

Regional Traffic & Medical Services and Cost Efficiency of International Tourist Hotels in Taiwan

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Abstract

This study analyzes how regional public transport facilities and medical services affect the efficiency of international tourist hotels (ITHs). First, we adopt data envelopment analysis (DEA) to measure the cost efficiency of international tourist hotels in Taiwan during 1998 to 2009. Next, we use the truncated regression to estimate the effect of traffic convenience and medical services on cost efficiency. The distance to international airports and distance to MRT station have significantly negative effects on cost efficiency of international tourist hotels, while the distance to the freeway exit, distance to bus station, and pick-up service, chain system, and shorter operating year have significantly positive impacts on their cost efficiency. The shorter distance to the hospital and more hospitals in a region significantly improve cost efficiency of ITHs in Taiwan.

Keywords: international tourist hotels, cost efficiency, travel convenience, medical services

1. Introduction

The demand for travelling has been increasing rapidly along with the economic growth and the dramatically improved quality of life. In recent years, tourism not only has become the main source of foreign exchange earnings, but also plays an indispensable role in economic development in most countries. The tourism industry is also one of the six emerging industries in Taiwan, and many strategies are developed to attract tourists in recent years. With the active promotion of the tourism industry by the Taiwanese Government, it has become more and more important in the economic development. Between 2005 and 2009, revenue of the tourism industry has increased by 4.5%, from 1.98% to 2.07% of GDP, and the number of employment has also increased by 32.8%, from 205,000 to 273,000 people (Chou et al., 2011).

According to the statistical results of the Taiwan Tourism Bureau, most tourists chose to lodge in the hotels, and they spent 39.32% of their total traveling expenditures in hotels (Chou et al., 2011). Tourists spent NT\$ 165 billion dollars in the international tourist hotels (ITHs), which accounts for 62.12% among the total accommodation expenditures (Chou et al., 2011). Thus, international tourist hotel industry is one of the key successful sectors of the tourism industry. Since 1987, Taiwanese government has gradually removed the constraints in the *Regulation for the Management of Tourist Hotel Enterprises*; consequently the number of international tourist hotels in Taiwan has risen from 44 in 1985 to 70 in 2010, meanwhile becoming more competitive. In order to survive and gain profits, efficiency is an essential factor to be considered when developing strategies. Efficiency measurement can help the hotel managers control idle resources in the operating process as well as improve the allocation of resources, and it also enables the hotels to find their own strengths and weaknesses by comparing with the performance of the whole industry (Chen, 2007; Honma and Hu, 2012). Consequently, it is important to evaluate the efficiency appropriately and to utilize the factors which can improve the efficiency.

Transportation is the key factor for tourists to visit each tourist attraction, and it is also essential in tourism activities. A well-developed infrastructure for transportation is an important factor for tourists to choose and reach their destinations, and it is also one of the basic requirements for the development of tourism (Akama & Kieti, 2003). In addition, people may get sick or injured by accidents while travelling. If the patient could not

receive immediate and appropriate medical treatment, then the degree of traveling risk shall increase and it will reduce the tourists' willingness to visit this destination again. Therefore, we want to analyze the effect of traffic convenience and medical services on the cost efficiency of hotels.

In this study, the cost efficiency of international tourist hotels in Taiwan during 1998-2009 is analyzed with a two-stage procedure. In the first stage, we adopt data envelopment analysis (DEA) to compute and rank the hotels according to their efficiency. In the second stage, we use the truncated regression suggested by Simar and Wilson (2007) to find out the effects of environmental variables (i.e., traffic convenience and regional medical services) on cost efficiency scores. We hope to assist the hotel manager, the hotel investor and the government to improve the hotel efficiency through the perspectives of transportation and public medical services.

The structure of this study is as follows: Section 2 gives a literature review on hotel efficiency and the interactive relations of traffic convenience and public medical services to tourism. Section 3 introduces the methodology and the data. Section 4 discusses the empirical results, and the conclusion is located in Section 5.

2. Literature Review

2.1 Hotel Efficiency

The concept of using frontier production function to measure efficiency is proposed by Farrell (1957), and he is the first one to divide cost efficiency into technical efficiency and allocative efficiency. Recently, there are more and more cases of study using the frontier approach to measure hotel performance, and DEA and SFA are two primary methods available to be found.

Anderson et al. (1999) use SFA to analyze the operating efficiency of 48 hotels in U.S.A. The input variables include the number of full-time equivalent employees, the number of rooms, total gaming related expenses, total food and beverage expenses and other expenses, while the output variables include the total revenues of rooms, gaming, food and beverage and other revenues. The results show that the average efficiency value of these hotels is 89.4%, which is comparatively higher and in consistent with the condition of a highly efficient and competitive market.

Barros and Mascarenhas (2005) analyze the efficiency of 43 Portuguese state-owned hotels by DEA. The input variables include the number of full-time equivalent employees, the book value of the premises, and the number of rooms, while the output variables include sales, the number of guests, and the aggregated number of nights spent. The results show that there are only four hotels achieving technical efficiency and allocative efficiency, and the hotels close to main tourist routes or with more rooms receive higher efficiency scores. Organizational management environments with accountability, transparency and efficiency incentives may also improve the hotel performance.

Barros and Dieke (2008) use revenue per room as the output variable, and they use total cost and investment expenditure as the input variables to analyze the technical efficiency of 12 Luanda hotels by DEA. Their study finds that the efficiency of these hotels may increase during the observation period, but at a decreasing rate. In addition, market share and joint members of a group may also positively affect the efficiency of these hotels.

There are also some researchers studying the efficiency of hotels in Taiwan. Tsaur (2001) investigate 53 international tourist hotels in Taiwan from 1996 to 1998 by DEA under 7 input and 6 output variables. The average operating efficiency is 87.33%, and the efficiency score for the catering divisions (89.05%) is better than that of the room divisions (71.3%). The hotels in chain operation are more efficient than others.

Hwang and Chang (2003) adopt DEA and the Malmquist method to measure the managerial performance of 45 international tourist hotels in Taiwan and the change of efficiency from 1994 to 1998. The result reveals that the efficiency of each hotel is significantly different according to its sources of customers and management styles. The study categorizes the hotel industries into six groups, based on efficiency and the change of efficiency, and suggests that the hotel managers can make strategies according to the characteristics of each group.

Chen (2007) studies the operating performance of 55 international tourist hotels by SFA and finds that the average efficiency is 80.3%. The highest efficiency score is 97.72%, and the lowest is 34.34%. A comparison between the efficiency of chain and non-chain hotels indicates that the former is better than the latter.

Hu et al. (2009) use two-stage DEA to compute and explain the cost efficiency of international tourist hotels in Taiwan. The input variables include the number of rooms, the number of employees, and total floor space of catering division, while the output variables include total revenues of food and beverages, total revenues of rooms, and other revenues. The result shows that the average cost efficiency is 57%, and the cost inefficiency is due in large part to technical inefficiency. The hotels in chain systems, located in resort areas, with a higher

occupancy rate or near the international airports show significantly higher efficiency scores.

Chen et al. (2010) also employ DEA to measure the cost efficiency of international tourist hotels from 1997 to 2007 by using three input variables and three output variables. The research use Tobit regression in the second stage to analyze the effects of tourist nationalities on the cost efficiency of hotels.

Assaf et al. (2010) apply meta-frontier with four input variables and five output variables to analyze 78 international tourist hotels in Taiwan. They separate hotels into groups by size, ownership and classification. The result shows that the chain hotels, the larger hotels, and the international tourist hotels have higher efficiency scores.

2.2 Traffic Convenience and Medical Services

There are plenty of studies indicating that the development of transportation has deep connection with tourism industry. Khadaroo and Seetanah (2008) prove that transport infrastructure is an important factor in improving the international tourism flows. Prideaux (2000) outlines a transport cost model that identifies the significance of transport as a factor in destination development as well as in the selection of destinations by tourists. Transportation is also a key factor in the hotel industry, especially for the new investor and the travelers. Chou et al. (2008) probe into the indicators considered by investors in evaluating the location selection of hotels, showing that easy access to tourist attractions from hotel is an important factor. The convenience of location and parking are also two important factors for customers when choosing hotels (Saleh & Ryan, 1992).

This study measures from an economic perspective of the traffic convenience of hotels and tries to apply the concept of the travel cost method (TCM), which is widely used to estimate the value of non-market goods, to the hotel efficiency research. The traditional TCM model estimates the number of trips as a demand function by using the cost of traveling to the site (Loomis et al., 2000). However, the number of trips is underestimated because it did not consider traveling time in the traditional method. Brown and Nawas (1973) construct a travel cost model including transportation cost, time cost and access cost, and Earnhahrt (2004) further proves that transportation cost and time cost have a significantly negative effect on recreational demand.

Prideux (2000) points out that the distance travelled is a key factor in determining the importance of transportation cost when selecting a destination because it includes both the actual fare cost and the time element. Shieh et al. (2014) find that generally most tourists in Taiwan prefer a larger, older, and closer-to-airport hotel. We use the distance between each international tourist hotels and each public transport facility to represent transportation cost. The shorter distance from public transport facilities to hotels, the less transport cost spent, making it more convenient to access. We want to study in details whether traffic convenience would affect the efficiency of hotels, and what kind of public transport facilities would help improve the efficiency of their nearby hotels.

Medical concern is one of the major risk factors by tourists before traveling (Carter, 1998; Lepp & Gibson, 2003). International travelers may encounter the risks of receiving physical or psychological illness due of weather and hygiene problems, and the risks will be higher if countries visited provide inadequate medical services (World Health Organization, 2011). Tsaur et al. (1997) further demonstrated that medical support is also an important factor in evaluating health risks.

Public medical service is also a factor affecting tourists' decisions when choosing destinations. According to the previous investigations, sufficient public medical services have a positive impact on tourism development (Gauci et al., 2002). Batabyal & Ghosh (2012) also point that the development of medical sector may significantly increase in tourist arrivals. The result of Yang et al. (2010) is similar to other studies. They analyze the cases of tourist arrivals in China and find that sufficient public health care is helpful in attracting international tourists. In this study, we are also concerned about whether medical resources would influence the cost efficiency of hotels.

There are plenty of studies in hotel efficiency, and we summarize them in Table 1. We find that type (Tsaur, 2001; Hwang & Chang, 2003; Chen, 2007; Barros & Dieke, 2008; Hu et al., 2009, 2010; Chen et al., 2010; Assaf et al., 2010), location (Hwang & Chang, 2003; Barros & Mascarenhas, 2005; Chen, 2007; Hu et al., 2009; Hu et al., 2010), scale (Barros & Mascarenhas, 2005; Assaf et al., 2010), and the distance to the international airport (Hu et al., 2009; Chen, 2010; Shieh et al. 2014) are four variables used mostly in the existing literature for explaining the hotel efficiency. In the above literature, distance to an international airport is the only variable which is related to transportation. Since there is a strong relationship between traffic convenience and the hotel industry, we try to apply the concept of transportation cost to the research in hotel efficiency by using also other traffic-related variables, for example, the distances between public transport facilities and hotels. Public medical services are also an important concern in international travel, but there is currently lacking in any study which

discusses the effect of medical services to hotel efficiency. We believe that more medical resources available for a hotel, the higher efficiency scores it would get. This is a new idea in the hotel industry. Overall, this study aims to focus on the issue that which kind of public transportation facilities will help improve the efficiency scores of their nearby hotels, and the actual effects of medical services on the hotel efficiency.

Table 1. Literature on hotel efficiency

Authors	Method	Unit	Main findings
Anderson et al. (1999)	SFA	48 America hotels, 1994	The average efficiency score is 89.4%, and it's consistent with a highly efficient and competitive market.
Barros & Mascarenhas (2005)	DEA	43 Portuguese hotels, 2001	Scale economies, organizational governance environmental and location affect the efficiency of hotels.
Barros & Dieke (2008)	DEA	12 Luanda hotels, 2000-2006	The efficiency score increase over the studied period. Greater market share and network management can improve the efficiency.
Tsaur (2001)	DEA	53 Taiwan hotels, 1996-1998	The average efficiency is 87.33%. The chain-hotels have higher efficiency scores.
Hwang & Chang (2003)	DEA	45 Taiwan hotels, 1994-1998	The average efficiency is 79.16%. The resort hotels and the international chain hotels have better performance.
Chen (2007)	SFA	55 Taiwan hotels, 2002	The average efficiency is 80.3%. The hotels of chain operation and the hotels located in resort area are more efficient.
Hu et al. (2009)	DEA	66 Taiwan hotels, 1997-2006	The average cost efficiency is 91.15%. Chain system, resort area, higher occupancy rate and near the international airports improve efficiency scores.
Chen et al. (2010)	DEA	Taiwan hotels, 1997-2007	The chain system, shorter distances to the international airport and established year can improve cost efficiency. The tourists' nationalities affect the cost efficiency.
Assaf et al. (2010)	Meta-frontier	78 Taiwan hotels, 2004-2008	The chain hotels, the large hotels and the international tourist hotels have higher efficiency scores.

3. Methodology and Data

3.1 Data Envelopment Analysis

Development envelopment analysis is a linear programming methodology to measure the efficiency of homogeneous decision-making units (DMUs). Reynolds (2003) points out that DEA focuses managers' attention on specific actions that will improve productivity; therefore, DEA holds great promise for studies aimed at enhancing productivity in hospitality-related operations. The DEA concept is proposed by Farrell (1957) and uses the production frontier to measure the performance. Charnes et al. (1978) construct the first DEA model based on Farrell. They adopt linear programming with multiple inputs and multiple outputs to measure the cost efficiency under the presumptions of constant returns to scale and input orientation. This model is called the CCR model. A fundamental assumption under the CCR model is constant returns to scale (CRS).

We apply the input-oriented CCR model to measure the technical efficiency (TE_{CRS}) of ITHs. It means that we want to study how much inputs can be reduced without changing the outputs. Then the cost minimization DEA model under the CRS assumption is applied to compute the cost efficiency (CE_{CRS}) of ITHs. Finally the allocative efficiency under the CRS assumption can be found by the following relation:

$$AE_{CRS} = CE_{CRS}/TE_{CRS} \quad (1)$$

The ranges of CE, TE, and AE are all between 0 and 1. A DMU has cost, technical, or allocative efficiency when its CE, TE, or AE is 1, respectively.

3.2 Truncated Regression

Past researches often use Tobit regression in the second stage to analyze the impact of environmental variables on cost efficiency. However, Simar and Wilson (2007) indicate that the DEA efficiency estimates are serially correlated in a complicated and unknown manner in the second stage when using Tobit regression; therefore, the results will be inappropriate and invalid. Simar and Wilson (2007) demonstrate that the estimated result of truncated regression is better than Tobit regression. Therefore, we apply the truncated regression in the second stage.

3.3 Data Sources and Variable Definitions

The operation of an organization is a procedure to transfer the inputs to the outputs. Mostly, outputs of hotels are measured by their revenues. The revenues of food, beverage and lodging are the main sources and account for about 80% of the total revenues of the international tourist hotels in Taiwan. Other revenues, for example revenues of swimming, services revenues of laundry, rent and services, etc., are accounted for less than 20%. On the other hand, the inputs of hotels include employees, equipment, and capitals, etc. The salaries of employees represent the human resources of the hotel. The number of rooms and the total floor spaces of catering divisions represent the capital investment of the hotels (Hwang & Chang, 2003).

Table 2. Definitions of outputs, inputs, input prices and environmental variables

Variables	Definitions
<i>Outputs</i>	
Total revenues of food and beverage	This includes incomes from sale of foods, snacks, alcohol, beverages in dining room, coffee room, banquet, and night club (tips are not included), measured in NTD.
Total revenues of rooms	This includes incomes from lease of rooms (tips are not included), measured in NTD.
Other revenues	This includes incomes other than the two items mentioned above. They include operating revenues from lease of store space, laundry, swimming pool, ball courts, barber shop, beauty salons and bookstores, measured in NTD.
<i>Inputs</i>	
Number of guest rooms	These include the amount of guest rooms that can be provided for rent from an international tourist hotel. Accordingly, the unit of measurement is simply "rooms", without subsequent adjustment for size or quality.
Number of employees	Total employees involved in the operation of international tourist hotels, including medium- and high-ranking executives, guest room and catering staff, cooks, maintenance crews, and repairmen.
Total floor spaces of catering divisions	This includes the total floor spaces used by the operational units of all hotels' catering facilities, measured in Ping (1 Ping = 3.305785 square meters).
<i>Input prices</i>	
Average price of room operations	This refers to the total operating expenses per room, measured in NTD/room. We use the total revenue of a hotel divided by the number of rooms.
Average annual employee wage	This includes salary and related expenses per employee, measured in NTD/individual.
Average price of F&B operations	This refers of catering department expenses per square meter of floor space, measured in NTD/Ping.
<i>Environmental variables</i>	
Distance to public transport facilities	The distance between hotels to the nearest public transport facilities which include airport, train station, MRT station, freeway exit, bus stop. Distance to MRT station is expressed by dummy variable, "1" represents less than 1 km.
Distance to hospital	The distance between hotels to the nearest hospital, measured in kilometer.
The number of hospitals	The number of hospitals in each county in Taiwan.
The number of medical personnel per ten thousand	Measured in each county in Taiwan
Pick-up service	"0" represents no, and "1" represents yes.
Type	"0" represents independent management, and "1" represents hotels joining a chain.
Year	1998 is year 1 and 1999 is year 2, and so on
Location	"0" represents metropolitan area, and "1" represents resort area

We use the independently pooled panel data which are unbalanced from 1998 to 2009. All the operating variables are collected from the annual Operating Report of International Tourist Hotels in Taiwan published by Taiwan Tourism Bureau. The number of the international hotels varies every year since some of them would fail to reach the criterion set by the government and would be removed from the list. The followings are the numbers of observations from 1998 to 2009: 1998(52), 1999(54), 2000(54), 2001(54), 2002(55), 2003(57), 2004(57), 2005(56), 2006(57), 2007(57), 2008(58), and 2009(56), making 667 observations in total.

The definitions and the descriptive statistics of input variables, output variables, input prices, and environmental variables are described in Tables 2 and 3.

Table 3. Descriptive statistics of outputs, inputs, and input prices

Variables	Units	Mean	SD	Min	Max
<i>Outputs</i>					
Total revenues of food and beverage	10 ³ NT\$	275,345	274,072	3,965	1,318,317
Total revenues of rooms	10 ³ NT\$	238,404	217,399	7,339	1,456,306
Other revenues	10 ³ NT\$	98,269	141,214	0	1,415,516
<i>Inputs</i>					
Number of guest rooms	Number	72,996	43,638	3,910	246,626
Number of employees	Number	335	229	32	1,230
Total floor space of catering division	Ping (1 Ping = 3.305785 square meters)	1,191	1,364	48	16,022
<i>Input prices</i>					
Average price of room operations	NT\$	3,060	1,336	867	9,334
Average employee annual wage	NT\$	526,014	156,231	62,239	971,509
Average price of F&B operations	NT\$	106,027	98,404	2,374	1,962,222

Note: The base year for all monetary units is 1998.

4. Empirical Results

4.1 Operational Efficiency Analysis

This study adopts input-oriented DEA approach to compute the cost efficiency of international tourist hotels in 1998-2009 by using the Deap 2.1 software kindly provided by Professor Tim Coelli. The average cost efficiency score is 62.41%. It means that hotels in Taiwan can reduce their input costs by 37.59% without decreasing any output.

Cost efficiency can be divided into technical efficiency and allocative efficiency. Technical efficiency is the ability to maximize the output under given input, while allocative efficiency is the ability to use the inputs and outputs to reach the best proportion given their prices. The trends of the average values of cost efficiency, technical efficiency and allocative efficiency in 1998–1999 are showed in Figure 1. The direction of cost efficiency is very similar to allocative efficiency. That is, the effect of allocative efficiency on cost efficiency is relatively large compared to technical efficiency, and this result is in consistent with the finding in Hu's research in 2009.

We can find 3 obvious recessions in 1999–2000, 2002–2004 and 2006–2007. A 7.3-magnitude earthquake struck Taiwan in 1999 and took 2415 lives. Its epicenter was situated in Nantou which is one of the famous tourist attractions in Taiwan. Some of the hotels there collapsed and had to rebuild due to the earthquake. Therefore, the low cost efficiency in 1999–2000 may reflect the impact of this serious disaster.

The reduction of cost efficiency in 2002–2004 is possibly due to SARS. The first case of SARS appeared in China in 2002 and spread to other countries around the world explosively, and it caused 73 deaths in Taiwan. The international tourist arrivals declined by 24.5% compared to 2004. It affected the safety of travelling in Taiwan and the efficiency of ITHs.

The last recession in the Figure 1 between 2006 and 2007 may be influenced by the political instability. In late

2006, demonstration campaigns and incidents were held to pressure the President Shui-bian Chen to resign, resulting in the massive political and social turmoil in Taiwan. The occupancy rate of ITHs is 47.43% only in 2007, and it has been the lowest figure in the recent twelve years.

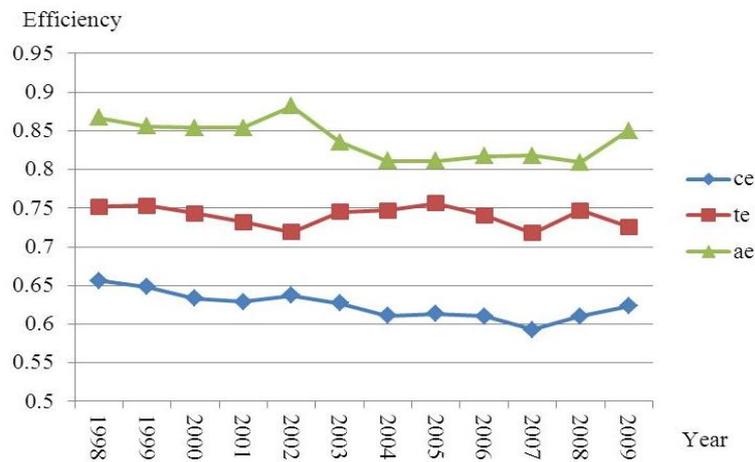


Figure 1. Average efficiency scores of international tourist hotels in Taiwan during 1998-2009

Table 4. Top 5 cost-efficient and cost-inefficient hotels in 1998-2009

CE Ranking	Taiwan ITH Name	CE	TE	AE
<i>Top 5 cost-efficient hotels</i>				
1	Lalu hotel	1.00	1.00	1.00
2	Grand Formosa Regent Taipei	0.99	1.00	0.99
3	Grand Hyatt Taipei	0.98	1.00	0.98
4	Far Eastern Plaza Hotel Taipei	0.96	0.99	0.97
5	The Westin Hotel	0.92	0.98	0.93
<i>Top 5 cost-inefficient hotels</i>				
65	The Hibiscus Resorts	0.34	0.40	0.87
66	Taipei Fortuna Hotel	0.34	0.40	0.83
67	Hotel Kingdom	0.33	0.46	0.74
68	Jen Dow International Hotel	0.30	0.36	0.82
69	Park Hotel	0.27	0.35	0.77
<i>Average of all hotels</i>		0.62	0.74	0.84

Table 4 shows the average efficiency, technical efficiency, and allocative efficiency of top 5 cost-efficient and cost-inefficient hotels during 1998–2008. The cost efficiency score of Lulu hotel located in Nantou is the highest, which is equal to 1. The efficiency of Park hotel located in Taichung is 26.88% and which is the poorest among all the ITHs. In Table 4, we also can find that the allocative efficiency scores of top 5 cost-inefficient hotels are similar to the overall average, while their technical efficiency is much lower than the overall average score and the top 5 efficient hotels. It indicates that technical inefficiency is the main factor of cost inefficiency. Namely, these inefficiency hotels may have too many unneeded resources or be inefficient in execution. We suggest hotel managers to focus on utilizing resources effectively to create maximum outputs by making appropriate marketing or management strategies.

4.2 Result of Truncated Regression

We use two models to test the effect of transportation cost (model A) and medical services (model B) on the

efficiency of hotels by truncated regression. Six environment variables included in model A are: distance to the international airport (DAIR), distance to bus stop (DBUS), distance to freeway exit (DFW), distance to MRT exit (DMRT; 0= less than 1 KM, 1= further than 1 KM), distance to train station (DTRAIN) and pick-up service (SER; 1=yes, 0=no). Three environment variables included in model B are: distance to hospital (DHOS), the number of hospitals (NHOS) and the number of medical personnel per ten thousand (PEO). Three environment variables used in both models are: type of operation (TYPE; 1=chain, 0=independent), established years (YEAR) and type of location (LOC; 1=resort area, 0=metropolitan area). The cost efficiency scores are dependent variables in both models.

Table 5. Estimated results of truncated regression on cost efficiency

Independent variables	Model A	Model B
	Cost efficiency	Cost efficiency
Constant	0.5712*** (<.001)	0.5003*** (<.001)
DAIR	-0.0004** (0.0325)	
DBUS	5.3E-05*** (0.0079)	
DFW	0.0004* (0.0526)	
DMRT	-0.1473*** (<.001)	
DTRAIN	0.0015 (0.2227)	
SER	0.0766*** (0.0020)	
DHOS		-0.0040*** (0.0011)
NHOS		5.7E-05*** (<.001)
PEO		-6.6E-05 (0.4761)
TYPE	0.1338*** (<.001)	0.1112*** (<.001)
YEAR	-0.0015*** (0.0045)	-0.0032*** (<.001)
LOC	-0.0084 (0.8321)	0.1370*** (<.001)

***, **, and * represent significance at the 1%, 5%, and 10% levels.

The number in the parenthesis () is the P-value.

The estimated results of two truncated regressions are listed in Table 5. As for the impact of travel convenience, distance to the international airport and the distance to MRT station have a significantly negative impact on the efficiency, while the distance to the freeway exit, distance to bus station, and pick-up service have significantly positive impacts on the cost efficiency. This means that a hotel close to the airport and MRT station, far away

from the bus station and freeway exit, or with pick-up service has significantly higher cost efficiency. The results may be driven by the preference of travelers. According to the statistics from Taiwan Tourism Bureau, about 99% of international tourists visited Taiwan by taking airplanes, and about 60% of them lodged in Taipei in 2009. Taipei is the most developed region with MRT system in Taiwan. It implies that hotels near the airport and MRT stations or with pick-up services are more convenient to be accessed by international tourists and can receive higher cost efficiency scores.

As for the impact of medical services, the coefficient for the distance to hospital is significantly negative, and the coefficient for the number of hospitals is significantly positive. In other words, the shorter distance between hotels and hospitals, or there are more hospitals available in a region, the higher cost efficiencies of these hotels would have.

The coefficients of the type of operation and the established year are significant in both models. The type of operation being chain-operated and latter established year would increase the cost efficiency of ITHs. The type of location shows a significantly positive effect on efficiency in model B, suggesting that hotels located in resort areas has better cost efficiency.

5. Conclusion

With the rapid growth of economy and more attention given to recreation, tourism has become an important industry in many countries, among which Taiwan is of no exception. The number of hotels has increased dramatically since 1985, and the hotel industry is becoming oversupplied. With the growing competition in the sector, the efficiency of hotel management has become a key factor in gaining profit. Although plenty of studies have analyzed the international tourist hotel efficiency in Taiwan, we try to take a more rigorous approach to explain the cost efficiency in a different way. We apply input-oriented cost DEA to compute the cost efficiency of international tourist hotels and adopt a truncated model to explain the cost efficiency by introducing variables of traffic convenience and medical services.

The cost efficiency of international tourist hotels in Taiwan from 1998 to 2009 is 62.41%. We can find that infectious diseases, natural disasters and unstable politics are reasons of the declination of average cost efficiency, and most of these factors are unavoidable. Therefore, the hotel managers are suggested to work out strategies previously and invest appropriately to avoid being bankrupted in the recession of the tourism industry. The government should design an effective response mechanism for emergencies such as infectious diseases and natural disasters to minimize any loss and regain shortly the international tourists' confidence in having a trip in Taiwan. For those cost-inefficient hotels, technical inefficiency due to their idle resources is possibly the main cause. Thus, we suggest those hotel managers to maximize the outputs with given inputs by making better management and promotion strategies.

In the result of truncated regression, we point that the hotels near international airports, MRT stations or other pick-up services may have higher cost efficiency. This can be shown that the hotels near airports and MRT stations are easier to be accessed by international tourists. Based on the result of the truncated regression, we suggest that hotels near international airports, MRT stations, and with pick-up services shall gain advantages in advertisement and on the websites to attract more tourists and achieve a better performance. For new investors in the hotel industry, they should regard the distance factor, such as distance to an international airport and an MRT station, as an important factor in selecting hotel location. The government also needs to be dedicated to the transportation development, especially to the means of transportation between hotels, airports, and scenic spots for promoting the coordination between the tourist and hotel industries.

As for the medical services, the shorter distance to a hospital or more hospitals in a region, the higher cost efficiency of the hotel will have. It can be regarded also that hotels with more medical resources nearby are more efficient. Medical tourism is a hot issue in recent years. After allowing the residents in mainland China to visit Taiwan, medical tourism has been regarded an enormous commercial opportunity to be exploited. To follow this trend, we suggest the hotel managers to cooperate with the traveling agencies and the hospitals for effectively introducing a medical travel itinerary. It is also available to integrate health-care programs into the hotel services to satisfy the customers' needs of medical treatments. Introducing the programs, services and other information about medical tourism through hotel websites to attract international travelers is also an effective way to be used. For the government, it is suggested to improve the medical standard in Taiwan and to introduce a better medical environment when promoting the tourist business. With the improvement of medical environment, the number of international tourists shall grow, and the hotels in Taiwan shall achieve a better performance.

The results of other environment variables are similar to the previous studies. The hotels operating in chain system may have higher cost efficiency scores than those of the hotels operating independently. Hotels with

shorter operating years generally receive higher efficiency scores. We find that most inefficient hotels are depending on independent management and with longer operating years. We suggest that these cost-inefficient hotels are in need of introducing a modernized management and meanwhile finding their own market positions. The Lalu hotel which operates independently is a successful example for these hotels. The Lalu hotel positions itself as a top-end resort hotel, having its architecture designed in natural beauty and providing its customers with high-class and customized services. It is the most famous and cost-efficiency international tourist hotel in Taiwan.

In future research, we may add the preferences of tourists with different nationalities or the main purposes of trips as a variable to the model to analyze the effects of travel convenience and medical services on the hotel selection. In addition, adding hotels in other Asian countries for observation will help us compare their differences.

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