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Managerial Efficiency and Hospitality Industry: the Portuguese Case*

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Abstract:

In this paper, the innovative two-stage procedure of Simar and Wilson (2007) is used to estimate the efficiency determinants of Portuguese hotel groups from 1998 to 2005. In the first stage, the hotels' technical efficiency is estimated with DEA in order to establish which hotels have the most efficient performance. These could serve as peers to help improve performance of the least efficient hotels. In the second stage, the Simar and Wilson model is used to bootstrap the DEA scores with a truncated regression.

The paper contributes to the hotel industry literature by adopting a somewhat novel approach that has never been applied to this industry despite its managerial implications. The motivation for the analysis lies in the fact that during the period under analysis Portuguese hotels faced a number of threats. Knowing what the best practices are is then good news for managers and institutions.

Keywords: Efficiency, Data envelopment analysis, Bootstrap, Hospitality industry.

1. Introduction

Performance analysis is a central issue of corporate governance because in a competitive environment, a company less efficient than its competitors fails generally to maintain a sufficient market share to survive on the market. The tourism industry is not immune to this performance need. Therefore, developing tools enabling to evaluate the performance of tourism activities is of critical importance. In particular, in order to provide policy makers guidelines, to correct inefficient management directions and to promote positive effects from competition, it proves fundamental to use performance indicators as regard hotels.

Two scientific methods to quantitatively analyse performance are econometric frontier (Kumbhakar and Lovell, 2000) and data envelopment analysis (Cooper, Seiford and Tone, 2000; Thanasoulis, 2001). Both methods have advantages and drawbacks. Unlike the econometric frontier approach, the DEA allows for the use of multiple inputs and outputs, not imposes any functional form on the data, and doesn't make distributional assumptions for the inefficiency term. With DEA, the frontier relates to the sample considered in the analysis i.e. the efficient isoquant is estimated from the data.

This paper analyses the Portuguese hotel industry from 1998 to 2005 with a two-stage DEA procedure to estimate and explain technical efficiency. This technique, developed by Simar and Wilson (2007) overcomes severe limitations inherent in using the two-stage DEA approach commonly employed in the efficiency literature (Balcombe et al., 2008). Following this technique, the efficient DEA scores are calculated in the first stage, and a bootstrap procedure is adopted in the second stage to identify the sources of efficiency. The paper contributes to the hotel industry literature by adopting a quite new model that, despite its managerial implications, has never been applied to this industry.

The motivation for the present research relates to the fact that in spite of the expansion experienced during the period under analysis, Portuguese hotels face a number of threats. Firstly, several financial groups have entered the market. For example, the Portuguese financial institution, *Banco Espírito Santo*, has recently acquired the *Tivoli* hotels and expanded it amounting now to fourteen hotels. Secondly, foreign hotel chains have established a market presence, such as *Holiday-Inn* and *Marriott*, taking advantage of the benefits arising from the EU Single Market, which was established in 1992 with the aim of facilitating the free movement of goods

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3 and services throughout the member-states. Third, much hotel constructions have
4 taken place on the basis of EU funding, which has resulted in the rapid expansion of
5 hotels throughout the country. The combination of all these factors gives to the
6 Portuguese hotel sector an extremely competitive character which points to the need
7 for an improvement in efficiency (Santos, 2004).
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10 This paper is organized as follows: after this now ending introduction, section 2
11 presents the institutional settings, describing the Portuguese hotel sector and its
12 characteristics; Section 3 reviews the existing literature on the topic; Section 4
13 explains the theoretical framework; Section 5 exposes the first stage results; Section 6
14 offers the second stage results; Section 7 discusses the results and considers the
15 limitations of the paper, in addition to possible future research tracks; and Section 8
16 presents the conclusions.
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26 **2. Institutional Settings**

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28 As a tourist destination, Portugal continues to explore alternatives that would allow
29 for the repositioning of its brand image from a low-cost “sun-and-sand” destination to
30 an international cultural and heritage tourist attraction (Santos, 2004). In response to
31 the efforts of the Portuguese institutional tourist authorities to achieve this
32 repositioning, many new hotels have been built to provide accommodations in “news”
33 regions i.e. not traditionally promoted “sun-and-sand” destinations.
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39 Considering the increased competitiveness in tourism, hotels economic efficiency
40 takes a central importance in the nationwide performance. According to the World
41 Tourism Organisation statistics (1999), Portugal was ranked at the 19th place as a
42 tourist destination in 1990 and at the 24th place in 1998 with 1.1% of the total
43 amounts of tourists in the world (see the Financial Times Survey on Portugal, 21
44 October, 2002). This value represents a small value at the international level,
45 especially when it is compared with the value of Portugal neighbour, Spain, 6.7%. But
46 inbound tourism represents about 5% of Portuguese national GDP, revealing a
47 significant economic impact of tourism activities which are directly related to the
48 hotel sector.
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56 Similarly to many other countries, the Portuguese hotel sector is comprised of both
57 large and small units that compete in the market. However, a distinct characteristic of
58 the Portuguese hotel sector is that it is dominated by national groups. Specifically,
59 when compared with Spain, which relies extensively on foreign capital, the
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3 Portuguese hotel sector relies heavily on national capital. For this reason, the
4 country's largest hotel chains mostly comprise national groups. But things are
5 changing with the European common market and we include in our study recognised
6 international names such as *Sheraton*, *Ritz* and *Savoy*.
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10 In Table 1 below, we present several characteristics of the hotels analysed. These
11 hotels outline a representative sample of the most important hotel groups in Portugal.
12 Data, which spans the period from 1998 to 2005, were obtained from the list of the
13 1000 largest (in terms of sales) enterprises in Portugal which is published annually by
14 a major Portuguese daily newspaper, *Diário de Notícias*. This publication was
15 supplemented by additional informations obtained from the *Portuguese Hotels*
16 *Association* and in the *Commercial Company Registry*.
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19 We can see that in comparison with other economic entities, the 15 hotels in the
20 sample are small units in economic terms. In the ranking of the largest 1000
21 Portuguese enterprises, only 5 hotels are present in the top 500. However, *Diário de*
22 *Notícias* publishes also the ranking of the largest 1500 enterprises in Portugal and
23 therefore, while some small hotels are not ranked in the 1000 ranking, informations
24 about them can be obtained from the list of the largest 1500. These informations are
25 resumed in the table 2 which presents the institutional settings. Five variables are
26 shown: sales, number of guests, full-time workers, book value of property and
27 operational cost. These variables will serve as outputs and inputs in our study.
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3. Literature Review

39 In this section, we show that this paper makes a fresh contribution to the literature on
40 tourism industry and more precisely to the literature on the hotel sector which is an
41 important and extremely competitive sector in most tourism countries.
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44 First, regarding our subject i.e. hotels performance, previous analysis are restricted to
45 a small number of studies. Among the earliest studies, we cite Brotherton and
46 Mooney (1992), Wejaysinghe (1993), Baker and Riley (1994) and Donaghy (1995)
47 who suggest different methodology but no frontier models to examine the
48 performance of hotels. In Table 3, the latest studies using frontier models to scan the
49 efficiency of tourism organisations are presented.
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3 From a policy perspective, these papers generally propose guidelines to overcome the
4 identified inefficiency. Sometimes, papers discuss hypothesis which say that there is a
5 relation between an organizational or managerial aspect of the enterprise and its
6 efficiency (for example Botti et al., 2009).
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10 When compared with other research fields, this bibliography is, as far as we are
11 concerned, clearly brief for such an important aspect of the tourism industry. Indeed,
12 tourism is vital for many countries such as Thailand, Morocco or Fiji (Narayan,
13 2005). This is due to the large intake of money for domestic businesses and to the
14 opportunity for employment in the service industries associated with tourism, i.e.
15 transportation services such as taxis, accommodation such as hotels, and other
16 hospitality industry services such as resorts. With the present paper, we seek to call
17 the attention of management researchers to this neglected aspect of one of the fastest
18 growing industries in the world (Bhattacharya and Narayan, 2005).
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21 Moreover, we can see that there is only one study that use a two stage procedure; and
22 that the paper of Barros and Dieke (2007) use the Malmquist nonparametric
23 technique, which is calculated from DEA linear programming approach and which
24 enables separation of the *catching-up* effect, i.e. changes over time in technical
25 efficiency, from *technological change*, i.e. the shift, due to technological progress, of
26 the best practice frontier over time. Then our paper is innovative from this
27 methodological perspective as it employs the DEA Simar and Wilson (2007)
28 technique to estimate and explain technical efficiency of hotels.
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42 **4. Theoretical Framework**

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44 Our framework is based on two literature streams: models of industry efficiency and
45 data envelopment analysis.
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49 **4.1 Models of Industry Efficiency**

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51 Most studies on tourism efficiency are empirically driven, with no clear theoretical
52 framework. On the contrary, in this paper, two economic efficiency models are
53 adopted as theoretical reference. Firstly, the strategic-group theory (Caves and Porter,
54 1977) which justifies differences in efficiency scores as being due to differences in
55 the structural characteristics of units within an industry, which in turn lead to
56 differences in performance. Units with similar asset configurations pursue similar
57 strategies with similar results in terms of performance (Porter, 1979). While there are
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different strategic options to be found in an industry, due to mobility impediments, not all options are available to each organization in the industry, causing a spread in their efficiency score. Secondly, the resource-based theory (Barney, 1986, 1991; Rumelt, 1991; Wernerfelt, 1984) that justifies different efficiency scores by the fact that organizations base their strategy on resources and competences that don't have the same quality and that are not perfectly mobile across the industry.

Purchasable assets cannot be considered to represent sources of sustainable profits. Indeed, critical resources are not available in the market. Rather, they are built up and accumulated by the organisation, their non-imitability and non-substitutability being dependent on the specific traits of their accumulation process. Differences in resources thus result in barriers to imitation (Rumelt, 1991) and in managers' ability to preserve accumulated critical resources over time. In this context, assets exhibit inherently differentiated levels of efficiency and sustainable profits are ultimately a return on the unique assets controlled by the organisation (Teece et al., 1997).

4.2. Methodology

Following Farrell (1957), Charnes et al. (1978) first introduced the term, data envelopment analysis to describe a mathematical programming approach to the construction of production frontiers and the measurement of efficiency in relation to the constructed frontiers. At this time, a large number of articles on theoretical extensions and empirical applications of DEA have been published. Surveys of these papers can be found in Lovell and Schmidt (1988), Lovell (1993) and Tavares (2002).

Estimation of Efficiency Scores

To estimate efficiency scores for each observation, we use a DEA estimator. The DEA approach usually (but not always) assumes that all firms, or more broadly, decision-making units (DMUs) within a sample have access to the same technology for transforming a vector of N inputs, denoted with x , into a vector of M outputs, denoted with y . We assume that technology can be characterised by the technology set, T , defined as[†]:

$$T = \{(x, y) \in \mathfrak{R}_+^N \times \mathfrak{R}_+^M : x \in \mathfrak{R}_+^N \text{ can produce } y \in \mathfrak{R}_+^M\}. \quad (1)$$

[†] We assume that standard regularity conditions of the neo-classical production theory hold (for details, see Färe and Primont (1995)).

Having access to the same technology, any of the DMUs may or may not be on the frontier of this technology; the distance of a particular DMU from the frontier may depend on various factors which may be endogenous to the DMU, such as the organisational form and/or exogenous, such as the competitive rivalry or government policies. The distance from the actual allocation of each DMU in technology set T to the frontier of T is believed to represent the inefficiency of each DMU and is caused by the DMU's specific endogenous or exogenous factors and some unexplained statistical noise. Our goal is to measure such inefficiency and investigate its dependency on drivers of efficiency.

Our analysis will follow a two-stage approach and in this sub-section, we focus on the first stage, where we estimate efficiency scores for each DMU j ($j=1, \dots, n$), using the Farrell/Debreu-type output-oriented technical efficiency measure:

$$TE(x^j, y^j) = \max_{\theta} \{\theta : (x^j, \theta y^j) \in T\}. \quad (2)$$

In practice, T is unobserved and so we replace it with its DEA-estimate, \hat{T} :

$$\hat{T} = \{(x, y) \in \mathfrak{R}_+^N \times \mathfrak{R}_+^M : \sum_{k=1}^n \lambda_k y_m^k \geq y_m, \quad m = 1, \dots, M, \quad \sum_{k=1}^n \lambda_k x_i^k \leq x_i, \\ i = 1, \dots, N, \quad \lambda_k \geq 0, \quad k = 1, \dots, n\}. \quad (3)$$

where $\lambda_k \geq 0$ ($k = 1, \dots, n$) are the intensity variables over which optimisation (2) is made. Geometrically, \hat{T} is the smallest convex free disposal cone (in (x, y) -space) that contains (or 'envelopes') the input-output data[‡]. It is a consistent estimator of the unobserved true technology set T , under the assumption of constant returns to scale (CRS)^{§, **}.

[‡] For more details on DEA, see Fare, Grosskopf and Lovell (1994), Charnes et al. (1995), Briec (1997), Coelli, Prasada and Battese (1998), Copper et al. (2000) and Thanassoulis (2001).

[§] Alternatively, the non-increasing returns to scale (NIRS) or variable returns to scale (VRS) would be modelled if the constraint $\sum_{k=1}^n \lambda_k \leq 1$ or $\sum_{k=1}^n \lambda_k = 1$, respectively, is added to (3). In this paper we assume CRS to gain more discriminatory power in comparison between DMUs and then analyse the returns-to-scale component in the second stage.

** The proof of consistency also requires certain regularity conditions (see Kneip et al. (1998, 2003) for these conditions, the resulting rates of convergence, the limiting distribution of DEA estimators, etc.)

The estimates of the efficiency scores, TE_j ($j=1, \dots, n$), obtained by replacing T with \hat{T} in (2) are consistent estimates of the corresponding true efficiency scores, TE_j ($j=1, \dots, n$) given by (2). They are bounded between unity and infinity, with unity representing an estimated perfect (technical or technological) efficiency score of 100%. On the other hand, $(1/TE_j)$ would represent the estimated relative %-level of the efficiency of the j^{th} DMU ($j= 1, \dots, n$), relative to the estimated best-practice technology frontier, \hat{T} .

In our study, we measure outputs by

- (i) sales,
- (ii) number of guests,

and inputs by

- (iii) full-time workers,
- (iv) book value of property,
- (v) operational costs.

Regression Analysis of Determinants of Efficiency

Next, we briefly outline an application of regression analysis for studying dependency between the efficiency scores and hypothesised explanatory variables, following the approach of Simar and Wilson (2007). Here, we assume and test the following specification:

$$TE_j = a + Z_j\delta + \varepsilon_j, \quad j = 1, \dots, n \quad (4)$$

which can be understood as the first-order approximation of the unknown true relationship. In equation (4), a is the constant term, ε_j is statistical noise, and Z_j is a (row) vector of observation-specific variables for DMU j that we expect is related to the DMU's efficiency score, TE_j , through the vector of parameters δ (common for all j) that we need to estimate.

** These properties include various forms of continuity, (weak) monotonicity, commensurability, homogeneity and (weak) indication for all technologies satisfying certain regularity conditions (see Russell (1990, 1997) for details).

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4 A common practice in the DEA literature for estimating model (4) had previously
5 been to employ the Tobit-estimator, until Simar and Wilson (2007) demonstrated that
6 such an approach is inappropriate. Instead, they justify an approach based on a
7 truncated-regression with a bootstrap, and illustrate (in Monte Carlo experiments) its
8 satisfactory performance. Here, we will employ their approach. Specifically, noting
9 that the distribution of ε_j is restricted by the condition $\varepsilon_j \geq 1 - a - Z_j\delta$ (since both
10 sides of (4) are bounded by unity), we follow Simar and Wilson (2007) and assume
11 that this distribution is truncated normal with zero mean (before truncation), unknown
12 variance, and (left) truncation point determined by this very condition. Furthermore,
13 we replace the true but unobserved regressand in (4), TE_j , by its DEA estimate \hat{TE}_j .
14 Formally, our econometric model is given by:
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$$17 \hat{TE}_j \approx a + Z_j\delta + \varepsilon_j, \quad j = 1, \dots, n, \quad (5)$$

18 where

$$19 \varepsilon_j \sim N(0, \sigma_\varepsilon^2), \text{ such that } \varepsilon_j \geq 1 - a - Z_j\delta, \quad j = 1, \dots, n, \quad (6)$$

20 which we estimate by maximising the corresponding likelihood function, with respect
21 to $(\delta, \sigma_\varepsilon^2)$, given our data. Relying on asymptotic theory, normal tables can be used to
22 construct confidence intervals but more precision can be gained by using the
23 bootstrap, particularly because our regressand are not true variables, but their
24 estimates that are likely to be dependent (see Simar and Wilson (2007) for details). To
25 construct the bootstrap confidence intervals for the estimates of parameters $(\delta, \sigma_\varepsilon^2)$,
26 we use the parametric bootstrap for regression, which incorporates information on the
27 parametric structure and distributional assumption. For the sake of brevity, we refer
28 the reader to Simar and Wilson (2007) for the details of the estimation algorithm.
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49 5. DEA Results

50 When one talks about the efficiency of a firm, one usually means its success in
51 producing as large as possible an output from a given set of inputs. Our paper adopts
52 this direction and will therefore estimate an output-oriented technically efficient (TE)
53 DEA index, assuming that hotels aim to maximize the profits resulting from their
54 activity.
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59 As far as models are concerned, the CCR (or Charnes, Cooper and Rhodes) efficient
60 score model (1978) is probably the most widely used and best known DEA model. It

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3 is the DEA model that assumes constant returns to scale relationship between inputs
4 and outputs. CCR measures the overall efficiency for each unit, namely in aggregating
5 pure technical efficiency and scale efficiency into one value (Gollani and Roll, 1989).
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7 The BCC (or Banker, Charnes and Cooper) efficient score model (1984) is a DEA
8 model that assumes variable returns to scale between inputs and outputs. It measures
9 pure technical efficiency alone (Gollani and Roll, 1989). The efficiency score
10 obtained with the BCC model gives a score which is at least equal to the score
11 obtained using the CCR. Scale efficiency score is obtained by dividing the aggregated
12 CCR score by the technical efficient BCC score (Färe et al, 1994). A unit is scale
13 efficient when its size of operation is optimal. If its size is either reduced or increased,
14 its efficiency will drop.

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23 The choice of an assumption about returns-to-scale (constant versus variable) is not
24 neutral because it conditions the representation of the possibility set. The assumption
25 of constant returns to scale implies a long term vision where units' size can be
26 modified. With the variable returns-to-scale assumption, the reasoning takes place in
27 the short run and units' size is fixed. In our case, since hotel chains have different size
28 (according to their total number of hotels) and their scale size is controllable by their
29 central management, the variable return-to-scale hypothesis was chosen. Moreover,
30 the VRS score measures pure technical efficiency only; then, when assuming that
31 pure technical efficiency is attributed to managerial skills, the BCC scores are
32 interpreted as managerial skills.

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41 However, for comparative purposes, we also present the constant returns-to-scale
42 index which is composed of a non-additive combination of pure technical and scale
43 efficiencies. A ratio of the overall efficiency score (the CRS score) to pure technical
44 efficiency score (the VRS score) provides a scale efficiency measurement. The CRS,
45 VRS and scale efficiency scores of the analysed hotels are presented in Table 4. The
46 ranking in Table 4 is in hierarchical order of VRS technical efficiency scores, starting
47 from the most efficient to the least efficient.

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A number of points emerge from the present study. Firstly, similar to previous
research on hotels (Reynolds, 2003), significant differences in efficiency are prevalent
among Portuguese hotels. The DEA score is between zero (0%) and 1 (100%). Units
with DEA scores equal to 1 (100%) are efficient. A unit with a score of less than
100% is relatively inefficient, e.g. a unit with a score of 95% is only 95% as efficient

as the best performing hotels. Secondly, best-practice calculations indicate that almost all Portuguese hotels operate at a high level of technical efficiency during the period. Thirdly, all technically efficient CRS hotels are also technically efficient in VRS, signifying that the dominant source of efficiency is scale. Fourthly, the efficiency scores presented in Table 4 are average values for the period, but when the hotels are analyzed across all years, the result is the same: most Portuguese hotels display technical efficiency, but some of them do not display scale efficiency. Therefore, the overall conclusion is that Portuguese hotels are well managed as far as technical efficiency is concerned. However, dimension makes a difference and therefore, some hotels have decreasing returns to scale (DRS), while others have increasing returns to scale (IRS). Hotels with DRS are too large in dimension and should be decreased. Hotels with IRS are too small in dimension and should be increased.

6. Determinants of Efficiency

In order to examine the hypothesis that the efficiency of the Portuguese hotel companies is determined by different contextual variables, we followed the two-step approach, as suggested by Coelli *et al.* (1998), estimating the regression shown below. It is recognised in the DEA literature that the efficiency scores obtained in the first stage are correlated with the explanatory variables used in the second term, and that the second stage estimates will then be inconsistent and biased (Simar and Wilson, 2000). A bootstrap procedure is needed to overcome this problem (Efron, 1979; Efron and Tibshirani, 1993). To this end, as explained earlier, we adopt the approach of Simar and Wilson (2007).

The estimated specification is the following:

$$\theta_{i,t} = \beta_0 + \beta_1 Trend_{i,t} + \beta_2 Trend_{i,t}^2 + \beta_3 Quoted_{i,t} + \beta_4 M \& A_{i,t} + \beta_5 Group_{i,t} + \beta_6 International_{i,t} + \varepsilon_{i,t} \quad (9)$$

where θ represents the CCR efficient score. *Trend* is a yearly trend. *Square trend* is the square value of the trend. *Quoted* is a dummy variable which is one for quoted hotel groups and zero otherwise. This aims to capture the efficiency related to the scrutiny inherent in being quoted on the stock market. *M&A* is a dummy variable which is one for companies involved in mergers and acquisitions and zero otherwise. This aims to capture growth orientation strategies inherent in some hotel groups. *Group* is a dummy variable which is one for hotels belonging to an economic group,

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3 and zero otherwise. It aims to capture economies of scope in the activity. Finally,
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5 *International* is a dummy which is one for hotel groups with an international
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7 expansion strategy. It aims to capture international growth orientation strategies.

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9 For comparative purpose the traditional Tobit model has been estimated with
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11 bootstrap and results revealed that while the signs of the parameters are maintained,
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13 their values changed a lot, namely the value of the variance, meaning that the Simar
14
15 and Wilson (2007) procedure is more efficient.

16 - Insert table 5 here -

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18 The truncated regression with a bootstrap model appears to fit the data well, with
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20 positive t-statistics, which are statistically significant for all parameters, with the
21
22 exception of the international dummy variable.

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24 It is observed that the efficiency increases over the observation period, according to
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26 the trend, but at decreasing rates, according to the square term. A rationale for this is
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28 based on the growth limits of internal markets. *Quotation* contributes to the
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30 efficiency. This means that the discipline of the stock exchange and the public
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32 scrutiny inherent to it contribute to the efficiency of the hotels. To be involved in
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34 *mergers and acquisitions* contributes to efficiency. This is an expected result, since
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36 companies involved in *M&As* are more aware of their market environment. They must
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38 also be aware of their efficiency. To be a *member of a hotel group* also contributes
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40 positively to the efficiency, since it induces internal benchmarking which contributes
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42 to efficiency improvements. Finally, to be involved in an *international expansion*
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44 strategy increases the efficiency. A rationale for this is based on the awareness that
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46 must accompany such a strategy and which naturally translates into efficiency
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48 increases.

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7. Discussion, Limitations and Extensions

What is the explanation for such dispersion of the efficiency scores among Portuguese hotels? The first reason is the economics of scope, related to activities such as casinos in some hotels, as for example in the *Estoril Sol* and the *Solverde*. The second reason is dimension due to scale economies, present in *Vila Galé* and *M.&J. Pestana*. The third possible reason is bad management, since it is recognised that the Portuguese management continues to suffer from various weaknesses. Evidence of managerial inefficiency was identified in an exhaustive survey on Portuguese management jointly conducted by *AdCapita and Cranfield University* (available in www.adcapita.com).

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3 The fourth reason is derived from the complacency of the Portuguese tourist
4 enterprises relative to foreign capital. This closeness is a distinctive characteristic of
5 the Portuguese tourism industry, when compared with its Spanish counterpart, and
6 was recently supported by European funding of Portuguese hotel constructions. The
7 closeness appears to induce indolence in the managerial behaviour. Fifth and finally,
8 these enterprises usually nurture close links with the government, which is beneficial
9 for gaining access to European subsidies and manifested in the fact that it is not
10 unusual to find former senior civil servants occupying directorial positions on the
11 boards of the hotel enterprises. Associated to other reasons, such cronyism results in
12 bad management. Reasons related to the economic environment, such as the VAT
13 rate, are not taken into account in this paper.

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23 The findings of the empirical study show that there are several drivers of efficiency
24 in Portuguese hotels. These drivers comprise the facts of being *quoted* on the stock
25 market, adopting *M&A* strategies and being part of a *group*. It is important to take
26 these elements into consideration when crafting a new strategy in order to improve
27 corporate efficiency.

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32 What is the innovation in the present research? First, the true efficiency score θ
33 estimated in first stage is not observed directly but is empirically estimated. Thus, the
34 usual estimation procedures that assumes independently distribute error terms are not
35 valid. Second, the empirical estimates of frontier efficiency are calculated based on
36 the sample of hotels used, which excludes some efficiency production possibilities
37 that are feasible but not observed in the sample. This implies that the empirical
38 estimates of efficiency are upwardly biased (Simar and Wilson, 2007). Thirdly, the
39 two stage procedure also depends upon other explanatory variables, which are not
40 taken into account in the first stage efficiency estimation. This implies that the error
41 term must be correlated with the second stage explanatory variables. Fourthly, the
42 domain of the efficient score θ is restricted to the interval zero and one, which should
43 be taken into account in the second-stage estimation (Simar and Wilson, 2007).
44 Overall, Simar and Wilson (2007) propose a procedure to deal with these challenges,
45 based on a double bootstrap that enables consistent inference within models
46 explaining efficiency scores while simultaneously producing standard errors and
47 confident intervals for these efficiency scores. For example, an alternative bootstrap
48 procedure adopted by Xue and Harker (1999) has been shown to be inconsistent by
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3 Simar and Wilson (1999). Related to the functional specification, it is recognized that
4 the Tobit does not describe adequately the efficient scores. The truncated
5 bootstrapped second-stage regression proposed by Simar and Wilson (2007) better
6 describes the efficient scores.
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10 Thus, the contribution of this paper to the literature with respect to technique is
11 threefold:
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- 13 (i) it improves the existing methods using DEA, by comparing and
14 contrasting relative approaches and variations;
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- 16 (ii) it combines DEA technique with a recently developed method; in using
17 this method to bootstrap the DEA scores with a truncated regression, it
18 better (from an econometric viewpoint) explains DEA efficiency levels;
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- 23 (iii) it presents the broader relevance of this new procedure which offers some
24 improvements in both estimation quality and inference in the second stage.
25 Indeed, by adopting the functional form (or truncated functional form) in
26 the second stage, it has enabled consistent inference to explain efficiency
27 scores while simultaneously producing standard errors and confidence
28 intervals for these efficiency scores.
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33 Furthermore, the paper has also provided benchmarks for improving operations of
34 hotels that perform poorly, arguing that *quoted* and *M&A* parameters increase
35 efficiency. However, more research is needed to confirm these results. Indeed, the
36 principal limitation of the paper is related to the data used. The homogeneity of the
37 sample is questionable, since we compare companies with different dimensions and
38 production characteristics. They may face different restrictions and therefore, might
39 not be considered to be directly comparable. However, we can always claim that the
40 units are not comparable and then a ratio analysis could not equally be carried out.
41 Moreover, the data set is short, thus the conclusions are limited. In order to generalise
42 them, we would need to have a larger data set. Indeed, reducing the number of
43 observations in a DEA procedure increases the likelihood that a given observation is
44 judged relatively efficient (Banker, 1993).
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54 Several research tracks can be proposed. First, in this analysis, the DEA model
55 allowed for complete weight flexibility. In situations in which some of the measures
56 are likely to be more important than others, DEA allows for restricting factor weights
57 through linear constraints. These linear constraints represent ranges for relative
58 preferences among factors based on managerial input. Such analysis enables effective
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3 incorporation of managerial input into the DEA evaluations. Second, the input and
4 output dimensions considered are context-specific. More comprehensive input and
5 output measurements, namely, allowing for non-discretionary factors, such as
6 environmental, socio-economic or quality inputs and outputs, need to be taken into
7 consideration. The influence of non-discretionary variables, excluded from our
8 analysis, amounts to an assumption that these factors are constant across the sample.
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10 Third, non-parametric, or alternatively, parametric free-disposal hull analysis can be
11 used to assess the efficiency scores. However, previous research has shown that
12 although the DEA scores are inferior in value to econometric scores, the ranking is
13 preserved (Bauer *et al.*, 1998).
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23 **8. Conclusion**

24 This article proposed a simple framework for the evaluation of Portuguese hotels and
25 the rationalisation of their operational activities. The analysis was based on a DEA
26 model that allowed for the incorporation of multiple inputs and outputs in determining
27 the relative efficiencies. Benchmarks were provided in order to improve the
28 operations of the less performing companies. In the second stage, the determinants of
29 the economic efficiency were investigated. Several interesting and useful managerial
30 insights and implications from the study were discussed.
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37 The general conclusion is that the hotel companies should adopt procedures that
38 induce greater efficiency, in following the example of efficient peers identified in the
39 benchmarking exercise. However, more investigations are needed to confirm these
40 first results and clarify unresolved questions.
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Table 1: Characteristics of the sample in 2004

Nobs	Hotels	Ranking in the largest 1000	Sales (Millions €)	Net income after taxes (€)	Number of Employees
1	<i>Estoril Sol</i>	134	138,914	8,952	961
2	<i>Solverde-Investimentos Turísticos da Costa Verde</i>	212	103,271	8,861	1,287
3	<i>M & J Pestana - Soc. Turística da Madeira</i>	411	52,605	11,828	662
4	<i>Vila Galé-Sociedade de Empreendimentos Turísticos</i>	492	44,592	3,581	1,055
5	<i>Enatur</i>	597	36,013	-1,229	1,281
6	<i>Salvor - Soc. de Investimentos Turísticos</i>	712	28,660	1,638	605
7	<i>Sociedade Figueira Praia</i>	714	28,612	5,410	228
8	<i>Dom Pedro-Investimentos Turísticos</i>	742	27,406	471	589
9	<i>Lusotur - Empreend. Imobiliários e Turísticos</i>	747	27,235	2,152	211
10	<i>ITI - Invest. Turísticos da Ilha da Madeira</i>	762	26,449	4,083	391
11	<i>Portis - Hotéis Portugueses</i>	861	21,780	1,157	352
12	<i>Hotéis Tivoli</i>	892	20,713	2,596	414
13	<i>Hotel Ritz</i>	894	20,553	-60	304
14	<i>Empreendimentos Turísticos Savoy</i>	980	16,690	178	484
15	<i>Hotéis Sheraton de Portugal</i>	997	14,786	300	230

Table 2: Characteristics of the inputs and outputs

Outputs				
Variables	Units	Range	Mean	Square deviation
Sales	€	236.211,00- 2.300.592,00	850.699,40	491.143,16
Number of guests	Number	2452-23359	16100	12476,37
Inputs				
Variables	Units	Range	Mean	Square deviation
Full-time workers	Number	11-92	56	21,36
Book value of property	€	23.868,00- 7.768.983,00	1.954.570,00	2.113.910,30
Operational costs	€	984,00- 426.536,00	158.874,70	95.476,50

Table 3: Literature survey of frontier models on Tourism

Study	Method	Units
Botti, Briec and Cliquet (2009)	DEA-CCR and BCC	15 hotels chains in France (1997)
Barros and Dieke (2007)	DEA two-stage procedure (Malmquist and bootstrapped tobit model)	25 travel agencies in Portugal (2000-2004)
Barros and Santos (2006)	DEA-allocative	15 hotels in Portugal (1998 to 2002)
Barros (2005)	DEA-CCR and BCC	42 Enatur hotels in Portugal (1999-2001)
Barros and Alves (2004)	DEA- Malmquist	42 Enatur hotels in Portugal (1999-2001)
Hwang and Chang (2003)	DEA-CCR, Superefficiency and Malmquist	45 hotels in Taiwan
Reynolds (2003)	DEA CCR and BCC	38 restaurants
Brown and Ragsdale (2002)	DEA-CCR and cluster analysis	46 US hotels
Anderson, Fok and Scott (2000)	DEA (Technical and Allocative)	48 hotels
Anderson, Fish, Xia and Michello (1999)	Stochastic Translog Production Frontier	48 hotels
Anderson, Lewis and Parker (1999)	DEA and stochastic Frontier	31 corporate travel departments
Johns, Howcroft and Drake (1997)	DEA	15 UK hotels over a 12-month period
Bell and Morey (1995)	DEA	31 units of corporate travel departments
Morey and Dittman (1995)	DEA	54 hotels

Table 4: DEA efficiency scores for Portuguese hotels, 1998-2005

Hotels designation	Technical Efficiency CRS	Technical Efficiency VRS	Scale Efficiency
<i>Solverde-Investimentos Turísticos da Costa Verde</i>	1.000	1.000	1.000
<i>Vila Galé-Sociedade de Empreendimentos Turísticos</i>	1.000	1.000	1.000
<i>Enatur</i>	1.000	1.000	1.000
<i>M&J Pestana-Soc. Turística da Madeira</i>	0.984	1.000	0.984
<i>Estoril Sol</i>	0.956	1.000	0.956
<i>Salvor-Socied. de investimentos Turísticos</i>	0.897	1.000	0.897
<i>Dom Pedro-Investimentos Turísticos</i>	0.864	0.997	0.867
<i>Hotéis Tivoli</i>	0.924	0.944	0.978
<i>ITI-Invest. Turísticos da Ilha da Madeira</i>	0.726	0.990	0.733
<i>Hotel Ritz</i>	0.969	0.984	0.985
<i>Lusotur-Empreend. Imobiliários e Turísticos</i>	0.879	0.954	0.921
<i>Empreendimentos Turísticos Savoy</i>	0.799	0.951	0.840
<i>Portis-Hotéis Portugueses</i>	0.905	0.937	0.966
<i>Sociedade Figueira Praia</i>	0.919	0.921	0.997
<i>Hotéis Sheraton de Portugal</i>	0.830	0.912	0.910
Mean	0.910	0.972	0.935
Median	0.919	0.990	0.966
Std. Dev	0.080	0.032	0.076

Table 5: Truncated bootstrapped second-stage regression
(dependent variable: CCR index)

Variable	Model 1	Model 2	Model 3
<i>Constant</i>	-1.16*	-1.10*	-1.16*
<i>Trend</i>	0.11*	0.09*	0.192*
<i>Square trend</i>	-0.03*	-0.07*	-0.071
<i>Quoted</i>	0.03*	0.02	0.042*
<i>M&A</i>	0.03*	0.05*	0.025*
<i>Group</i>	0.16***	0.13*	0.15*
<i>International</i>	0.01	-	-
<i>Variance</i>	0.06***	0.07*	0.06***
Total number of observations	1000	1000	1000