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Data Envelopment Analysis for establishing the financial benchmark of Korean hotels

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Abstract: In the wake of catastrophic natural disasters and rising threats of terrorism, the hotel industry has seen a decline in revenue and an increase in competition. To avoid a downward spiral, the hotel industry needs to develop more competitive business strategies in order to make its operations lean and robust. These strategies may include: customer relationship management, yield management, niche marketing and continuous improvement of financial health. The success of these strategies hinges on the ability of hotel managers to assess the financial efficiency of their hotel in comparison to

competition. In an effort to help hotel management enhance its financial efficiency in an increasingly competitive hotel industry, this paper proposes a Data Envelopment Analysis (DEA), which develops a meaningful set of benchmarks that will dictate best practices and form a successful hotel business model. Using the examples of 39 international and regional hotels in Korea, this paper illustrates the usefulness of DEA for the continuous improvement of hotel business practices.

Keywords: hotel management; benchmarking; Data Envelopment Analysis; DEA.

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1 Introduction

As revenue from tourists visiting Korea began to subside after a decade of boom and expansion, the hotel industry has become more vulnerable to competitive threats and financial instability than ever before. With a saturation of hotels and a decline in tourism in the wake of the International Monetary Fund (IMF) financial crises and a stagnant world economy, the key to a hotel's survival is its ability to minimise financial risks by increasing its Economic Value Added (EVA), reducing debt ratio, sustaining loyal customer bases, and improving employee productivity. Commitment to financial stability, however, cannot be translated into a competitive advantage unless hotel managers develop a reliable financial performance standard. Examples of a financial performance standard include financial audits, industry norms, and benchmarks. Since a hotel needs to measure its financial performance relative to its competitors so that it can solidify financial strengths and constantly reinvest capital assets, benchmarking seems to be the most effective way for setting a reliable financial standard and measuring the financial efficiency of a hotel.

In general, benchmarking is a continuous improvement process by which an organisation can assess its internal strengths and weaknesses, evaluate comparative advantages of leading competitors, identify best practices of industry functional leaders and incorporate these findings into a strategic action plan geared towards gaining a position of superiority (Min and Galle, 1996). The main goals of benchmarking include: identifying key performance measures for each function of business operations; measuring one's own performance levels as well as those of leading competitors; comparing the performance levels and identifying areas of comparative advantages and disadvantages; implementing programmes to close a performance gap between an organisation's own operations and its leading competitors (Furey, 1987).

Although the aforementioned benchmarking concept has been successfully applied to the hotel industry in the past, few of the prior studies to date have focused on the financial performance of hotels. A vast majority of the prior studies (*e.g.*, Morey and Dittman, 1995; Min and Min, 1996; Min and Min, 1997; Phillips and Appiah-Adu, 1998; Min *et al*., 2002) have primarily attempted to measure service performance of hotels in comparison to those of their leading competitors. Although most of these prior studies surmised that the financial performance of the hotel reflected its service performance, little has been studied to examine whether or not the financial success of the hotel allows its management to reinvest its extra financial resources in continuous service improvement (see, *e.g.*, Raja *et al*., 2006 for a correlation between service quality of the organisation and its financial performance). For example, Banker *et al*. (2005) observed that the high level of customer satisfaction with hotel service quality was indicative of the future revenue growth of the hotel. In other words, most of the prior studies on hotel service quality used the service performance as a surrogate measure of the financial performance and consequently did not develop a specific financial standard as the barometer of the hotel's competitiveness. To fill the void left by the prior studies, this paper measures the financial efficiency of hotels relative to their competitors and then identifies factors primarily responsible for their financial success and/or failure. The financial efficiency measured by input/output ratios reflects the long-term

viability of hotels better than traditional financial ratios, such as Return on Investment (ROI), because such efficiency reveals the strengths and weaknesses of hotels in comparison to other competitors in the hotel industry. As a way of comparatively assessing the profitability and financial stability of hotels with multiple inputs and outputs, this paper proposes a Data Envelopment Analysis (DEA), which has successfully explored measuring the operational efficiency of banks (*e.g.*, Oral and Yolalan, 1990; Yeh, 1996; Thanassoulis, 1999), hospitals (Valdmanis, 1992), nursing homes (Kleinsorge and Karney, 1992), purchasing departments (Murphy *et al*., 1996), cellular manufacturing (Talluri *et al*., 1997), travel demand (Nozick *et al*., 1998), information technology investments (Shafer and Byrd, 2000), customer service performances of Less-Than-Truckload (LTL) motor carriers (Poli and Scheraga, 2000), international ports (Tongzon, 2001), trucking firms (Min and Joo, 2003), national chain hotels in Taiwan (Chiang *et al*., 2004), state-owned chain hotels in Portugal (Barros, 2005), and container terminals (Min and Park, 2005). For further details on other DEA applications, interested readers should refer to Seiford (1990).

In general, DEA is referred to as a linear programming (non-parametric) technique that converts multiple incommensurable inputs and outputs of each Decision-Making Unit (DMU) into a scalar measure of operational efficiency, relative to its competing DMUs. Herein, DMUs refer to the collection of private firms, non-profit organisations, departments, administrative units, and groups with the same (or similar) goals, functions, standards and market segments. DEA is designed to identify the best practice DMU without *a priori* knowledge of which inputs and outputs are most important in determining an efficiency measure (*i.e.*, score) and assessing the extent of inefficiency for all other DMUs that are not regarded as the best practice DMUs (*e.g.*, Charnes *et al*., 1978). Since DEA provides a relative measure, it will only differentiate the least efficient DMU from the set of all DMUs. Thus, the best practice (most efficient) DMU is rated as an efficiency score of one, whereas all other less efficient DMUs are scored somewhere between zero and one. To summarise, DEA determines the following (Sherman and Ladino, 1995):

- the best practice DMU that uses the least resources to provide its products or services at or above the performance standard of other DMUs
- the less efficient DMUs compared to the best practice DMU
- the amount of excess resources used by each of the less efficient DMUs
- the amount of excess capacity or ability to increase outputs for less efficient DMUs without requiring added resources.

In measuring the financial efficiency of hotels, we chose DEA over other alternative techniques, such as Cobb Douglas functions and Analytic Hierarchy Process (AHP), because DEA reflects the multiple aspects of organisational performances, does not necessitate *a priori* weights of performance measures, does not require an explicit *a priori* determination of input and output functional relationships, and provides valuable insights as to how financial efficiency can be improved.

2 The model input and output measures

A careful identification of inputs and outputs is critical to the successful application of DEA to any benchmarking study (Oral and Yolalan, 1990; Yeh, 1996). Thus, the assessment of comparative efficiency using DEA begins with the selection of appropriate input and output measures that can be aggregated into a composite index of overall performance standards. Although any resources used by DMU should be included as input, we selected four categories of inputs: costs of land property, building capacity, other assets, and operating expenses. Costs of land property are: land purchase costs (*e.g.*, book value of the property) or leasing costs, depreciation and hotel property taxes that negatively affect the hotel's profitability. We separated these costs from fixed assets, owing to excessively high real-estate prices in Korea. Building capacity comprises hotel rooms, parking space, recreational/sports facilities, restaurants/coffee shops, retail stores/souvenir shops, and banquet/conference facilities that are needed to operate hotels. For example, the building capacity category includes the total number of rooms available. The ratio (*i.e.*, occupancy ratio) of the total number of rooms sold to the total number of rooms available indicates how efficiently the hotel's rooms are utilised to generate revenue and then increase net operating income (see, *e.g.*, O'Neill and Mattila, 2006 for a close tie between the occupancy ratio and the net operating income). In other words, the building capacity can dictate the efficiency of asset management. Thus, the building capacity should be chosen as one of the inputs.

Other assets include equipment (including computers, audio/video systems), furniture, cash, and liquid assets that are invested to generate revenue. Since Return on Assets (ROA) represents earnings on revenues multiplied by revenues on total assets, other assets affect the profitability of hotels and therefore should be regarded as input. In addition, operating expenses associated with food and beverage purchases, other hotel necessity (*e.g.*, complimentary items) purchases, and labour expenses (*e.g.*, wages for housekeeping services) that negatively affect the profitability of hotels and consequently would be viewed as another input.

On the output side, the overall performance of hotels can be measured by revenues from several sources: room, food/beverage (including banquets), and others (*e.g.*, conventions, fashion shows) that significantly influence the financial efficiency of hotels. Other well-known financial ratios such as profit margin and return-on-investment were not employed here because a less profitable hotel may be more efficient in utilising its personnel and equipment than a more profitable hotel. In fact, Sherman (1984) observed that profit measure alone was not a good indicator of how efficiently resources were used for customer services. We obtained the aforementioned input and output data from a series of annual financial reports available to hotel stakeholders in 2003. These reports listed 39 hotels throughout Korea. Since these hotels are not homogeneous in terms of their location (Seoul versus non-Seoul areas), class (luxury versus budget), and type (franchised chain versus independent), we attempted to discern the different characteristics of the hotels and their impact on the financial efficiency of hotels. Thus, we later added location to the list of input variables for modified DEA models, while adding both operating and non-operating income to the list of output variables for modified DEA models (see Tables 1 and 2).

Table 1 Descriptive summary statistics for the hotels under study

DEA measures	*Mean (in won)*	*Standard deviation (in won)*	*Minimum (in won)*	*Maximum (in won)*
Land property	35,533,192,837.4	64,615,097,780.5	364,137,928	323,899,840,000
Building capacity	34,653,698,236.9	68,159,971,503.1	566,215,243	392,841,413,432
Other assets	21,933,004,149.6	39,764,029,485.0	187,167,139	184,379,644,387
Operating expenses	9,418,233,498.4	17,948,434,113.7	221,390,022	94,352,739,135
Revenue-Room	9,659,464,271.3	13,778,582,156.1	453,336,759	53,344,549,031
Revenue-Food/ Beverage	13,562,227,565.3	22,262,293,975.0	70,124,720	85,164,242,101
Other revenues	14,869,158,486.3	44,636,891,040.5	284,143,667	246,007,098,117
Operating income	1,761,030,864.9	5,473,888,365.8	–6,647,335,399	21,361,078,254
Non-operating income	1,361,340,429.1	2,103,392,854.2	11,645,068	7,826,951,393

Table 2 DEA models and their inputs and outputs

DEA models	*Inputs*	*Outputs*
Model 1	Land property; building capacity; other assets; operating expenses	Revenue from room; revenue from food/beverage; other revenues
Model 2	Land property; building capacity; other assets; operating expenses	Operating income; non-operating income
Model 3	Land property; building capacity; other assets; operating expenses; location	Revenue from room; revenue from food/beverage; other revenues
Model 4	Land property; building capacity; other assets; operating expenses; location	Operating income; non-operating income

3 DEA model development

The DEA model, with the inputs and outputs summarised in Tables 1 and 2, was adopted for this study. The DEA model is mathematically expressed as:

$$\text{Maximise efficiency score } (jp) = \frac{\sum_{r=1}^{t} u_r y_{rjp}}{\sum_{i=1}^{m} v_i x_{ijp}} \tag{1}$$

$$\text{Subject to } \frac{\sum_{r=1}^{t} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1, \mathrm{j} = 1, \ldots, n, \tag{2}$$

$$u_r, v_i \geq \varepsilon, \ \forall r \text{ and } i, \tag{3}$$

where:

y_{rj} = amount of output r produced by DMU j
x_{ij} = amount of input i used by DMU j
u_r = the weight given to output r
v_i = the weight given to input i
n = the number of DMUs
t = the number of outputs
m = the number of inputs
ε = a small positive number.

To ease computational complexity associated with the fractional non-linear form of the above equations, the above Equations (1), (2), and (3) can be converted into a linear programme as follows:

$$\text{Maximise efficiency score } (jp) = \sum_{r=1}^{t} u_r y_{rjp} \tag{4}$$

$$\text{Subject to } \sum_{i=1}^{m} v_i x_{ijp} = a, \tag{5}$$

$$\sum_{r=1}^{t} u_r y_{rj} - \sum_{i=1}^{m} v_i x_{ij} \leq 0, \quad j = 1, \ldots, n, \tag{6}$$

$$-u_r \leq -\varepsilon, \qquad r = 1, \ldots, t, \tag{7}$$

$$-v_i \leq -\varepsilon, \qquad i = 1, \ldots, m, \tag{8}$$

where:

a = an arbitrarily set constant (*e.g.*, 100).

By solving the above Equations (4)–(8), the efficiency of DMU (jp) is maximised subject to the efficiencies of all DMUs in the set with an upper bound of 1. The above model is solved n times to evaluate the relative efficiency of each DMU. Notice that the weights u_r and v_i are treated as unknown variables whose values will be optimally determined by maximising the efficiency of the targeted DMU jp. An efficiency score (jp) of 1 indicates that the DMU under consideration is efficient relative to other DMUs, while an efficiency score of less than 1 indicates the DMU under consideration is inefficient. In a broader sense, an efficiency score represents a hotel's ability to transform a set of inputs (given resources) into a set of outputs. The above model also identifies a peer group (efficient DMU with the same weights) for the inefficient DMU (Boussofiane *et al*., 1991). A complete DEA analysis focusing on output maximisation with constant returns to scale was conducted by applying a linear programme formulated in Equations (4)–(8) to actual data (cross-sectional data in 2003) containing the sample of 39 hotels

listed in Table 3. Herein, we made sure that the minimum number of DMUs exceeded twice the total number of inputs and outputs in the proposed DEA model. Otherwise, the results of the DEA model would produce too many efficient DMUs with an efficiency score of 1 and create over-fit problems (Drake and Howcroft, 1994).

Table 3 Overall efficiencies with respect to Models 1 and 2

	Model 1		*Model 2*	
Hotel	*Efficiency (%)*	*Rank*	*Efficiency (%)*	*Rank*
Amiga	48.70	31	29.49	27
Renaissance	88.23	23	47.31	19
Seoul Hilton	60.07	29	36.88	22
Plaza	100.00	1	20.09	30
Intercontinental	66.30	26	58.84	16
Sheraton-WalkerHill	91.96	19	32.10	24
Westin-Chosun	100.00	1	82.58	10
Shilla	100.00	1	41.25	20
Jeju Grand	48.08	32	84.77	9
Concord	23.69	37	0.03	39
Gyungju Hilton	14.78	39	30.80	26
Capital	100.00	1	100.00	1
Sofitel Ambassador	100.00	1	57.04	17
Sejong	65.26	27	33.77	23
Holiday Inn Seoul	100.00	1	27.00	28
Changwon Tourist	100.00	1	100.00	1
Commodore	50.40	30	31.11	25
Seoguipo Resort	60.36	28	10.84	33
GS Plaza	100.00	1	11.85	32
Daegu Prince	84.16	24	0.07	36
Daegu Grand Tourist	100.00	1	61.17	15
Daegu Park	100.00	1	100.00	1
New Prince Tourist	100.00	1	0.06	37
Solak Park	45.84	34	0.06	38
Yoosung Tourist	89.77	21	63.22	14
Green Tourist	47.69	33	26.68	29
Crown Tourist	100.00	1	100.00	1
Pacific	90.22	20	41.12	21
Youido Tourist	100.00	1	100.00	1
Ambassador	89.55	22	54.99	18
Sydney Tourist	32.24	35	64.71	13
International Tourist	71.36	25	65.72	12
Dawn Beach Tourist	26.28	36	0.08	35
Busan Tourist	100.00	1	100.00	1
Grace Tourist	22.03	38	100.00	1
Sooanbo Park	95.08	18	12.00	31
Best Western Legend	100.00	1	68.31	11
New Hill Top Tourist	100.00	1	100.00	1
Park Business	100.00	1	0.08	34

4 DEA results and discussions

First, we measured the relative financial efficiency of the 39 Korean hotels in an effort to see how sensible those hotels were in spending their resources, such as use of assets and expenses to generate gross revenue. The results obtained from the use of Frontier Analyst (2004) software show that 17 hotels including first-class, luxury hotels such as Plaza, Westin-Chosun, and Shilla recorded an efficiency score of 1 (100%) in 2003 in terms of the base line model (*i.e.*, Model 1) (see Table 3). Part of these luxury hotels' success may have something to do with their prime locations in burgeoning business districts, convention centres, and nearby shopping malls, which enhance visibility, attract international conventioneers, and subsequently increase gross revenues. However, since revenues alone may not reflect a hotel's operational efficiency, we replaced revenues with incomes (operating and non-operating incomes) for the outputs of the DEA model and then reran it. With the exception of Westin-Chosun, the rankings of Plaza and Shilla dramatically declined from one to 30 and 20, respectively. Indeed, none of the first-class, luxury hotels (Amiga, Renaissance, Seoul Hilton, Plaza, Intercontinental, Sheraton-Walker Hill, Westin-Chosun, Shilla) ranked any higher than ten in terms of their financial efficiency measured by Model 2 (see Table 3). All but two (Shilla and Intercontinental) of these luxury hotels recorded a financial efficiency below 50% with respect to Model 2. This finding implies that high revenues or economies of scale created by the luxury hotels do not necessarily lead to higher incomes.

On the other hand, regional but niche-oriented hotels targeting tourists such as Capital, Changwon Tourist, Daegu Park, Crown Tourist, Youido Tourist, Busan Tourist, and New Hilltop Tourist scored perfect financial efficiencies (100%) with respect to both Models 1 and 2. A key differentiator between good and poor performing groups is the extent to which a hotels' assets and land/building properties were utilised. For example, underachieving hotels such as Amiga, Renaissance, Seoul Hilton, Intercontinental, Concord and Gyungju Hilton struggled to utilise their assets and land/building properties to the fullest extent (Tables 4 and 5). The underutilisation of their assets contributed significantly to the lagging growth of revenue from room, food and beverage, and other revenues. All of these six luxury hotels have plenty of room for improvement in other revenue opportunities available through the hosting of cultural events such as banquets, fashion shows, parties and conventions as evidenced by their potential improvement in other revenues exceeding 90% (Table 4). In particular, both Seoul Hilton and Gyngju Hilton significantly fell short of achieving their revenue potentials owing in part to sudden changes in ownership and management, which created uncertainty and instability for the future. As a result, both Hiltons lost their core competencies in convention-related businesses. In addition, the across-the-board economic stagnation, coupled with restructuring of the hotel industry through mergers/acquisitions, exacerbated the Hilton chain's revenue growth opportunity.

Table 4 Potential Improvement (in percentage) with respect to Model 1

	Input (%)				*Output (%)*		
Hotel	*Land*	*Building capacity*	*Other assets*	*Operating expenses*	*Revenue from room*	*Revenue from food and beverage*	*Other revenues*
Amiga	–59.48	0.00	–28.75	0.00	113.72	105.36	105.36
Renaissance	–58.42	0.00	0.00	–12.62	36.03	13.33	204.64
Seoul Hilton	–50.28	0.00	–35.12	0.00	66.48	66.48	254.60
Plaza	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Intercontinental	–37.88	0.00	0.00	0.00	50.84	50.84	92.69
Sheraton-WalkerHill	0.00	0.00	–47.59	–22.78	88.42	8.74	8.74
Westin-Chosun	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shilla	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Jeju Grand	0.00	0.00	–2.28	0.00	107.99	176.96	107.99
Concord	0.00	0.00	–81.63	0.00	322.06	322.06	322.06
Gyungju Hilton	–4.30	0.00	0.00	–31.80	576.63	576.63	576.63
Capital	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sofitel Ambassador	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sejong	–51.17	0.00	–15.62	0.00	178.29	53.23	53.23
Holiday Inn Seoul	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Changwon Tourist	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commodore	–60.26	0.00	0.00	0.00	98.42	98.42	132.78
Seoguipo Resort	–31.23	–6.77	–90.93	0.00	65.66	65.66	329.81
GS Plaza	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daegu Prince	0.00	–27.13	0.00	0.00	39.30	18.82	34.85
Daegu Grand Tourist	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Daegu Park	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Prince Tourist	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Solak Park	0.00	–36.84	0.00	0.00	118.16	118.16	118.16
Yoosung Tourist	–54.36	0.00	0.00	0.00	17.21	11.40	11.40
Green Tourist	–7.58	0.00	0.00	0.00	109.68	287.25	109.68
Crown Tourist	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pacific	–87.46	–7.39	0.00	0.00	10.84	252.05	10.84
Youido Tourist	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ambassador	–61.12	0.00	–72.83	0.00	11.67	11.67	157.14
Sydney Tourist	–40.11	0.00	–31.25	0.00	210.16	228.41	210.16
International Tourist	–81.22	0.00	–76.77	0.00	40.14	116.32	40.14
Dawn Beach Tourist	0.00	0.00	0.00	0.00	961.44	283.36	280.48
Busan Tourist	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grace Tourist	0.00	–5.40	0.00	0.00	355.34	353.87	353.87
Sooanbo Park	–57.09	0.00	0.00	0.00	5.18	50.81	5.18
Best Western Legend	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Hill Top Tourist	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Park Business	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: Negative values show relative underutilisation of resources and zero values indicate relatively full utilisation.

Table 5 Potential improvement (in percentage) with respect to Model 2

	Input (%)				*Output (%)*	
Hotel	*Land*	*Building capacity*	*Other assets*	*Operating expenses*	*Operating income*	*Non-operating income*
Amiga	0.00	0.00	–36.92	0.00	239.07	239.07
Renaissance	0.00	0.00	0.00	–70.20	111.39	111.39
Seoul Hilton	–9.53	0.00	–16.53	0.00	171.15	171.15
Plaza	–39.75	–46.10	–4.90	0.00	47.97	397.67
Intercontinental	–88.35	–65.02	–52.66	0.00	69.95	451.95
Sheraton-WalkerHill	0.00	0.00	–44.71	0.00	211.57	211.57
Westin-Chosun	–73.99	0.00	–74.91	0.00	21.09	151.45
Shilla	0.00	0.00	–2.65	0.00	142.41	142.41
Jeju Grand	–4.77	0.00	–40.44	0.00	17.96	167.21
Concord	–25.59	–54.35	–60.83	0.00	88.39	999.90
Gyungju Hilton	0.00	0.00	–10.55	–74.66	77.90	224.71
Capital	0.00	0.00	0.00	0.00	0.00	0.00
Sofitel Ambassador	–88.52	–36.78	–95.57	0.00	75.32	75.32
Sejong	0.00	0.00	–1.25	0.00	196.12	196.12
Holiday Inn Seoul	0.00	0.00	–34.37	–45.64	126.91	270.43
Changwon Tourist	0.00	0.00	0.00	0.00	0.00	0.00
Commodore	–81.00	–43.65	0.00	0.00	105.80	221.42
Seoguipo Resort	–71.91	–65.01	–84.01	0.00	822.42	822.42
GS Plaza	–79.92	–93.91	0.00	0.00	88.19	743.99
Daegu Prince	–81.07	–79.19	0.00	0.00	60.31	999.90
Daegu Grand Tourist	–84.89	–60.61	–59.69	0.00	63.47	325.12
Daegu Park	0.00	0.00	0.00	0.00	0.00	0.00
New Prince Tourist	–86.31	–61.39	0.00	0.00	517.18	999.90
Solak Park	–37.25	–65.83	0.00	0.00	97.57	999.90
Yoosung Tourist	–65.67	0.00	0.00	–15.48	58.17	495.49
Green Tourist	–78.44	–65.51	0.00	0.00	724.68	274.85
Crown Tourist	0.00	0.00	0.00	0.00	0.00	0.00
Pacific	–91.74	–48.11	0.00	–83.43	143.17	255.80
Youido Tourist	0.00	0.00	0.00	0.00	0.00	0.00
Ambassador	–75.63	0.00	–89.35	0.00	81.87	299.89
Sydney Tourist	–65.65	0.00	–78.50	0.00	54.54	999.90
International Tourist	–92.46	–57.87	–69.77	0.00	52.16	52.16
Dawn Beach Tourist	–64.37	–58.80	0.00	0.00	154.83	999.90
Busan Tourist	0.00	0.00	0.00	0.00	0.00	0.00
Grace Tourist	0.00	0.00	0.00	0.00	0.00	0.00
Sooanbo Park	–95.86	–87.52	0.00	0.00	103.30	733.27
Best Western Legend	–89.59	–86.25	–15.17	0.00	46.40	395.13
New Hill Top Tourist	0.00	0.00	0.00	0.00	0.00	0.00
Park Business	0.00	–78.53	–24.09	0.00	40.74	999.90

Note: Negative values show relative underutilisation of resources and zero values indicate relatively full utilisation.

On the other hand, independent but small-scale hotels such as Capital, Changwon Tourist, Daegu Park, Crown Tourist, Busan Tourist, and New Hill Top Tourist maximised their revenue and income-generating opportunities as shown in Tables 3, 4, and 5. However, we discovered that hotels such as Plaza, Shilla, Holiday Inn Seoul, New Prince Tourist, GS Plaza and Park Business, which are efficient in generating relatively high revenues, are not necessarily efficient in generating income as evidenced by the significant differences in efficiency between Models 1 and 2 (see Table 3). On the other hand, hotels such as Jeju Grand and Grace Tourist that are not efficient in generating revenues turned out to be relatively efficient in generating income. For example, Grace Tourist ranked at the near bottom (38th of 39 hotels) in terms of its efficiency in Model 1, but ranked at the top (1st out of 39 hotels) in terms of efficiency in Model 2. Therefore, the hotel's capability to generate revenues has no bearing on its capability to generate income.

Also, since good location can potentially attract more customers, we investigated the impact of location on a hotel's revenue and income. As shown in Tables 6 and 7, hotels located in the Seoul metropolitan area with more than 12 million population do not necessarily outperform regional hotels situated in smaller cities and rural towns with respect to efficiency in generating income. However, as summarised in Table 7, the result of Friedman's rank sum test reveals that the hotel's location has significant impact on its efficiency in generating revenues at $\alpha = 0.05$.

Table 6 Efficiency scores with respect to location

Hotel	*Location*	*Model 3*		*Model 4*	
		Score	*Rank*	*Score*	*Rank*
Amiga	1	1.01	27	0.33	27
Renaissance	1	1.44	15	0.48	19
Seoul Hilton	1	0.94	28	0.41	25
Plaza	1	1.74	14	0.42	22
Intercontinental	1	0.66	32	0.59	17
Sheraton-WalkerHill	1	2.39	10	0.41	23
Westin-Chosun	1	4.49	2	0.84	15
Shilla	1	3.22	5	0.44	21
Jeju Grand	2	0.58	33	1.73	8
Concord	2	0.29	37	0.03	39
Gyungju Hilton	2	0.15	39	0.32	28
Capital	1	3.07	6	1.56	11
Sofitel Ambassador	1	1.13	24	0.59	16
Sejong Hotel	1	1.44	16	0.39	26
Holiday Inn Seoul	1	2.44	9	0.29	30
Changwon Tourist	2	2.17	11	4.06	3
Commodore	2	0.85	30	0.44	20
Seoguipo Resort	2	0.80	31	0.20	31
GS Plaza	2	1.32	21	0.15	34

Table 6 Efficiency scores with respect to location (continued)

		Model 3		*Model 4*	
Hotel	*Location*	*Score*	*Rank*	*Score*	*Rank*
Daegu Prince	2	1.39	19	0.10	37
Daegu Grand Tourist	2	2.00	12	1.17	12
Daegu Park	2	2.88	7	3.69	4
New Prince Tourist	2	1.41	17	0.09	36
Solak Park	2	1.01	26	0.09	38
Yoosung Tourist	2	1.18	22	1.72	9
Green Tourist	1	0.57	34	0.29	29
Crown Tourist	1	1.18	23	2.09	6
Pacific	1	1.40	18	0.41	24
Youido Tourist	1	2.49	8	1.57	10
Ambassador	1	1.13	25	0.55	18
Sydney Tourist	2	0.34	35	0.92	14
International Tourist	2	0.94	29	1.05	13
Dawn Beach Tourist	2	0.33	36	0.12	35
Busan Tourist	2	3.84	4	5.18	1
Grace Tourist	2	0.29	38	2.23	5
Sooanbo Park	2	1.82	13	0.17	32
Best Western Legend	2	4.11	3	1.88	7
New Hill Top Tourist	1	7.74	1	4.16	2
Park Business	2	1.38	20	0.15	33

Notes: 1 = Hotels in the Seoul metropolitan area.
2 = Regional hotels outside the Seoul metropolitan area.

Table 7 Rank sum statistics by location

Summary statistics	*Model 3*	*Model 4*
Rank Sum for Group 1	297	341
Rank Sum for Group 2	483	439
Test Statistics	–1.7748	–0.5353
Probability for Test Statistics	0.0380	0.2962

5 Conclusions and managerial implications

After more than two decades of rapid growth in tourism following the Summer Olympic games and World Cup Soccer events, the hotel industry in Korea has finally reached the mature stage of its life cycle. As the hotel industry matures, hotels that fail to enhance cash flows and improve productivity are unlikely to survive in the increasingly competitive marketplace. In an effort to help hotels manage their financial resources

more efficiently and formulate survival strategies, this paper proposed a DEA that was designed to analyse the financial efficiency of hotels, identify potential sources of inefficiency, and provide useful information (hindsight) for the continuous improvement of financial efficiency. This paper also summarises several major findings of this benchmarking study and develops practical guidelines for improving the financial efficiency of hotels.

First, while its sheer size and economies of scale could help a hotel generate revenue, hotel size is not a good indication of its efficiency in generating income. A vast majority of large-scale hotels with more than 500 guest rooms struggled to sustain their efficiency in generating income. Similarly, although the luxury brand and subsequent high price tag (more than $200 per night) might have helped several luxury hotels such as Plaza, Westin-Chosun, and Shilla generate large revenues, the luxury status (or five star hotel ratings) did not enhance the hotel's efficiency in generating income. With an exception of Shilla, all luxury, five star hotels registered relatively low efficiency ratings below 60% in terms of generating income. This finding indicates that unless luxury hotels fail to better utilise their assets (especially real estate and building property) and control their operating expenses, they would continue to lose their financial efficiency and competitiveness. For instance, Renaissance suffered from a dramatic increase in property taxes because of the overheated real estate market and the Korean government's controversial tax reform, which offset the appreciation in the real estate and property value. To make matters worse, the Korean government's recent crackdown on bad bank loans, which were used to bail out huge investments in the hotel infrastructure for large-scale hotels, might have contributed to the downfall of some luxury hotels. For instance, Hilton, which was originally owned by the defunct Daewoo conglomerate (or 'chaebol'), underwent rapid management changes and financial restructuring that led to a steep decline in its efficiency score. Such a decline in efficiency may have stemmed from a drastic increase in debt financing and the subsequent rise in interest payment coupled with the underutilisation of land and other assets. Furthermore, some hotels' merger/acquisition of new businesses in a time of financial crisis and the subsequent restructuring charges undermined their financial efficiencies. To summarise, the sheer scale (size) of hotel businesses lacking financial stability and particular niche areas may have been detrimental to the financial efficiency of hotels.

A second finding is that the location in heavily populated areas does not necessarily reflect the hotel's financial efficiency, although a good location can put the hotel in position to generate larger revenues by attracting more hotel guests. This finding is somewhat incongruent with an earlier finding by Barros (2005) indicating that hotels located in cities were more efficient than those in remote towns. However, hotels such as Seoguipo Resort, Solak Park, Sooanbo Park and Dawn Beach Tourist, located near mountain and beach attractions and primarily targeting seasonal tourists also suffered from lagging financial efficiency (see Tables 4, 5, and 6). To summarise, what is considered a prime location in a densely populated area may be more costly to manage because higher property taxes and employee wages may not necessarily enhance the hotel's financial efficiency.

Third, as evidenced by wide variations in financial efficiency among franchised chain hotels, we could not discern any pattern indicating that franchising helped the financial status of a hotel. Indeed, all best-practice, benchmark hotels such as Capital, Changwon Tourist, Daegu Park, Crown Tourist, Busan Tourist, Youido Tourist, and New Hill Top Tourist are independently operated hotels that are not affiliated with any domestic or

international hotel franchises (Table 3). This finding contradicts the result obtained from an earlier study conducted by Chiang *et al*. (2004) indicating that franchised hotels performed more efficiently than independent hotels in Taipei, Taiwan.

Finally, we noticed a pattern among poor performing hotels, such as Seoul Hilton, Gyungju Hilton, Concord, Commodore, Seoguipo Resort, and Renaissance. There was a substantial lack of revenues generated from sales of food and beverage and other revenues generated by hosting cultural events (Table 4). That is to say, heavy reliance on room revenue alone would not salvage a hotel's financial problem. Thus, hotels need to diversify their revenue sources in order to enhance their financial efficiency. These revenue sources may include: revenues from hotel restaurants and coffee shops, alumni unions, banquets, parties, fashion shows, conventions and souvenir shops. This finding implies that hotels, which failed to diversify their service offerings and adapt to changes in customer needs, had less likelihood of generating revenue in tough economic times, and therefore, underutilise their resources. Based on the above findings, we suggest the following survival strategies:

- Take initiative in trendy, niche-market segments with high profitability and customisation potential. Examples include year-round tourist markets and hosting cultural events (*e.g.*, fashion shows, beauty pageants and symposiums), parties and conferences. On the other hand, hotels limiting their services to a specific customer base, such as seasonal guests, may struggle. Thus, the hotel's success will depend heavily on its ability to diversify its service offerings and respond to changing service trends in a timely manner.
- consider leasing fixed assets such as building, equipment, and land to increase the cash flow and the fixed asset turnover ratio, which should improve financial efficiency in the long run
- improve a debt ratio to reduce interest payment and enhance profitability by using a conservative investment strategy for renovations or employee hiring
- restrain from quick mergers and acquisitions and then evaluate the financial risks and return-on-investment associated with the expansion in hotel capacity
- minimise service disruptions and subsequent financial instability resultant from hotel labour unions by instilling gain sharing principles for hotel employees
- eliminate unnecessary wastes (*e.g.*, complimentary items and newspapers, free shuttle services to shopping districts and airports) associated with service activities by implementing activity-based costing principles that enable management to focus on the activities generating the income.

To conclude, this paper differentiates between thriving and struggling groups of Korean hotels on the basis of DEA efficiency scores. The DEA efficiency score gives management a warning that the lower the DEA score is, the more likely a hotel is to fail. Thus, DEA is very useful for identifying the least efficient hotels (or hotel business models), which require the closest attention. Furthermore, given the fierce competition in the hotel industry, hotels should prove to their potential stakeholders that their revenues in terms of DEA scores are comparatively higher than their competitors; thus, DEA becomes an important tool for diagnosing potential financial problems and judging the relevancy of impending investment decisions. The proposed DEA model also included

multiple outputs (including non-financial measures such as location) and a greater number/category (*e.g.*, luxury versus budget, franchised chain versus independent) of hotels in various organisational settings.

To summarise, the main contribution of this paper includes the novel application of DEA to the financial performance measurement of hotels. The proposed DEA model not only helps hotel management establish detailed business strategies for prioritising the use of financial resources, but also helps evaluate the effects of financial investment on the profitability of a hotel. Since the proposed DEA model provides detailed benchmarks for hotels, it also allows hotels to continue to improve their financial health and enhance their competitiveness. The proposed DEA model, however, can be extended to consider time-series data through the DEA window analysis.

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