.613**(0.004)	0.598**(0.006)
Group (CHN)	0.397**(0.011)	1.373**(0.000)	−0.227 (0.281)
Size (SIZ)	0.001** (0.000)	0.000** (0.000)	0.000**(0.000)
Segment (SGM)	−0.692** (0.000)	−0.556** (0.016)	−0.908**(0.002)
Category (CAT)	−0.718** (0.000)		
Number of observations	1,466	813	653
−2 log likelihood	1,357.09	638.521	635.380
Nagelkerke *R*2	0.326	0.330	0.356

* Significant coefficients at a significance level = 0.10. **Significant coefficients at a significance level =0.05 (significance levels in parenthesis).

11.1 million Euros in the period under study. The level of intangible investment, as measured by the INT variable, was 2.64 percent, and nearly half of the hotels in the sample (44.57%) were part of a group (CHN). In addition, 36.14 percent of the hotels belonged to the vacation segment, 44.58 percent belonged to the city segment, and 19.28 percent belonged to the cultural segment.

The results of the analyses from the two hotel categories are listed in Exhibit 3 (parts b and c). We found generally that high-category hotels are larger and invest more effort to increase intangibles and improve their quality. Moreover, high-end hotels also appear to belong to a group more commonly and are more likely to be either vacation or city hotels.

Estimation Results

The results of our binomial logistic modeling to solve equation (11) are shown in Exhibit 4. Model M "1" in Exhibit 4 refers to the total sample of hotels, M "2" is for medium hotels, and M "3" analyzes high-end hotels. All three models show the relationship between technical efficiency, EF_j, and the independent variables selected.

The results of M "1" indicate that the estimated coefficient associated with the QLT explanatory variable—which measures the quality of the hotel—is negative and statistically significant for the sample as a whole; therefore, as quality increases, efficiency decreases. Interestingly, several

authors have found a strong positive relationship between quality and efficiency (Brown and Ragsdale 2002; Fine 1983; Wheelwright 1981). The literature identifies a number of disadvantages related to increased quality, notably the expenses incurred in obtaining an official certification of quality, the time used to obtain one, and the bureaucracy needed to develop and maintain such organization (H. Ingram and Daskalakis 1999; Joubert 1998; Kanji 1998; Nield and Kozak 1999; Quazi and Padibjo 1998; Singels, Ruël, and Van de Water 2001; Yahya and Goh 2001). For the case of Spanish hotels, Claver, Tarí, and Pereira (2006) indicate the scant importance of QLT for financial results, which suggests that QLT is a necessary but not sufficient driver of competitiveness. This realization appears to be reflected in hotels' apparent reticence to apply for quality certification.

Second, belonging to a group, calculated by the variable CHN, is also relevant for the hotel's level of efficiency, with a positive, statistically significant coefficient overall. But CHN is not a statistically significant variable among high-category hotels (as indicated in M "3"). Other studies have found that belonging to a group is directly related to efficiency (Barros and Dieke 2008; Chung and Kalnins 2001; P. Ingram and Baum 1997; Israeli 2002; Israeli and Uriely 2000; Lin 2011; Mathews 2000).

Our analysis of other explanatory variables, including the intangible variable INT, had a similar outcome when we grouped hotels according to star rating (also shown in Exhibit 4). All variables are significant for the medium-category segment (M "2"), including INT, even though this was not the case for the total sample. Again, the coefficient on INT was negative for medium hotels, even though it was positive for high-end hotels. The negative findings do not support Barros and Alves's (2004) suggestion regarding the beneficial effects of the rate of innovation nor the data obtained by Camisón (1995) and Buick (2003) regarding technological innovation and the development of information systems. In contrast, that result is consistent with those obtained by Jerman, Kavcic, and Kavcic (2009) for hotels in Croatia, Slovenia, and Austria. In any event, we observe that the intangibles represented by INT do not yet constitute a significant investment in the Spanish hotel industry, which makes analysis of these factors more difficult.

We also found that Model M "2" detects the positive effect of QLT on hotel efficiency for the medium hotels, which is consistent with the results obtained by Mohanty and Rajput (1988), McCracken and Kaynak (1996), and Brown and Dev (1999). Therefore, quality has a direct effect on efficiency for the medium hotels, although we cannot say the same of high-end hotels.

Equally important for the midscale hotels are belonging to a group or not (CHN), hotel size (SIZ), and market segment (SGM). As an example, in the holiday segment, the hotels belonging to a group and of larger size within their category have higher levels of efficiency. It is also notable that the intangibles statistic was significant for this category but not for the total sample (M "1").

Finally, Model M "3" shows the results for the high-category hotels. In this segment, the predictions are slightly higher compared with M "2" (medium-category model). The QLT variable remains statistically significant but with a negative sign, which suggests that a high investment in quality does not lead to efficiency among high-category hotels but rather to its opposite. It is also important to note the significance of the variables INT and SGM, and the non-significance of the variable CHN. Therefore, in this high-category segment, the hotels with intangibles, of larger size, and in the vacation segment are the most efficient.

Conclusion

Our model analyzes the efficiency levels of Spanish hotels in medium and high star-rating groups, according to quality standards, intangible assets, size, market segment, and membership in a chain. For all 166 hotels, the variables best explaining whether a given hotel is efficient or inefficient were quality, the market segment, size, and belonging to a group. However, when we controlled for the star-rating category of the establishments, the results were not only more robust, but we could more precisely determine the influence of variables that had been submerged. For example, investment in intangibles, which was not statistically significant for the total sample, was significant when we analyzed medium-category hotels and high-category hotels individually. We concluded, however, that intangibles are still growing in effect for the efficiency of Spanish hotels, since the hotels are still increasing their investment in intangibles. Furthermore, we verified that belonging to a group (CHN) explains efficiency in medium-category hotels but is not significant in the case of high-category hotels.

The variable controlling for hotel size (SIZ) reached acceptable statistical significance, which suggests that larger hotels have greater efficiency ratios. This finding agrees with those of several authors (Anderson et al. 1999; Claver, Molina, and Pereira 2007; Pine and Phillips 2005).

The market segment (SGM) is statistically significant according to Cool and Schendel (1988) and Claver, Molina and Pereira (2007). In that regard, our results indicated that the hotels belonging to the vacation segment have a higher efficiency ratio.

The variable for hotel category (CAT) also reached significance in the model we used. This finding confirms the results from the exploratory analysis, where we noted the importance of controlling for the effect of the star-rating category, given the structural differences between the various categories of hotels.

Regarding QLT and efficiency, our findings are consistent with similar studies (Brown and Ragsdale 2002; Fine 1983; Wheelwright 1981), but the positive effect of quality was only found for medium-category hotels, whereas the

relationship is the reverse for high-category hotels. This negative relationship was also detected by Joubert (1998), Singels, Ruël, and Van de Water (2001), Yahya and Goh (2001). The Spanish case highlights the scant importance of QLT on financial results, which suggests that quality is necessary but not sufficient for competitiveness (Claver, Tarí, and Pereira 2006).

Our results for SIZ and efficiency are consistent with those of Anderson et al. (1999), Pine and Phillips (2005), Claver, Molina and Pereira (2007) for all of the categories analyzed. Likewise, the acceptable level of significance found for the group-membership variable, CHN, only partly confirms the hypothesis supported by P. Ingram and Baum (1997), Israeli and Uriely (2000), Chung and Kalnins (2001), Pine and Phillips (2005), and Barros and Dieke (2008), who suggest that belonging to a group improves efficiency levels. In our work, chain membership was only significant for medium-category hotels and did not explain efficiency in high-category hotels.

The variable market segment (SGM) was also found to have a significant relationship with efficiency for all categories of establishments. Hotels in the vacation segment show a significantly greater efficiency than those in the city or cultural segment. Consistent with the suggestions of Cool and Schendel (1988) and Claver, Molina and Pereira (2007), SGM is a significant variable in explaining the level of efficiency.

Finally, although the degree of investment in intangibles, INT, appears to lead to greater efficiency in hotels, this variable does not behave in the same manner for midscale hotels and upper-end hotels. Investment in intangibles improves efficiency in the high category but has a negative effect in the medium category. Our findings for four- and five-star hotels are similar to those reported by Siguaw, Enz, and Namasivayam (2000) for hotels in the United States.

Our analysis found that the largest of the medium-category hotels were also the most efficient, and they also had the highest quality and belonged to a group. Market segment was a factor, as the resort hotels were more efficient than other types. Market segment and size also set apart the efficient high-category hotels, and investment in intangibles also was associated with highly efficient properties.

Limitations and Suggestions for Future Research

This measurement of hotel efficiency is not without limitations. The main limitation of this study involves the problems of selecting inputs and outputs for the construction of indicators of efficiency and the suitability of using these measures. We used net sales as an output, for instance. Although this method is most commonly used in research, it is conditioned by the effect of prices, which are not easy to obtain given the heterogeneity of the different products sold by hotels (Ariff and Can 2008; Lin 2011). Likewise, qualitative variables, such as customer satisfaction, could be incorporated as an output, as in some previous studies (Brown and Ragsdale 2002). However, it has not been possible to incorporate that type of measure for the sample used in this study.

Future investigations of the efficiency of Spanish hotels should consider other variables that could help to better explain the levels of efficiency. For example, Pestana and Mascarenhas (2005) and Pestana (2005) present an interesting perspective on hotel efficiency in an analysis of public hotels in Portugal. This research suggests that future studies could differentiate between hotels that are publicly and privately owned to verify whether this variable has a significant influence on Spanish hotels' efficiency.

Managerial Implications

Considering the results, the managerial implications of this paper are as follows: first, the strategic models used by managers of Spanish hotels to increase efficiency must consider a hotel's size, quality, investment in intangible assets, and whether it belongs to a hotel group. Adopting this analytical procedure could help hotel managers to understand and optimize their hotels' direction and market position. Second, the direction must include contextual factors that go beyond managerial control, as it is not clear whether hotels in different categories or market segments have the same operating environment. Third, a comparative analysis of every hotel should be conducted using information from the sample, which may help to correct the detected weaknesses in efficiency. Fourth, the combination of DEA and a logistic regression simplifies the strategically complex reality in which hotel directors carry out their decision making. By defining which variables can be adjusted to affect efficiency, directors acquire substantial knowledge on business strategies and the advantages of rival hotels. This information also enables hotel managers to identify the strategic variables that they must develop to improve their competitive posture and efficiency.

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