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Scale and scope economies of international tourist hotels in Taiwan

Chih-Chiang Weng[a], Kuo-Liang Wang[b,*]

[a]Department of Accounting, Shih Chien University, Taiwan
[b]Department of Economics, National Chengchi University, No. 64, Section 2, Jhihnan Road, Wunshan District, Taipei City 116, Taiwan

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Abstract

Based on the survey data of Taiwan's international tourist hotels in 2000, this paper applies Zellner's seemingly unrelated regression technique to a simultaneous system of a translog multi-product cost function and its corresponding factor share equations to investigate the extents of scale and scope economies of Taiwan's international tourist hotels. The empirical results show that product-specific scale economies exist for accommodation, food and beverage, as well as other services. Ray scale economies are significantly present. Economies of scope exist in providing food and beverage and other services jointly, as well as accommodation and food and beverage services jointly. However, economies of scope may not be present when accommodation and other services are jointly provided.

JEL classifications: M21; L80

Keywords: Scale economies; Scope economies; Seemingly unrelated regression

1. Introduction

Statistics from the World Tourism Organization (WTO) show that during the period of 1990–2002, both tourist arrivals and receipts in the Asia Pacific region rose at an average annual rate of 7%, higher than other regions in the world except the Middle East (please refer to Tables 1 and 2). The Asia Pacific region has been the rapidly growing tourism destination in the world, and has even surpassed the Americas to become the world's second-largest tourist-receiving region since 2001. Taiwan, as part of the emerging market in tourism, has enjoyed its fame with varied topography and diversified ecological resources and attracted worldwide tourists. The lifting of travel restrictions, for example, the government's institution of a 5-day visa-free entry program to 15 countries, also helped to increase arrivals to Taiwan. In 2001, Taiwan's foreign-exchange tourism receipts amounted to US$3.991 billion, and total tourism revenues of US$11.138 billion accounted for 3.9% of Taiwan's GDP. In order to mold a new image of Taiwan as an "island of tourism," the Tourism Bureau of the Ministry of Transportation and Communications has not only made efforts to promote Taiwan's splendid variety of activities and scenery to the world, but carried out planning for the encouragement of private participation in the construction of tourism and recreational facilities, including tourist hotels. A total of six tourist hotel construction plans were approved in 2001, involving a total investment of NT$14.545 billion and an overall room count of 1636. Five tourist hotels had been completed, inspected and found qualified, and issued operating licenses by the end of 2001, adding a total of 992 rooms. In 2001, as depicted in Table 3, Taiwan had 58 international tourist hotels with a total of 17,815 rooms. Although the Asian financial crisis and the recessive global economy had severe impacts on the international tourism market of Taiwan, there was a

*Corresponding author. Tel.: +886-2-29387623; fax: +886-2-29390344.
E-mail address: wang@nccu.edu.tw (K.-L. Wang).

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Table 1
International tourist arrivals by regions, 1990–2002

Region	International tourist arrivals (million)					Market share (%) 2002[a]	Average annual growth (%) 1990–2002[a]
	1990	1995	2000	2001	2002[a]		
World	455.9	550.4	687.3	684.1	702.6	100.0	3.7
Africa	15.0	20.0	27.4	28.3	29.1	4.1	5.7
Americas	93.0	108.8	128.0	120.2	114.9	16.3	1.8
Asia and the Pacific	57.7	85.6	115.3	121.1	131.3	18.7	7.1
Europe	280.6	322.3	392.7	390.8	399.8	56.9	3.0
Middle East	9.7	13.6	24.0	23.6	27.6	3.9	9.1

Sources: Tourism Highlights, World Tourism Organization, 2001–2003.
[a]Preliminary data.

Table 2
International tourist receipts by regions, 1990–2002

Region	International tourist receipts (US$ billion)					Market share (%) 2002[a]	Average annual growth (%) 1990–2002[a]
	1990	1995	2000	2001	2002[a]		
World	263.4	406.2	474.4	469.7	474.0	100.0	5.0
Africa	5.3	8.1	10.9	12.5	11.8	2.5	6.9
Americas	69.2	99.7	132.8	119.7	114.3	24.1	4.3
Asia and the Pacific	41.2	78.0	86.3	90.7	94.7	20.0	7.2
Europe	143.2	212.8	233.0	230.4	240.5	50.7	4.4
Middle East	4.4	7.6	11.5	11.3	13.0	2.7	9.4

Sources: Tourism Highlights, World Tourism Organization, 2001–2003.
[a]Preliminary data.

Table 3
Visitor arrivals and international tourist hotels in Taiwan, 1995–2001

Year	Visitor arrivals		International tourist hotels	
	Number of visitors	Growth rate (%)	Number of hotels	Number of rooms
1995	2,331,934	9.6	53	16,714
1996	2,358,221	1.1	53	16,964
1997	2,372,232	0.6	54	16,845
1998	2,298,706	−3.1	53	16,558
1999	2,411,248	4.9	56	17,403
2000	2,624,037	8.8	56	17,057
2001	2,617,137	−0.3	58	17,815

Sources: Tourism Statistics, Bureau of Tourism, Taiwan, 1995–2001.

stable increasing trend in the number of visitor arrivals during the period of 1995–2001. International hotel chains have targeted the international tourism market in Taiwan because of its growth potential.

In the past two decades, some major hotel chains acquired or merged with smaller chains or independent accommodation operations to expand their global network of properties, or to gain a specific category of properties. More and more hotels emphasize providing diversified facilities or broader range of services, such as restaurants, meeting lounges, fully equipped business centers, banquet halls, clubs or other recreational facilities to meet different needs of travelers. These developments motivate our interest in the issues concerning the magnitude of cost advantages that international tourist hotels in Taiwan can realize as a result of both their greater sizes and their ability to engage in the joint production of a broad as opposed to a more narrow line of services.

Most of the previous studies have focused on trends and developments of the hotel industry or on the issues of performance evaluation (e.g., Sangree & Hathaway, 1996; Morey & Dittman, 1995; Anderson, Fork, & Scott, 2000; Tsaur, 2001; Hwang & Chang, 2003). Lin and Liu (2000) pooled the cross-sectional and the time-series data of Taiwan's international tourist hotels from 1993 to 1997, and applied Zellner's seemingly unrelated regression estimation technique to the three-output-and -four-input translog cost function and cost share equations to study economies of scale and scope of international tourist hotels in Taiwan. Their empirical results show that there exist overall economies of scale and cost complementarities between the room business and the food and beverage business for international tourist hotels in Taiwan in 1997. In contrast with Lin and Liu's work, this paper tries to formulate a slightly

different cost model, in which more appropriate output and input variables will be adopted, to investigate if international tourist hotels in Taiwan are subject to economies of scale, which are evident when the firm's average cost decline as its output expands, and/or economies of scope, which appear when cost savings can be realized by a single firm providing several services jointly, as compared to many firms each specializing in a single service.[1] Hopefully, the results will be expected to provide a useful basis to discuss: (1) the magnitude of cost advantages associated with increasing firm sizes; (2) the range of the services international tourist hotels can efficiently provide to customers; and (3) the economic rationales underlying international tourist hotels' mergers and acquisitions.

The rest of the paper is organized as follows. Section 2 builds an empirical model composed of a translog multi-product cost function (TMCF) and its associated factor share equations. Data description, estimation procedures and empirical results are presented in Section 3. Section 4 concludes the paper.

2. The empirical model

According to the duality theory, cost and production functions which are dual to each other contain the same information regarding production possibilities given certain regularity conditions (Shephard, 1953). The structure of production can be studied empirically using either a production function or a cost function. Since functional forms developed for cost functions imply derived demand equations that are linear in the parameters, and at the same time represent very general production structures, estimation of the cost function is more attractive than direct estimation of the production function for studying the issues of economies of scale and scope.

Although there are a variety of flexible functional forms (e.g., generalized Leontief, translog, quadratic and CES) for empirical estimation of the production technology, the translog form proposed by Christensen, Jorgenson, and Lau (1973) will be used in this paper due to its empirical practicality. The TMCF for international tourist hotels with m inputs and $n$outputs can be written as

$$\begin{aligned}\ln TC = {} & \alpha_0 + \sum_i \alpha_i \ln w_i + \sum_k \beta_k \ln Q_k \\ & + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln w_i \ln w_j \\ & + \frac{1}{2}\sum_k \sum_l \theta_{kl} \ln Q_k \ln Q_l \\ & + \sum_i \sum_k \delta_{ik} \ln w_i \ln Q_k, \\ & i,j = 1,\ldots,m, \quad k,l = 1,\ldots,n, \end{aligned} \tag{1}$$

where $\gamma_{ij} = \gamma_{ji}$, $\theta_{kl} = \theta_{lk}$, TC is the total cost, Q_k is the level of the kth output, and w_i is the price of the ith input. Corresponding to a well-behaved production function, the TMCF must be linearly homogeneous in input prices. This requires the following parameter restrictions:

$$\begin{aligned} & \sum_i \alpha_i = 1, \quad \sum_i \gamma_{ij} = \sum_j \gamma_{ij} = 0, \quad i,j = 1,\ldots,m, \\ & \sum_i \delta_{ik} = 0, \quad k = 1,\ldots,n. \end{aligned} \tag{2}$$

Although Eq. (1) contains all necessary information on the international tourist hotel's technology, additional equations summarizing the international tourist hotel's input choice need to be included in order to obtain accurate parameter estimates. Applying the Shephard's lemma directly to Eq. (1) yields m factor share equations as follows:

$$\begin{aligned} S_i = \frac{w_i X_i}{TC} = \frac{w_i(\partial TC/\partial w_i)}{TC} = \frac{\partial \ln TC}{\partial \ln w_i} = \alpha_i \\ + \sum_j \gamma_{ij} \ln w_j + \sum_k \delta_{ik} \ln Q_k, \quad i = 1,\ldots,m, \end{aligned} \tag{3}$$

where S_i and X_i indicate, respectively, the cost share and the level of input usage of the ith input. The set of factor share equations adds structural information but no additional unknown parameters. Eqs. (1)–(3) form a system to be estimated to explore the production properties of international tourist hotels.

Ray scale economies ($RSCE$) are a straightforward extension of the concept of single-product scale economies and measure the proportional change in cost resulting from an equal proportional change in the levels of all outputs, holding the product mix unchanged. Therefore, the degree of ray scale economies is defined as

$$\begin{aligned} RSCE &\equiv \sum_k SCE_k \\ &\equiv \sum_k \frac{\partial \ln TC}{\partial \ln Q_k}, \end{aligned} \tag{4}$$

[1] Baumol, Panzar, & Willig (1982) have shown that, in an unregulated market, the presence of multi-product firms is evidence of at least weak economies of scope over the set of products that they produce. In addition, Maurice, Thomas, and Smithson (1992, pp. 624–636) also claim that many firms in the United States produce multiple products mainly because these products are complements in production or consumption.

where

$$\frac{\partial \ln TC}{\partial \ln Q_k} = \beta_k + \sum_l \theta_{kl} \ln Q_l + \sum_i \delta_{ik} \ln w_i, \quad k = 1, \ldots, n. \tag{5}$$

SCE_k, the measure of the product-specific scale economies as described in Panzar and Willig (1977), indicates how costs change as the level of one output changes, holding the levels of all other outputs constant. SCE_k is greater than, equal to, or less than one as there are decreasing, constant, or increasing returns to scale with respect to the output k. Similarly, a value of *RSCE* greater than one indicates that total cost increases more than proportionately with scale, implying that firms are operating in the region of decreasing returns to scale; firms are operating in the region of increasing returns to scale for a value of *RSCE* less than one; returns to scale are said to be constant as *RSCE* is equal to one.

Economies of scope measure the cost advantages for firms' providing diversified outputs against specializing in the production of a single output (Panzar and Willig, 1981). That is, economies of scope exist when it is more economical or efficient to produce two or more outputs jointly in a single firm than to produce the outputs in separate specializing firms. Theoretically, interproduct cost complementarities are a sufficient, not a necessary, condition for economies of scope (Baumol et al., 1982). Interproduct cost complementarities can be examined by measuring the impact of a change in the level of one output on the marginal cost of the other output. Thus, the degree of interproduct cost complementarities is measured as

$$C_{kl} \equiv \frac{\partial^2 TC}{\partial Q_k \partial Q_l} = \frac{TC}{Q_k Q_l}\left[\frac{\partial^2 \ln TC}{\partial \ln Q_k \partial \ln Q_l} + \frac{\partial \ln TC}{\partial \ln Q_k}\frac{\partial \ln TC}{\partial \ln Q_l}\right], \quad k, l = 1, \ldots n, \quad k \neq l. \tag{6}$$

where C_{kl} will have the same sign as the expression in the brackets. A negative derivative indicates that economies of scope exist.

3. Data description, estimation procedure and empirical results

3.1. Data description

The data used in this paper are from the 2000 survey of international tourist hotels in Taiwan investigated by the Tourism Bureau of the Ministry of Transportation and Communications, Taiwan. Similar to the classification of outputs in Lin and Liu (2000), the outputs of international tourist hotels measured in terms of revenues are divided into three broad categories: accommodation (including laundry service) (Q_A), food and beverage (Q_B), and other services (including store rental, auxiliary guest services, service charge, night club, etc.)(Q_C). However, different from Lin and Liu's classification of inputs and definition of input prices, this paper categorizes inputs into labor, capital, and material, which were generally adopted in the theoretical and empirical frameworks in the existing literatures.[2] Consequently, the price of labor (w_L) is measured by dividing annual labor expenditures (including salaries, pensions and fringe benefits) by the total number of employees, which is namely the average annual wage per employee. By referring to Muldur and Sassenou (1993), the price of capital (w_K) is approximately constructured by dividing capital expenditures (including rent, interest expenditures, depreciation and various amortizations and depletions) by the net fixed assets. The price of material (w_M) is approximately measured by dividing material expenditures (including expenditures on food and beverage, laundry, water, electricity, fuel, insurance, advertising, etc.) by the total operating revenues. Total cost (TC) is the sum of labor, capital and material expenditures. The labor cost share (S_L), the capital cost share (S_K) and the material cost share (S_M) are then defined, respectively, as labor expenditures, capital expenditures and material expenditures per dollar of total cost. In order to alleviate the misspecification problem due to fitting a single translog cost function over a sample of firms that vary widely in terms of product mix (McAllister & McManus, 1993), only the hotels providing all three services are included in the sample. After deleting unqualified and incomplete observations, the actual sample size for this paper is 52.[3] The basic statistics of all relevant variables are listed in Table 4. The data are standardized by dividing each output and price variable by its mean to make the calculations of the measures of economies of scale and scope more tractable (Caves, Christensen, & Tretheway, 1980).

3.2. Estimation procedure

The TMCF and each of the factor share equations are specified with additive disturbances that are jointly

[2] Lin and Liu (2000) categorized total operating costs into salary expenses, capital expenses, food and beverage expenses, as well as sales and administrative expenses. The factor prices are thus defined as average salary per hour, average capital price per day, food and beverage expense per dollar of food and beverage revenue, as well as sales and administrative expense per dollar of operating income, respectively.

[3] International tourist hotels that had not run their businesses for a whole year are not included in the sample to ensure the consistency and completeness of the data.

Table 4
The basic statistics of relevant variables

Variable	Mean	Std. dev.
Revenues from accommodation service	235,725,485	228,701,169
Revenues from food and beverage service	307,244,141	323,036,689
Revenues from other service	108,727,688	144,863,962
Labor cost	207,244,044	189,650,005
Capital cost	129,707,067	153,381,322
Material cost	246,045,785	227,608,355
Total cost	582,996,896	538,992,188
Wage	491,880	153,396
Capital price	0.10529	0.13256
Material price	0.41443	0.09680
Share of labor cost	0.35936	0.07373
Share of capital cost	0.20641	0.08800
Share of material cost	0.43423	0.08504

Note: Revenues and expenditures are measured in terms of NT dollars.

normally distributed with a zero mean and constant variance. The disturbances are assumed to be contemporaneously correlated across equations. Accordingly, Zellner's seemingly unrelated regression (SUR) technique is used to estimate the system of equations (Zellner, 1962). Since the factor shares sum to unity, the variance–covariance matrix of disturbances across equations is singular. One of the factor share equations must be deleted from the system prior to estimation. Then, the Zellner's procedure is iterated until convergence to yield maximum-likelihood estimates (Kmenta and Gilbert, 1968), and to guarantee that the estimates are invariant to which equation is dropped (Barten, 1969, pp. 24–25).[4] Since the results of the Zellner's procedure are maximum-likelihood estimates, the hypotheses based on various restrictions imposed on the production technology can be tested by using the likelihood ratio test.[5]

3.3. Empirical results

The parameter estimates, of which 21 are estimated directly and the remaining seven are derived from the linear homogeneity restrictions, are presented in Table 5. The first-order parameters and the parameters that measure the interactions between input prices are all significant at least at the 0.05 level. The parameters that measure the interactions among the output levels as well as between outputs and input prices are generally significant. Especially, the parameters which are relevant to indicate whether the marginal cost of providing one service is affected by changes in the output level of the other service, including θ_{AB}, θ_{AC} and θ_{BC}, are significant at least at the 0.05 level. Since all output and price variables are mean-scaled, the measures of *RSCE* and interproduct cost complementarities calculated at the mean levels of outputs and input prices are degenerated into $\sum_{k=A}^{C}\beta_k$ and $(\beta_k\beta_l+\theta_{kl})$, $k,l=A,B,C,\quad k\neq l$, respectively. The computed measures of product-specific scale economies, *RSCE* and interproduct cost complementarities from the parameter estimates are given in Table 6.

Table 5
Parameter estimates of the TMCF model

Parameter	Estimate	Standard errors
α_0	20.2598[aa]	0.0454
α_L	0.3374[aa]	0.0072
α_K	0.2338[aa]	0.0138
α_M	0.4289[aa]	0.0193
β_A	0.3748[aa]	0.0932
β_B	0.2032[bb]	0.0756
β_C	0.2437[aa]	0.0664
γ_{LL}	0.1385[aa]	0.0101
γ_{LK}	−0.0134[bb]	0.0059
γ_{LM}	−0.1251[aa]	0.0065
γ_{KK}	0.0748[aa]	0.0080
γ_{KM}	−0.0614[aa]	0.0041
γ_{MM}	0.1866[aa]	0.0071
θ_{AA}	−0.0622	0.1078
θ_{AB}	−0.1508[bb]	0.0639
θ_{AC}	0.2236[aa]	0.0488
θ_{BB}	0.2463[aa]	0.0601
θ_{BC}	−0.1701[aa]	0.0408
θ_{CC}	0.0262	0.0193
δ_{LA}	−0.0186	0.0127
δ_{LB}	0.0178[cc]	0.0096
δ_{LC}	−0.0335[aa]	0.0087
δ_{KA}	−0.0085	0.0226
δ_{KB}	−0.0573[aa]	0.0172
δ_{KC}	0.0473[aa]	0.0153
δ_{MA}	0.0271	0.0181
δ_{MB}	0.0395[aa]	0.0135
δ_{MC}	−0.0139	0.0117

Note: Significance levels are aa = 1%, bb = 5%, and cc = 10% for two-tail tests.

The estimate of the product-specific scale economies calculated at the mean levels of outputs and input prices for each service is significant and less than one, implying that international tourist hotels in Taiwan on average enjoy product-specific scale economies in providing each of the services. As to the individual hotel's overall economies of scale, the *RSCE* estimate also indicates that international tourist hotels on average experience economies of scale. That is, an equal proportional increase in all three outputs results in a decline in ray average cost (Bailey & Friedlaender, 1982). This result is

[4] In this paper, the cost of material equation is excluded from estimation.

[5] The likelihood ratio is $\lambda=(|\hat{\Omega}_R|/|\hat{\Omega}_U|)^{-T/2}$, where $|\hat{\Omega}_R|$ and $|\hat{\Omega}_U|$ represent the determinants of the restricted and unrestricted estimates of the disturbance covariance matrix, respectively; T is the number of observations. Theil (1971) has shown that the test statistic, $-2\ln\lambda$, is distributed asymptotically as Chi-squared with degrees of freedom equal to the number of independent restrictions being imposed.

Table 6
Economies of scale and scope estimates (calculated at the mean levels of input prices and outputs)

	Estimate	Standard errors
SCE_A	0.3748[aa]	0.0932
SCE_B	0.2032[bb]	0.0756
SCE_C	0.2437[aa]	0.0664
$RSCE$	0.8217[aa]	0.0423
$\beta_A\beta_B + \theta_{AB}$	−0.0746	0.0639
$\beta_A\beta_C + \theta_{AC}$	0.3150[a]	0.0617
$\beta_B\beta_C + \theta_{BC}$	−0.1206[a]	0.0510

Note: Significance levels are aa = 1% and bb = 5% for two-tail tests; a = 1% for one-tail tests.

consistent with Lin and Liu's finding. Furthermore, the hypothesis of constant returns to scale can also be tested by using the likelihood ratio test. The hypothesis implies the following restrictions:

$$\sum_k \beta_k = 1, \quad \sum_k \theta_{kl} = \sum_l \theta_{kl} = 0, \quad k, l = 1, \ldots, n,$$
$$\sum_k \delta_{ik} = 0, \quad i = 1, \ldots, m. \tag{7}$$

As a result, the test statistics is 50.78, far exceeding the 1% critical Chi-squared value of 16.81 with six degrees of freedom. Hence, the hypothesis that international tourist hotels in Taiwan operate in the region of constant returns to scale is rejected at the 0.01 level of significance. To explore how these scale economies vary with hotels' sizes, a line diagram where product-specific scale economies and ray scale economies are plotted against international tourist hotels' sizes measured by their total operating revenues is constructed in Fig. 1. The degrees of ray scale economies and the scale economies specific to any service seem to be independent of the hotels' sizes.

The estimates of $(\beta_A\beta_B + \theta_{AB})$ and $(\beta_B\beta_C + \theta_{BC})$ are negative, and the latter is at the 0.01 level of significance. The estimate of $(\beta_A\beta_C + \theta_{AC})$ is positive at the 0.01 level of significance.[6] The negative value of $(\beta_B\beta_C + \theta_{BC})$ indicates that cost savings can be realized while international tourist hotels engage in joint production of food and beverage and other services. Although the negative estimate of $(\beta_A\beta_B + \theta_{AB})$ is not statistically significant, it also indicates that there exist weak cost complementarities and thus economies of scope when accommodation and food and beverage services are jointly provided (Baumol et al., 1982). The accommodation department consists of reservations, front desk operations, bell services, and housekeeping. The food and beverage department is responsible for planning, preparing, and serving meals and beverage in the dinning room and cocktail lounge, as well as to guests in their rooms (Foster, 1993). Intuitively, housekeepers or door attendants in the accommodation department can be easily transferred to the food and beverage department or to the night club to take the jobs as waiters when the occupancy rate is low, or vice versa; administrative staffs can also be transferred easily between the accommodation department as well as the food and beverage department, even some facilities including spaces can be shared between the food and beverage department as well as other auxiliary service department, e.g. night clubs. In other words, the cost advantages in providing each pair of services are derived from cost savings when common inputs are shared, or fixed (or quasi-fixed) costs are spread over an expanded product mix due to the presence of excess or idle capacity. Different from Lin and Liu's finding, the positive pattern of cost interdependency between accommodation and other services demonstrates interproduct cost non-complementarities, which indicates that economies of scope may not exist. The possible reason for it is that facilities including spaces cannot be easily transferred between these two service sectors.

The interproduct cost complementarities of each pair of services for each international tourist hotel are also computed and plotted against hotels' sizes in Fig. 2. It also supports the empirical evidence about cost complementarity measurement. In addition, it is worthnoting that though there is unapparent relationship between interproduct cost complementarities of all service pairs and the hotels' sizes, it seems to indicate that cost savings realized from the joint production of food and beverage and other services, and cost non-complementarities incurred from the joint production of accommodation and other services are substantial for small-sized hotels. However, the cost advantages or disadvantages from joint production of each specific service pair appear to be virtually exhausted or to vanish for very large hotels. In other words, the cost effects resulting from providing diverse services is not present especially for the very large tourist hotels. Unlike smaller tourist hotels' relying on several major services to enjoy cost advantages or to suffer cost disadvantages, larger tourist hotels, usually part of an international hotel chain, seek diversification from providing broader range of services. Even there exist cost complementarities from joint production of some services, the cost advantage effect is no more apparent once another service which is not cost complementary to those is emphasized. Likewise, the cost disadvantages diminish as another cost-complementary service in the tourist hotels' product mix is increased in quantity.

Finally, the product-specific scale economies, ray scale economies, and interproduct cost complementarities are summaried according to international tourist

[6]The null hypotheses of $(\beta_k\beta_l + \theta_{kl}) = 0$, $k, l = A, B, C, \quad k \neq l$, are also tested by the likelihood ratio test, and the same results are obtained.

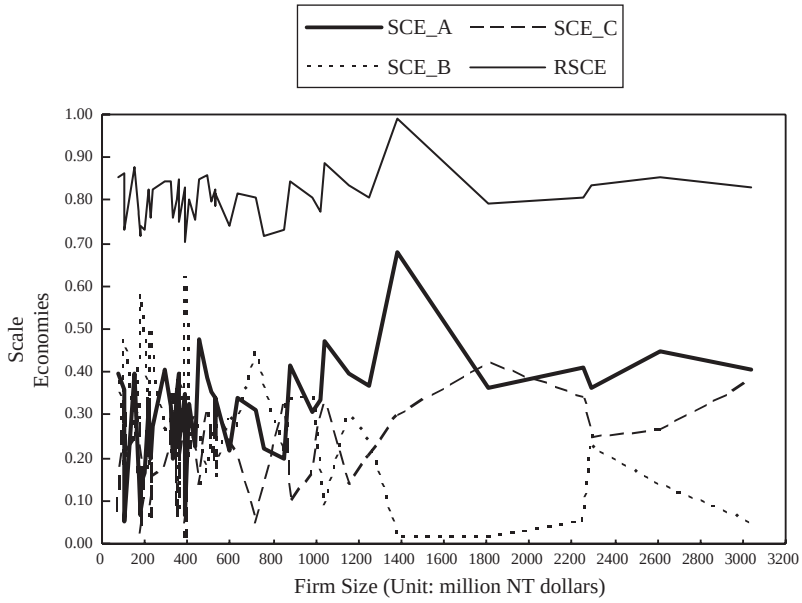

Fig. 1. Scale economies versus firm size.

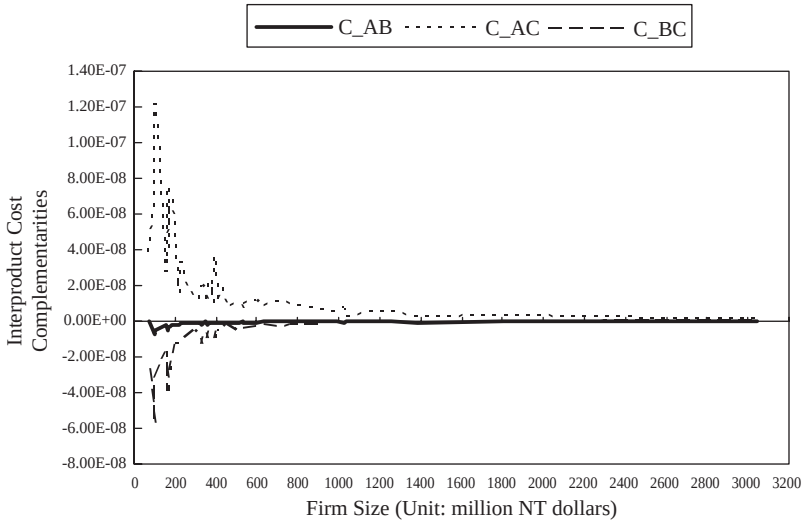

Fig. 2. Interproduct cost complementarities versus firm size.

hotels' characteristics, including their locations and operating styles. The results are listed in Tables 7 and 8. The two-sample rank sum test proposed by Wilcoxon (1945) and Mann and Whitney (1947) is further performed to verify the variation in cost properties between international tourist hotels with different locations and between those with different operating styles. It is found that there is no significant difference in the product-specific and ray scale economies between international tourist hotels located in scenic areas and those in the urban areas. The same result shows up in the product-specific scale economies in providing accommodation services and ray scale economies between hotels joining the international hotel chains and others. However, hotels joining the international hotel chains have larger product-specific scale economies in providing other services, but smaller product-specific scale economies in providing food and beverage services. As to interproduct cost complementarities, there exist significant differences in the measures between international tourist hotels with different locations and between those with different operating styles, except between those located in scenic areas and in the urban areas for the pair of accommodation and other services. Specifically, international tourist hotels located in the scenic area or not part of an international

Table 7
Economies of scale and scope estimates—classified by location

	Tourist hotels located in scenic areas			Tourist hotels located in urban areas		
	N	Mean	Standard deviation	*N*	Mean	Standard deviation
SCE_A	7	0.3292	0.1392	45	0.2938	0.1758
SCE_B	7	0.2385	0.2075	45	0.3095	0.1973
SCE_C	7	0.2530	0.1839	45	0.1945	0.1260
RSCE	7	0.8208	0.0708	45	0.7979	0.0697
$\beta_A\beta_B + \theta_{AB}$	7	−2.74E-9[a]	2.72E-9	45	−1.63E-9[a]	4.39E-9
$\beta_A\beta_C + \theta_{AC}$	7	4.09E-8	3.01E-8	45	3.88E-8	9.47E-8
$\beta_B\beta_C + \theta_{BC}$	7	−2.42E-8[a]	1.90E-8	45	−2.08E-8[a]	5.22E-8

[a]Denotes there are significant differences on the computed measures between tourist hotels with different locations.

Table 8
Economies of scale and scope estimates—classified by operating style

	Tourist hotels joining international hotel chains			Other tourist hotels		
	N	Mean	Standard deviation	*N*	Mean	Standard deviation
SCE_A	22	0.3419	0.0897	30	0.2669	0.2070
SCE_B	22	0.2153[a]	0.1207	30	0.3620[a]	0.2215
SCE_C	22	0.2544[a]	0.1062	30	0.1643[a]	0.1417
RSCE	22	0.8115	0.0395	30	0.7932	0.0851
$\beta_A\beta_B + \theta_{AB}$	22	−8.32E-10[a]	1.03E-9	30	−2.48E-9[a]	5.39E-9
$\beta_A\beta_C + \theta_{AC}$	22	1.16E-8[a]	1.53E-8	30	5.92E-8[a]	1.12E-7
$\beta_B\beta_C + \theta_{BC}$	22	−5.03E-9[a]	8.06E-9	30	−3.31E-8[a]	6.18E-8

[a]Denotes there are significant differences on the computed measures between tourist hotels with different operating styles.

hotel chain do enjoy economies of scope in joint production of food and beverage and other services, as well as in joint production of accommodation and food and beverage services to a larger extent.

4. Conclusions

With a rapid growth of international tourism markets in the Asia Pacific region in the past 13 years, there was a stable increasing trend in international tourist arrivals and receipts of Taiwan. Because of this trend, more and more international tourist hotels were established, and would attempt to join the international hotel chains to provide diversified facilities or various services. The purpose of this paper was to study the cost properties of international tourist hotels in Taiwan and to investigate if they are operating with efficient scales, offering proper product mixes, and/or moving in a good direction.

Based on the 2000 survey data of international tourist hotels in Taiwan, the paper uses the Zellner's SUR technique to estimate the translog multi-product cost function, together with its associated factor share equations to explore the production property of international tourist hotels in Taiwan. The empirical results show that product-specific scale economies exist for accommodation, food and beverage, as well as other services. Ray scale economies are significantly present. Cost complementarities and economies of scope exist in the joint production of food and beverage and other services, as well as in the joint production of accommodation and food and beverage services. However, the cost interdependency between accommodation and other services is positive, which indicates that economies of scope may not be present in providing this service pair.

As the emerging market in international tourism becomes more complex and competitive, international tourist hotels become more specialized and attempt to attract particular customer groups. In addition to adopting proper positioning strategies adjusting to competition through product, pricing, and promotion, the cost properties can also provide some insights into the operations of international tourist hotels. The empirical evidence of this paper may indicate that economies of scale offer substantial incentives for mergers and acquisitions among small- and medium-sized hotels even in the absence of consumption complementarities. The competitive circumstances may hasten consolidation among these hotels seeking to reduce the cost disadvantages when operating at less than the optimal scale. However, it seems to be unlikely that any benefits due to scope economies are to be realized by mergers among very large hotels. Cost

savings from joint production of the specific services are of considerable consequence to small-sized hotels. It would be much better for large-scaled hotels to change or adjust their product mix to offer customers a broader and more integrated services which are cost complementary to each other to enjoy economies of scope.

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