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Cost structure and productivity growth of the Taiwanese international tourist hotels

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Abstract

This study investigates the cost structure and economic implications of the Taiwanese international tourist hotel industry. A multi-product translog cost function with three inputs and three outputs is estimated using seemingly unrelated regression estimation and three-stage least squares. A balanced panel dataset consisting of 47 international tourist hotels in Taiwan over the period 1997–2001 was obtained from Taiwanese Tourism Bureau and used to estimate the cost function. The results show that both scale and scope economies exist in the Taiwanese international tourist hotel industry. In addition, productivity growth is positive over the study period. Managerial and policy implications for the Taiwanese international tourist hotel industry are also discussed.

Keywords: Cost structure; Scale economies; Scope economies; Productivity growth; Hotel industry

1. Introduction

Increases in personal incomes and decreases in the cost of travel have led to the rapid expansion of international tourism. As tourists travel to new tourist destinations, they demand not only tourist attractions, but also goods and services that the local residents may not demand. One industry which provides many of the services demanded by tourists is the hotel industry. Not only do hotels provide accommodation services, but they also provide food and beverages and other services including laundry, swimming pools, and conference facilities. Because it plays such an important role in the tourism industry, a good understanding of the characteristics of the hotel industry is useful for policymakers, and the performance of the hotel industry can serve as one of the leading indicators of the level of development of tourism in a country.

This paper uses a cost function approach to explore the characteristics of the Taiwanese international tourist hotel industry. The function used is a multi-product translog cost function, reflecting the many services that these hotels produce. Using this cost function, we investigate whether there exists economies of scale and scope, the price elasticity and elasticity of substitution of factor inputs, and technological progress in the Taiwanese international tourist hotels. The dataset consists of annual data on 47 international tourist hotels (four- and five-star equivalent) from 1997 to 2001. These hotels are the main players in the Taiwanese hotel industry, and attract not only international tourists but also foreign businessmen.

Previous work on estimating the cost function of Taiwanese international tourist hotels[1] include Tsaur and Tsai (1999), Lin and Liu (2000), and Weng and Wang (2006). Tsaur and Tsai (1999) estimated a single-output, four-input translog cost function for international hotels in Taiwan, using data from 1991 to 1997. They found that factor inputs are substitutes in the industry, that factor

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[1]Parenthetically, there also exists a large literature on measuring the efficiency of Taiwanese hotels. This includes papers evaluating efficiency using Data Envelopment Analysis (DEA) (e.g. Tsaur, 2001; Hwang & Chang, 2003; Chiang, Tsai, & Wang, 2004), or using the stochastic frontier approach (e.g. Chen, 2007).

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inputs are price inelastic, and that there is decreasing returns to scale. Lin and Liu (2000) improve on Tsaur and Tsai (1999) by estimating a multi-product translog cost function using three outputs and four inputs, using data from 1993 to 1997. Unlike Tsaur and Tsai, they find that there exist scale economies, and complementarities between accommodation and food and beverages. Weng and Wang (2006) follow Lin and Liu (2000) by using a multi-product translog cost function with three outputs and three inputs, with cross-sectional data in 2000. They find evidence of product-specific scale economies for each of their outputs (accommodation, food and beverages, and other services), as well as overall ray scale economies. They also find evidence of scope economies between certain pairs of outputs. However, because they used cross-sectional data, the productivity growth of the industry cannot be obtained from their result.

The present paper builds on these three papers. Following Lin and Liu (2000), we use a multi-product translog cost function, using newer data between 1997 and 2001. Our data, obtained using the same approach as Weng and Wang (2006), is also more appropriately measured than in Lin and Liu (2000). We also innovate relative to this literature by exploring technological change in the industry. This follows the approach of Wang and Chen (2005) and Wang and Liao (2006), who estimate cost structures and productivity growth in the Kaohsiung city bus system and in Taiwan Railway, respectively.

Our main results are as follows. First, there exists both scale and scope economies in the Taiwanese international tourist hotels. Second, there is substitutability among the factor inputs of capital, labour and materials. Third, the output cost elasticity is lower for accommodation services compared to food and beverages and other services. Finally, there is evidence of technological progress in the industry over time. As the main new finding of the paper, this last result is quite important as productivity and technological improvements show that Taiwanese international tourist hotels are improving their competitiveness not only to compete with one another, but also against hotels in other tourist destinations.

The rest of this paper is structured as follows. Section 2 develops the theoretical model, while Section 3 describes the data used and the estimation procedure. The empirical results are presented in Section 4. Section 5 provides the conclusions and some policy implications.

2. The theoretical model

To deal with the multi-product characteristic of the hotel industry, we follow the previous literature in estimating a flexible multi-product translog cost function. This cost function allows for different elasticities of substitution across inputs and outputs, and is an arbitrarily close local approximation to the true cost function.

The cost function for a hotel with m inputs and n outputs can be written as

$$\begin{aligned}\ln C = \ln C(W,Y,T) &= \alpha_0 + \sum\nolimits_{i=1}^{m}\alpha_i \ln w_i \\ &+ \sum\nolimits_{k=1}^{n}\beta_k \ln y_k + \frac{1}{2}\sum\nolimits_{i=1}^{m}\sum\nolimits_{j=1}^{m}\gamma_{ij}\ln w_i \ln w_j \\ &+ \frac{1}{2}\sum\nolimits_{k=1}^{n}\sum\nolimits_{l=1}^{n}\theta_{kl}\ln y_k \ln y_l \\ &+ \sum\nolimits_{i=1}^{m}\sum\nolimits_{k=1}^{n}\delta_{ik}\ln w_i \ln y_k + \eta_\tau T + \frac{1}{2}\eta_{\tau\tau}T^2 \\ &+ \sum\nolimits_{i=1}^{m}\alpha_{i\tau}\ln w_i \cdot T + \sum\nolimits_{k=1}^{n}\beta_{k\tau}\ln y_k \cdot T, \qquad (1)\end{aligned}$$

where C is the total cost, W the vector of prices of the inputs, Y the vector of outputs, and T is a time trend representing non-neutral (technological bias) and scale-augmenting technological change (Andrikopoulos & Loizides, 1998). The time trend terms differentiate our specification from that of Weng and Wang (2006). In addition, symmetry of effects across inputs and outputs requires $\gamma_{ij} = \gamma_{ji}$ and $\theta_{kl} = \theta_{lk}$. For a cost function to be well behaved, it must satisfy the neoclassical conditions of being continuous, non-decreasing concave, symmetric, and homogeneous of degree one in input prices. The homogeneity and symmetry conditions are given by the following restrictions on Eq. (1).

$$\sum_{i=1}^{m}\alpha_i = 1,\ \sum_{j=1}^{n}\gamma_{ij} = \sum_{i=1}^{n}\gamma_{ji} = \sum_{i=1}^{n}\delta_{ik} = \sum_{i=1}^{n}\alpha_{i\tau} = 0. \qquad (2)$$

By Shephard (1970)'s lemma, the input cost shares S_i are equal to the logarithmic partial derivatives of the cost function with respect to the input prices:

$$S_i = \frac{\partial \ln C}{\partial \ln w_i} = \alpha_i + \sum_{j=1}^{m}\gamma_{ij}\ln w_j + \sum_{k=1}^{n}\delta_{ik}\ln y_k + \alpha_{i\tau}T, \qquad (3)$$

where $\sum_{i=1}^{m} S_i = 1$.

To explore the characteristics of the cost structure, the following sets of elasticities and productivity indexes are calculated from the parameter estimates. The price elasticities of input demands ε_{ij} and Allen–Uzawa partial elasticities of substitution σ_{ij} between two inputs i and j, are computed from the coefficients of the translog cost function via the following formulae:

$$\begin{aligned}\sigma_{ii} &= [\gamma_{ii} + S_i^2 - S_i]/S_i^2 \quad \forall i \\ \sigma_{ij} &= [\gamma_{ij} + S_i S_j]/S_i S_j \quad \forall i,j,i\neq j, \qquad (4)\end{aligned}$$

and

$$\varepsilon_{ij} = S_i \cdot \sigma_{ij} \quad \forall i,j. \qquad (5)$$

Global concavity of the cost function requires that all own-partial elasticities of substitution, σ_{ii}, are negative at all points. In addition, a negative elasticity of substitution between factors i and j implies input complementarity, while a positive elasticity of substitution suggests input substitutability.