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Research Paper

Higher tourism specialization, better hotel industry efficiency?

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ABSTRACT

This study examines the effects of both specialization in tourism and market competition on the efficiency of the hotel industry. For this purpose, stochastic frontier analysis (SFA) was employed to evaluate the efficiency of the hotel industry on a provincial level in China and to analyze how it is impacted by specialization in tourism and market competition. The results confirm that tourism specialization and market competition exert a synergistic effect on hotel industry efficiency in China. This study finds that tourism development as represented by a high level of tourism specialization by a destination does not guarantee high efficiency in hotels but does enhance the negative effect of market competition on hotel industry efficiency. Significant policy and managerial implications stem from these findings.

1. Introduction

With the rapid emergence of nonstandard accommodation (e.g., guest houses, Airbnb, etc.) in many destinations with a high level of tourism development, traditional hotels face great challenges in maintaining and increasing industry efficiency. Examining the external factors influencing the efficiency of the hotel industry is crucial in terms of advancing hotel performance and improving the quality of destination accommodation products (Yang and Cai, 2016). Previous studies have suggested a few external factors such as accessibility, regional economic context, crisis events and trade openness impact hotel efficiency (Assaf and Cvelbar, 2015; Huang et al., 2012; Yang and Cai, 2016). As an essential component of a destination's tourism product, the efficiency of the hotel industry is inevitably influenced by the overall development level of tourism at the destination. However, the influence of the destination's tourism level as an external factor on hotel industry efficiency has not yet been examined.

This study aims to examine the relationship between destinations' level of tourism specialization and hotel industry efficiency. With the continuous expansion of the tourism industry and the growing competition in the hotel industry in most destinations, it is impossible for hotels to run their businesses without considering the level of market competition. Therefore, this study also includes market competition as an external factor that impacts a destination's hotel industry efficiency. The main objective is to examine whether and how the level of tourism specialization and market competition jointly impact hotel industry efficiency using the stochastic frontier approach. This research is

conducted in China, where the hotel industry has been developing for over four decades and is currently witnessing a diversifying supply under a booming tourism industry.

According to the World Tourism Organization (WTO, 2018), China's tourism industry ranks first in terms of the total volume of domestic tourists and international tourists in 2017. In 2016, the Chinese government initiated the all-for-one tourism development policy ("Quan yu lv you" in Chinese), which aims at boosting tourism production at the destination level. In recent years, many provinces in China have encouraged the building of high-end and luxury hotels, expecting that greater investment will boost the industry and allow it to reap higher profits (Wu and Yang, 2018). According to the former China National Tourism Administration (CNTA, now Ministry of Culture and Tourism), the number of four- and five-star hotels has increased rapidly, from a combined total of 1671 in 2006–3170 in 2017. The intense construction of high-end hotels, however, has not resulted in rapid profit gains. Since 2013, China's hotel industry has been experiencing challenges partially due to the anti-corruption policy launched by the Central Committee of the Communist Party of China and the State Council of China in late 2012. Consequently, the revenue per available room (RevPAR) decreased by 24.9 % from 2012 to 2015, and the occupancy rate dropped from 58.2 % in 2012 to 52.3 % in 2015.

Moreover, hotel providers are struggling with the growing competition and continuous pressure from market saturation and are seeking greater performance (Chang et al., 2019). In practical terms, understanding the determinants of hotel industry efficiency is important for identifying possible solutions to the problems experienced by industry

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Table 1
Summary of studies on internal factors of hotel efficiency.

Internal factors	Sources
Management style	Hwang and Chang, 2003; Chiang, 2006; Barros and Mascarenhas, 2005
Hotel ownership	Barros, 2004, 2005; Chen, 2007; Wang et al., 2006; Barros and Dieke, 2008; Perrigot et al., 2009; Assaf et al., 2010; Hu et al., 2010; Hsieh and Lin, 2010; Mao and Yang, 2016
Location and facilities	Hwang and Chang, 2003; Barros, 2005; Chen, 2007; Hu et al., 2010; Hsieh and Lin, 2010; Yang et al., 2012; Assaf and Agbola, 2011; Oliveira et al., 2013a,b; Lado-Sestayo et al., 2016; Madanoglu and Ozdemir, 2016
Market share	Barros and Dieke, 2008
Hotel size	Barros and Dieke, 2008; Pulina et al., 2010; Assaf and Agbola, 2011; Parte-Esteban and Alberca-Oliver, 2015; Aissa and Goaied, 2016a, b
Corporate governance	Guetat et al., 2015; Jarboui et al., 2015
Star rating	Assaf and Agbola, 2011; Oliveira et al., 2013b; Mao and Yang, 2016

practitioners (Yang et al., 2017). Numerous studies have been conducted on the internal determinants that influence the efficiency of the hotel industry; however, the influences in the external environment that are closely linked to the destinations' tourism development levels have yet to be adequately examined. With the background of rapid tourism development and fierce competition, the theoretical linkages between external factors and hotel industry efficiency should be consolidated. Many scholars have found that the number of tourists has a positive impact on the efficiency of hotel performance (Assaf et al., 2017). Higher numbers of tourists often reflect higher tourism specialization, which could be measured by the ratio of the number of tourists to residents in a region or the ratio of the total tourism revenue to regional GDP. Regions that are more specialized in tourism should have greater hotel industry efficiency. Thus, the complex effects of tourism specialization and market competition on the efficiency of the hotel industry merit fuller investigation.

The remainder of this paper is organized as follows: Section 2 briefly reviews the literature on hotel efficiency, and in Section 3, we present the theoretical considerations and develop hypotheses. The research methodology is specified in Section 4, and the variables and the dataset are subsequently explained. The findings and discussion are presented in Section 5. Finally, the conclusions and implications of the study are discussed in Section 6.

2. Literature review

The paper is related to a large body of literature on hotel efficiency, which can be divided into three major categories: (1) the evaluation of hotel efficiency; (2) the determinants of hotel efficiency; and (3) the efficiency of the Chinese hotel industry.

2.1. The evaluation of hotel efficiency

Both nonparametric and parametric frontier approaches dominate in the literature in the first category. Data envelopment analysis (DEA) is a representative nonparametric frontier approach, and stochastic frontier analysis (SFA) is a representative parametric frontier approach. DEA has been extensively used to evaluate the efficiency of hotels (Hwang and Chang, 2003; Barros, 2005; Perrigot et al., 2009; Assaf and Agbola, 2011; Brida et al., 2012; Oliveira et al., 2013a; Manasakis et al., 2013; Detotto et al., 2014; Huang et al., 2012; Solana-Ibáñez et al., 2016; Lado-Sestayo and Fernández-Castro, 2019; Kularatne et al., 2019).

Research adopting the DEA method does not assume the explicit specification of the form of efficiency frontier functions (Pasiouras, 2008). However, DEA models consider all deviations from the optimal frontiers as technical inefficiencies and do not take into account possible random errors (Berger and Humphrey, 1997).

Several authors also use SFA as a typical parametric frontier approach to analyze hotel efficiency (Anderson et al., 1999; Barros, 2004; Chen, 2007; Wang et al., 2006; Assaf and Magnini, 2012; Hu et al., 2010; Kim and Sangho, 2011; Oliveira et al., 2013b; Guetat et al., 2015;

Arbelo-Pérez et al., 2017). For example, Arbelo-Pérez et al. (2017) use a stochastic frontier model with a trans-log cost (profit) function to evaluate the cost (profit) efficiency of 838 hotels in Spain in the period 2009–2013 and focus on analyzing the impact of output quality on estimations of hotel efficiency. Compared with the DEA method, SFA assumes an explicit model for the underlying production relationship and allows for inefficiencies and random errors. SFA models also allow deviations from the production frontier to be attributed to both technical inefficiency and measurement error (Barros, 2004; Oliveira et al., 2013b). SFA can also be used to make statistical inferences for further analysis of hotel industry efficiency and the associated predictors. Thus, SFA is more appropriate than DEA in terms of model assumptions and determinant analysis.

2.2. The determinants of hotel efficiency

The second category focuses on the determinants of hotel efficiency. The current study has identified a variety of determinants that influence hotel efficiency, including internal and external factors. As depicted in Table 1, internal factors related to hotel characteristics and management have been extensively and intensively studied in numerous research articles.

However, since hotels are deeply embedded in local regional conditions (Yang and Cai, 2016), the hotel industry could be equally vulnerable to external factors defined by the tourism destination (Parte-Esteban and Alberca-Oliver, 2016). Given the background of continuous expansion in the tourism industry and growing competition in the hotel industry in most destinations, it is impossible for hotels to run their businesses beyond the influence of these two external environments. The hotel literature has been relatively silent in considering the effects of these two external factors on hotel efficiency with a few notable exceptions.

Chen (2010) empirically finds that tourism growth played a significant role in the corporate performance of the Taiwanese hotel industry by increasing lodging demand. Similar results are found in the studies of Chen (2011) and Assaf et al. (2017). These three studies have a common methodology with a linear perspective. However, as Göcen et al. (2017) argued, given increased lodging demand derived from the boosting tourism industry in destinations, market competition among hotels becomes more fierce because more competitors swarm into the market. Moreover, Assaf et al. (2017) found evidence that intense competition could harm the performance of hotels. Thus, from a non-linear view, the manner in which tourism specialization influences hotel efficiency is unclear because its impact on hotel efficiency may change over time, given stages in the development of tourism in which market competition level varies accordingly. In response to Aissa and Goaied (2016b) call to investigate the relationship between contextual factors and hotel performance, this study examines the synergistic effect of both tourism specialization and market competition on the efficiency of the hotel industry.

2.3. The efficiency of the Chinese hotel industry

To provide a contextual understanding for this research, it is necessary to briefly review studies on the efficiency of the Chinese hotel sector. Pine and Phillips (2005) compare China's hotel performance given variation in ownership, size and star rating and indicate that better performance is seen in hotels with foreign ownership, that are larger or that have a higher star rating. Tsai (2009) examines star-rated hotel productivity in China on a provincial basis using the data envelopment analysis (DEA) technique. By investigating aggregate hotel performance data for domestic and foreign-invested hotels in each Chinese province during the 2001–2012 period, Mao and Yang (2016) analyze FDI spillovers and explain the role of their moderating effects in the Chinese hotel industry. Using panel data of the hotel industry in 31 Chinese provincial regions from 2005 to 2013, Yang et al. (2017) employ the DEA method to show that different regions have different efficiency performance in the various hotel market segments. Liu and Tsai (2018) investigate the total factor productivity (TFP) growth, technological progress, pure technical efficiency change, scale efficiency change, and mix efficiency change of star-rated hotels in China by employing a Hicks-Moorsteen index approach.

In summary, the main gap identified in the literature on hotel efficiency is that compared to internal factors, external factors influencing hotel industry efficiency have not been intensively investigated. There is a trend to examine the impact of external factors on hotel industry efficiency. However, researchers have investigated these factors independently and ignored their joint effects. Moreover, there have been diverse methodologies in the studies of this field such as the adoption of SFA models. In the current context of rapid tourism development and the fierce competition within the hotel industry of many destinations, there is an urgent need to connect the hotel industry efficiency with the destination's tourism development characteristics. Levels of the hotel market competition and tourism specialization of a destination are strong representatives of the external factors that closely connect the hotel industry with the destination's tourism context. More importantly, the influences of these external factors on hotel industry efficiency may be dynamic and synergetic thus should be further examined. This research adopts the SFA method to examine the effects of tourism specialization and market competition on hotel industry efficiency. In the following section, we develop hypotheses for empirical examination based on the existing literature and our research objectives.

3. Hypothesis development

3.1. Tourism specialization and hotel efficiency

As a reflection of the development level of tourism destinations, the influence of tourism specialization on the efficiency of the hotel industry embedded in the tourism destination system can be described both directly and indirectly. From the perspective of direct impact, tourism specialization associated with tourism growth can immediately strengthen the development of the hotel industry by increasing the hotel occupancy rate and hence improving operating efficiency. This means that higher tourism specialization within the tourism destination generates a greater flow of tourists and an ongoing expansion of the hospitality market, which in turn ensures a higher demand for the accommodation provided by hotels and, therefore, higher revenues and profits. Accordingly, in tourism destinations with high tourism specialization, a high demand for lodging from the large number of tourists is likely to boost the efficiency of the hotel industry.

According to the tourism-led growth hypothesis approved by numerous studies (Balaguer and Cantavella-Jordá, 2002; Hye and Khan, 2013; Dogru and Bulut, 2018), tourism specialization has a positive impact on the economic growth of tourism destinations through the improvement of the business environment (Min et al., 2016), which in turn can have an indirect effect on the efficiency of the hotel industry,

based on the notion that optimizing the business environment helps improve productivity and competitiveness (Göçen et al., 2017). For instance, Chen (2007) showed that improved tourism growth could perfect the financial performance of Chinese hotel firms. Similar findings were reported by Chen (2010) in the context of Taiwanese hotels. Other studies have highlighted that strong tourism growth can boost the business environment for tourism-related firms such as hotels (Balaguer and Cantavella-Jordá, 2002; Dritsakis, 2004; Gunduz and HatemiJ, 2005; Kim et al., 2006). Hence, an increase in tourism specialization can bring sales and strengthen the financial performance of hotels, thereby raising efficiency.

However, tourism destinations with higher levels of tourism specialization have mature market features, such as free market access, diversified consumer demands and favorable policies that allow new hotel entrants (e.g., international hotel companies) and firms offering nonstandard types of accommodation (e.g., Airbnb) with personalized products (Zervas et al., 2015). Inevitably, these destinations will have a highly competitive environment, and the associated rising market competition could lead to a loss in hotel market share, which in turn has a negative impact on industry efficiency. Moreover, several studies confirm that tourism specialization may ultimately have a negative impact on the economic growth of tourism destinations through a crowding-out effect when tourism expands beyond a certain level (Pham et al., 2015). Thus, tourism development represented by the level of tourism specialization at a destination does not guarantee high efficiency in the hotel industry. In general, we assume that tourism specialization has a nonlinear influence on hotel efficiency. Hence, hypotheses 1 and 2 can be expressed as follows:

H1. Tourism specialization has a nonlinear effect on the efficiency of the hotel industry;

H2. Tourism specialization has a negative influence on hotel efficiency when it exceeds a certain threshold level.

3.2. Market competition and hotel efficiency

The relationship between market competition and hotel efficiency has been highly discussed in current research but a consensus is far from being reached. Basically, there are two strands of the literature providing arguments for both positive and negative signs in this relationship.

According to the “quiet life” hypothesis (Chintrakarn et al., 2013), high industry concentration lowers competition among firms, which in turn reduces incentives for their managers to maximize firm profit, as they may instead choose to enjoy the “quiet life”. In other words, in competitive markets, managers have a strong incentive to give their best effort to improve the efficiency of firms, which has been explained by Leibenstein's X-efficiency theory. Therefore, based on this logic, market competition has a positive influence on the efficiency of hotels. Intuitively, we expect high-efficiency scores for the hotel industry, since hotels are operating in a highly competitive environment with relatively low entry and high exit barriers (Singal, 2015).

Despite most research favoring a positive relationship as a commonly accepted view, several empirical studies on this issue find strong evidence supporting a negative link between market competition and hotel efficiency (Assaf et al., 2017). Intensified market competition reflected by a higher number of hotels offering a similar product implies lower average room rates (Abrate et al., 2012; Becerra et al., 2013). The contradictory opinion on such issues leads us to a bold hypothesis that the effect of market competition on hotel industry efficiency could be moderated by tourism specialization. Tourism destinations with growing tourism specialization are more likely to attract nonstandard accommodation firms, such as guesthouses and shared accommodations, as these firms prefer engaging in a more mature destination with a prosperous tourism industry (Gutiérrez et al., 2017). In short, we

assume that whether market competition imposes a positive or negative effect on the efficiency of hotels depends on the level of tourism specialization. Hence, we hypothesize the following:

H3. Market competition has a nonlinear effect on the efficiency of the hotel industry;

H4. The impact of market competition on hotel industry efficiency is moderated by tourism specialization.

4. Methodology

This research employs the SFA as an analytical tool. The stochastic frontier production function is a parametric methodology independently developed by Aigner et al. (1977) and Meeusen and Broeck (1977) that has been applied to many studies related to the estimation of inefficiencies in the production of economic entities. It assumes that the error term is composite, meaning that it is made up of inefficiency and random disturbance. Therefore, it is understood that an economic entity deviates from the frontier because of both inefficiency and random fluctuations. These fluctuations reflect the effect of variables that are not under the control of an economic entity. The SFA methodology has the advantage of estimating the frontier function and inefficiency effects function in a single-stage sampling procedure, which allows efficiency to be estimated more accurately.

This research adopts the model proposed by Battese and Coelli (1995) to estimate the efficiency of the hotel industry in China. The key advantage of this model is that it allows an estimation of efficiency for the hotel industry in each province and the factors that explain differences in efficiency between hotel sectors at the provincial level in a single-stage sampling procedure. This methodology is a significant step forward in terms of consistency with respect to previous models that first estimate the inefficiency level and subsequently use a two-stage procedure to assess a number of explanatory variables in an attempt to explain inefficiencies driving differences between regional hotel sectors. In short, we believe that the stochastic model enables the generation of inefficiency levels while simultaneously enabling these scores to be related to a set of explanatory variables.

4.1. Model specification

The Battese and Coelli (1995) model specification may be expressed as:

$$Y_{it} = \exp(X_{it} \beta + V_{it} - U_{it}), i = 1 \dots N, t = 1 \dots, T \quad (1)$$

where Y_{it} is the production of the i -th firm in the t -th time period;

X_{it} is a $1 \times k$ vector of input quantities of the i -th firm in the t -th time period;

β is a $k \times 1$ vector of unknown parameters to be estimated;

V_{it} and U_{it} are two components of the error term and are assumed independently of each other. In addition, V_{it} denotes the stochastic part that is assumed to be iid $N(0, \sigma_v^2)$, and U_{it} represents technical inefficiency in production, which is assumed to be independently distributed as truncations at zero of the $N(m_{it}, \sigma_u^2)$ distribution. In a linear equation, the technical inefficiency effects can be specified as Eq. (2):

$$U_{it} = Z_{it} \delta + \varepsilon_{it} \quad (2)$$

where Z_{it} is a $p \times 1$ vector of observable nonstochastic explanatory variables that may influence the efficiency of a firm and may even contain a time effect, and δ is a $1 \times p$ vector of parameters to be estimated. Additionally, ε_{it} is a random error defined as $N(0, \sigma^2)$ truncated such that U_{it} is defined as positive.

The likelihood function and its partial derivatives with respect to the parameters of the model are presented in Battese and Coelli (1995). As proposed by Battese and Broca (1997), the likelihood function is expressed in terms of the variance parameters, which are $\sigma^2 = \sigma_v^2 + \sigma_u^2$

and $\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$. The technical efficiency of production for the i -th firm at the t -th observation is defined by Eq. (3),

$$TE_{it} = \exp(-U_{it}) = \exp(-Z_{it} \delta - \varepsilon_{it}) \quad (3)$$

The maximum likelihood method is proposed for simultaneous estimation of the parameters of the stochastic frontier and the model for the technical inefficiency effects.

The functional form of the stochastic frontier production function used in this study is the trans-log production function (Christensen et al., 1973), which is the most commonly used functional form in this type of study. The trans-log stochastic production frontier function, for the case of one output and two inputs, can be expressed as Eq. (4):

$$\begin{aligned} \ln Y_{it} = & \beta_0 + \beta_1 \ln K_{it} + \beta_2 \ln L_{it} + \beta_3 T + \frac{1}{2} \beta_4 (\ln K_{it})^2 + \frac{1}{2} \beta_5 (\ln L_{it})^2 \\ & + \frac{1}{2} \beta_6 T^2 + \beta_7 \ln K_{it} \times \ln L_{it} + \beta_8 \ln K_{it} \times T + \beta_9 \ln L_{it} \times T + V_{it} - U_{it} \end{aligned} \quad (4)$$

Y_{it} is the total revenues of output for the hotel industry;

K_{it} is capital as an input for the hotel industry;

L_{it} is labor as an input for the hotel industry.

where the technical inefficiency effects are assumed to be defined as the following Eq. (5):

$$\begin{aligned} U_{it} = & \delta_0 + \delta_1 T + \delta_2 TS_{it} + \delta_3 (TS_{it})^2 + \delta_4 MC_{it} + \delta_5 TS_{it} \times MC_{it} \\ & + \delta_6 FTDD_{it} + \delta_7 FSH_{it} + \delta_8 ACP_{it} + \delta_9 PGDP_{it} + \delta_{10} POP_{it} + \delta_{11} TA_{it} \\ & + \delta_{12} SARS_{it} + \varepsilon_{it} \end{aligned} \quad (5)$$

where T indicates the time effect of inefficiency, TS stands for tourism specialization, MC for market competition, $FTDD$ for the foreign trade dependence degree, FSH for the number of five-star hotels, ACP for the anti-corruption policy, $PGDP$ for per capita gross domestic product, POP for total population at the provincial level, TA for transportation accessibility and $SARS$ for the severe acute respiratory syndrome. The variable TS^2 is quadratic term of TS , and $TS \times MC$ is the interaction term. To obtain some insights into the impact of these factors on the estimated inefficiency scores, it is necessary to investigate the marginal effects, since first-order effects are not informative, given the presence of the quadratic term and interaction term. We show that, accordingly, the impact of TS on inefficiency is given by $\frac{\partial U_{it}}{\partial TS_{it}} = \delta_2 + 2\delta_3 \times TS_{it} + \delta_5 \times MC_{it}$. Similarly, the marginal impact of MC is $\frac{\partial U_{it}}{\partial MC_{it}} = \delta_4 + \delta_5 \times TS_{it}$.

4.2. Variable definitions

4.2.1. Output and input variables in Eq. (4)

With respect to the input and output definitions of the Chinese hotel industry used in Eq. (4), we follow the widely used intermediation approach and consider the availability of data. We characterize two proxies for inputs: K is gross fixed assets (Pulina et al., 2010), and L is the total number of employees (Hwang and Chang, 2003; Assaf et al., 2010; Kularatne et al., 2019). We define our output in line with Hao et al. (2014) as Y total revenue. Therefore, the presented study uses total revenue as the output variable and chooses the total number of employees as the labor input variable and gross fixed assets as the capital input variable.

4.2.2. Core explanatory variables in Eq. (5)

In this paper, we focus on the impact of tourism specialization and market competition. Thus, these two factors are selected as core explanatory variables to capture inefficiency.

Tourism specialization (TS): In line with Algieri (2006) and Croes et al. (2018), TS is measured by the ratio between total tourism revenue and GDP at the provincial level.

Market competition (MC): As a classical measure for market competition, the HHI requires the collection of market share data in relation

to every market participant information, which is sometimes difficult to collect in a non-oligopolistic market, while data on the number of hotels and provincial population is often more accessible. Taking Huang et al. (2012) as a reference, which takes the number of hotels (NH) in a region as an indicator of the intensity of market competition within a region, this paper introduces the ratio of number of star-rated hotels over regional total population to evaluate market competition.

4.2.3. Control variables in Eq. (5)

To minimize the potential estimation bias deriving from the omitted variables, we base our choices on the most solid results drawn from earlier literature and thus include variables capturing several environmental factors and factors relating to the hotel industry.

Foreign trade dependent degree (FTDD) is measured by the ratio of trade (regional imports plus exports) to regional GDP. In line with previous studies (Huang et al., 2012), the destination's openness and connectivity also affect hotel performance (Assaf and Cvelbar, 2015).

For five-star hotels (FSH), we use the number of five-star hotels to measure their development scale. In general, the higher the star rating of a hotel is, the better it performs (Jiang et al., 2014). Assaf and Agbola (2011) and Such-Devesa and Mendieta-Penalver (2013) state that the greater the number of stars, the greater the level of technical efficiency. A high level of service quality can help improve customer satisfaction and loyalty, which in turn improves a hotel's operating efficiency (Assaf and Magnini, 2012). Five-star hotels are characterized by higher service quality than other hotels. Therefore, we assume that a provincial destination with more five-star hotels has greater efficiency in the hotel industry.

Anti-corruption policy (ACP, a dummy variable) has been a factor since the Chinese government launched the anti-corruption policy in the end of 2012, as the hotel industry has suffered a lasting shock, especially for star-rated hotels. This is because star-rated hotels have an advantage of public consumption owing to tight linkages with the government and the concomitant demand of business guests, resulting in higher average productivity (Mao and Yang, 2016). In the present study, the ACP dummy variable takes the value of one (1) for all provincial hotel sectors in 2013, 2014 and 2015 (the years after the implementation of the anticorruption policy) and the value of zero (0) otherwise.

Severe acute respiratory syndrome (SARS, a dummy variable) is measured consistent with Huang et al. (2012): the SARS dummy variable takes the value of one (1) for all provincial hotel sectors in 2003 (year of the SARS outbreak) and the value of zero (0) otherwise.

Per capita gross domestic product (PGDP) indicates the level of regional economic development. An economically prosperous province may have rapid growth in its hotel industry (Chen, 2010).

Population size (POP) is calculated by the number of permanent residents in a provincial region. Pizam (2009) argues that the hospitality industry is composed of businesses that provide accommodation, food and beverage and meetings to tourists, travelers and residents. Based on this notion, a greater number of residents may generate higher demand for hotels and thus benefit the efficiency of the hotel industry.

Transportation accessibility (TA) is measured by the total mileage divided by the provincial administrative area. Regional infrastructure and facilities may promote hotel development (Assaf and Cvelbar, 2015).

4.3. Dataset

This paper takes provincial panel data to estimate efficiency and analyzes the cause of inefficiency in China's hotel industry. Considering data availability and consistency, star-rated hotel industry panel data for 30 provincial regions in mainland China from 2001 to 2015 were collected from the China Tourism Statistics Yearbooks and Chinese Statistical Yearbook. All economic data for each province were adjusted for inflation using an annual GDP deflator (2001 = 100). Table 2

provides more details and presents the descriptive statistics of each variable.

5. Findings and discussion

To check whether there exists a reverse causality running from hotel industry efficiency to tourism specialization, we employed Granger causality analysis to examine whether hotel efficiency affects tourism specialization in the context of China. The result reveals that hotel industry efficiency does not Granger cause tourism specialization, which suggests that our study is likely to be free from bias caused by a potential opposing relationship between tourism specialization and hotel industry efficiency. Thus, this section presents the results of the stochastic frontier estimations and discusses the findings for the effects of tourism specialization and market competition on hotel industry efficiency.

5.1. Results of stochastic frontier analysis

Table 3 displays the results of the stochastic frontier estimation, which are obtained using the program Frontier 4.1.

As shown in Table 3, the value of Gamma (γ) is 0.431 and statistically significant at the one percent level, providing evidence for the existence of components of technical inefficiency effects (Coelli and Rao, 2005), which implies that the adoption of the SFA model in this study is a good choice. In addition, 18 out of the 23 parameters were statistically significant, indicating that the data fit well with the translog production form. Furthermore, the value of the LR test is 210.369, proving that the specified model is correct; that is, the null hypothesis that the parameters of the explanatory variables of the technical inefficiency function are zero is rejected ($H_0: \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = \delta_8 = \delta_9 = \delta_{10} = \delta_{11} = \delta_{12} = 0$).

For time variables, both the coefficient of time (T) and its square are positive, but only the first-order coefficient of time is statistically significant at the one percent level. The positive sign of the time variables implies that technological progress exists in the hotel industry in China over the observation period. This forward movement of the production frontier over time should be attributed to the application of advanced technologies in the Chinese hotel sector, such as information technology (Bilgihan et al., 2011), mobile terminals (Chen et al., 2016) and electronic commerce (Hua et al., 2015). Interactional variables between time and inputs (capital and labor) denote the nonneutral technological movement toward capital and labor. According to the coefficients of the interaction terms of time with capital ($T \times \ln K$) and time with labor ($T \times \ln L$) in Table 3, we notice that both the coefficient β_8 of variable $T \times \ln K$ and the coefficient β_9 of variable $T \times \ln L$ are negative, but only β_8 is statistically significant at the 10 % level, indicating a nonneutral technological regression toward capital, while the coefficient β_9 is not statistically significant.

Referring to the input variables in the production function, as Table 3 shows, both the first-order coefficients for capital (K) and labor (L) are strongly significant, but they have contrasting signs. The estimated coefficient of capital is negative and equals -1.850 . In contrast, the estimated coefficient of labor equals 2.540 , indicating the positive elasticity of labor. In addition, according to the second-order coefficients of the input variables, the squared variable of capital $(\ln K)^2$ is positive and significant at a 1% level. The estimated coefficient of squared labor $(\ln L)^2$ is negative but is not significant.

Furthermore, the estimated coefficient of the interaction variable between labor and capital $(\ln L \times \ln K)$ is negative ($\beta_7 = -0.115 < 0$), suggesting the presence of a substitution effect between labor and capital in China's hotel industry. With the coefficient estimates of the production function in Table 3, we can calculate the output elasticity ε with respect to capital K and labor L as follows.

Table 2
Variables and descriptive statistics.

	Unit	Definition	Obs.	Mean	Std.Dev.	Min.	Max.
Output							
Total revenue	ten thousand yuan	Total revenue of star-rated hotel industry	450	562733	614844	9817	2953663
Inputs							
Capital	ten thousand yuan	Gross fixed assets of star-rated hotel industry	450	1352413	1351178	31662	7455876
Labor	person	The total number of employees	450	48863	36930	3048	188642
Explanatory variables							
<i>Core explanatory variables</i>							
Tourism Specialization	—	The ratio between total tourism revenue and gross domestic product	450	0.104	0.052	0.017	0.333
Market Competition	per hotel/ten thousand persons	The ratio of number of star-rated hotels over regional total population	450	0.050	0.041	0.005	0.238
<i>Control variables</i>							
FTDD	—	Foreign trade dependent degree	450	0.317	0.366	0.015	1.711
FSH	—	The number of five-star hotels	450	14.896	18.112	0.000	102.000
ACP	—	Anti-corruption policy	450	0.200	0.400	0	1
PGDP	ten thousand yuan	Per capita gross domestic product (in logarithm)	450	9.695	0.640	8.006	11.064
POP	ten thousand persons	Population size (in logarithm)	450	8.152	0.758	6.260	9.292
TA	km./sq.km.	Transportation accessibility	450	0.216	0.159	0.009	0.778
SARS	—	Severe acute respiratory syndrome	450	0.067	0.250	0	1

Note: the measurements of output and input variables are rounded to the nearest whole number, and the measurements of explanatory variables are rounded to three decimal places.

Table 3
Parameter estimates of the trans-log production frontier function.

Variables	Parameters	Coefficients	t-ratio
Constant in the production frontier	β_0	7.380***	5.190
lnK	β_1	-1.850***	-5.440
lnL	β_2	2.540***	6.290
T	β_3	0.166***	3.280
$(1/2) \times (\ln K)^2$	β_4	0.251***	3.370
$(1/2) \times (\ln L)^2$	β_5	-0.045	-0.375
$(1/2) \times T^2$	β_6	0.001	0.418
$\ln K \times \ln L$	β_7	-0.115	-1.310
$T \times \ln K$	β_8	-0.011*	-1.910
$T \times \ln L$	β_9	-0.002	-0.331
Constant in the function of production inefficiency	δ_0	4.790***	8.010
T	δ_1	0.002	0.185
TS	δ_2	-2.140***	-2.820
TS ²	δ_3	5.600**	2.220
MC	δ_4	-2.350***	-4.630
TS \times MC	δ_5	6.130**	2.530
FTDD	δ_6	-0.178***	-2.680
FSH	δ_7	-0.014***	-9.250
ACP	δ_8	0.153***	3.680
PGDP	δ_9	-0.169***	-4.150
POP	δ_{10}	-0.220***	-5.950
TA	δ_{11}	-0.444***	-3.430
SARS	δ_{12}	0.096**	2.460
$\sigma^2 = \sigma_v^2 + \sigma_u^2$	sigma-squared	0.032***	13.400
$\gamma = \sigma_u^2 / (\sigma_v^2 + \sigma_u^2)$	Gamma	0.431***	5.470
Log likelihood function		154.705	
LR test of the one-sided error		210.369	
Total number of observations		450	

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

$$\varepsilon_K = \frac{\partial \ln Y_{it}}{\partial \ln K_{it}} = \beta_1 + \beta_4 \ln K_{it} + \beta_7 \ln L_{it} + \beta_8 T = -1.85 + 0.251 \times \ln K_{it} - 0.115 \times \ln L_{it} - 0.011 \times T$$

$$\varepsilon_L = \frac{\partial \ln Y_{it}}{\partial \ln L_{it}} = \beta_2 + \beta_5 \ln L_{it} + \beta_7 \ln K_{it} + \beta_9 T = 2.54 - 0.045 \times \ln L_{it} - 0.115 \times \ln K_{it} - 0.002 \times T$$

By taking the simple arithmetic mean, the average output elasticity ε_K and ε_L across the whole sample during the observation period are

0.1625 and 0.5337, respectively. The sum of the two is 0.6962 (< 1), which significantly points to decreasing returns to scale in China's hotel industry (Huang et al., 2012).

The marginal benefit of fixed asset investment in hotels is decreasing, mainly due to the existence of serious redundancy in the investments in the fixed assets of star-rated hotels (Yang and Cai, 2016) and particularly in the construction of high end hotels regardless of economic feasibility and actual demand. The consequence is that there is an oversupply of hotel rooms in some big cities because more upscale hotels were built by local real-estate developers on low-cost land without serious consideration of the actual market demand (Law et al., 2014). This perspective facilitates understanding the reasons for the oversupply of high-end hotels and the resulting adverse effects (Yang et al., 2017). The extensive growth of capital has become an obstacle to the improvement of management efficiency in hotels, and as the sign of the coefficient β_8 of variable $T \times \ln K$ indicates, over time, the growth of fixed asset investment continues to amplify the inhibiting effect. Although the marginal benefit of labor involved in hotels also decreases, this may be due to the oversupply of trained employees, which in turn decreased hotel industry performance (Yang and Cai, 2016); however, the coefficients β_5 , β_7 and β_9 related to labor are not significant.

5.2. Synergy effects of tourism specialization and market competition

Table 3 also reports estimates of the primary explanatory variables and suggests three main points. First, the coefficient δ_5 of the interaction variable is statistically significant and strong, indicating the existence of synergetic effects under the joint effect of tourism specialization (TS) and market competition (MC). As shown in Fig. 1, given a value of MC, $\ln(TE)$ experiences an increase and then a decrease with the gradual increase of TS. On the other dimension, $\ln(TE)$ varies with the value of MC; to be specific, if TS takes a low value, $\ln(TE)$ is increasing with the increase of MC, while if TS takes a high value, $\ln(TE)$ is declining with the growth of MC.

Second, a nonlinear relationship between tourism specialization and hotel efficiency is indicated by the negative coefficient of variable TS and the positive coefficient of variable TS² (the square of TS), which are both statistically significant; therefore, Hypothesis 1 is supported. The combination of the two opposing coefficients for variables that involve tourism specialization determines the specific shape of the nonlinear relationship. Given the values of δ_2 (-2.140) and δ_3 (5.600), the relationship has an inverse-U shaped characteristic with a turning point value equal to 0.191, which strongly proves Hypothesis 2. Furthermore, according to the positive and significant coefficient of the interaction

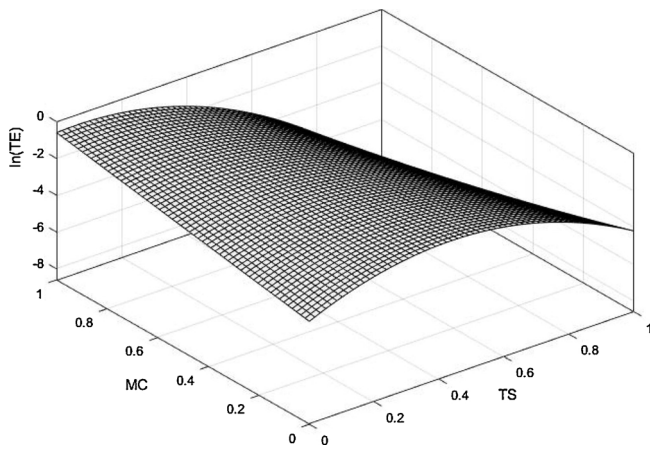


Fig. 1. Fitting surface for the synergy effects between TS and MC on efficiency (lnTE).

variable of $TS \times MC$, MC has a moderate negative effect on the relationship between TS and hotel industry efficiency, which means that the marginal impact of tourism specialization on hotel industry efficiency is not only direct but also influenced by MC, which implies that the inverse-U shape has a dynamic inflection point depending on the value of MC.

$$\frac{\partial \ln TE_{it}}{\partial TS_{it}} = \frac{\partial (-U_{it})}{\partial TS_{it}} = 2.14 - 11.2 \times TS_{it} - 6.13 \times MC_{it}$$

Generally, tourism specialization has a negative effect on the efficiency of the hotel industry when the value of tourism specialization exceeds a certain threshold. In other words, the higher the level of tourism development in a provincial region, the lower the efficiency of the hotel industry in the province. This is an interesting finding that seems to be contrary to popular belief that the hotel industry should benefit more from a destination with higher tourism specialization, since we usually conclude that a prosperous tourism industry with many tourists can produce a large potential accommodation market for the hotel industry and thereby boost its efficiency. However, a notable fact cannot be ignored: the rise of nonstandard accommodation suppliers is not only changing the competitive landscape in the hotel industry but also transforming the tourism industry (Heo et al., 2019). Classic economic theories of demand and supply indicate that increased supply may hurt firm performance by depressing price to a new and lower equilibrium (Assaf et al., 2017). The rapidly emerging sharing economy in recent years means that accommodation sharing (e.g., Airbnb) is growing quickly and becoming an important market force that is challenging the hotel industry (Xie and Kwok, 2017) and continuing to negatively affect hotel performance (Zervas et al., 2015).

Third, the coefficient δ_4 of the MC variable and the coefficient δ_5 of the $TS \times MC$ interaction variable equal -2.35 and 6.13 , respectively, both with a high level of statistical significance, indicating that MC has a positive impact on the efficiency of the hotel industry in the condition where the value of TS is below 0.383 ; otherwise, MC contributes to the decrement of hotel industry efficiency. Therefore, Hypotheses 3 and 4 are supported. Furthermore, the threshold point here is 0.383 , which implies that unless the TS of a province is below that level, the growth of MC is associated with an increase in efficiency, while the efficiency starts to decline with intensified market competition.

$$\frac{\partial \ln TE_{it}}{\partial MC_{it}} = \frac{\partial (-U_{it})}{\partial MC_{it}} = 2.35 - 6.13 \times TS_{it}$$

These findings suggest that the quiet-life hypothesis appears to be valid in the Chinese hotel industry only under the condition where TS is below 0.383 . For instance, those hotels in provinces with relatively low tourism specialization have operated in efficiently partly because they

have benefitted from market competition, as the hotel industry is also becoming increasingly sensitive to the changing tastes and preferences of tourists seeking accommodation. In the provincial-level destinations with relatively high tourism specialization, such as Shanghai, Guangdong and Beijing, hotels have experienced greater competition from other hospitality businesses, and their efficiency has been suffering from the negative impact of heightened competition.

5.3. Influences of external factors on hotel industry efficiency

From the results in Table 3, the coefficients of the control variables have the expected signs. The significant and positive coefficient of the time trend variable indicates that technical inefficiencies vary over time with an increasing tendency.

The coefficient δ_6 of the FTDD variable equals -0.178 with a 1% level of statistical significance. This indicates that, in line with previous research (Yang and Cai, 2016), foreign trade has a significant positive impact on the efficiency of the hotel industry by stimulating business trip demand for hotels. Business travelers and inbound tourists are the main target markets of the hotel industry. A 1% increase in foreign trade dependence degree yields a 17.8 % increase in operational efficiency for the hotel industry on average.

The number of five-star hotels also has a positive influence on the efficiency of the hotel industry, with a highly significant coefficient δ_7 equaling -0.014 . The result reveals that the higher the number of five-star hotels in a province is, the more efficient its hotel sector.

The coefficient δ_8 of the ACP variable equals 0.153 with a high level of statistical significance, indicating that the anti-corruption policy has had a negative impact on efficiency such that the operating efficiency of the star-rated hotel industry has been decreasing since the anti-corruption policy was launched in 2012. We explain that some nonmarket factors, such as the level of government consumption due to corruption, play an important role in the development of star-rated hotels in China. However, the anti-corruption movement has cut off the hotel revenue attached to administrative expenses and disrupted the political connections between star-rated hotels and government officials. Hence, the main channel driving the total revenue of star hotels has been abruptly blocked, with the consequence of lower efficiency (Zhang and Shu, 2018).

The coefficient δ_9 of the PGDP variable and δ_{10} of the POP variable are both negative and highly significant, again proving that an economically prosperous provincial destination may have rapid growth in its hotel industry (Chen, 2010). Similarly, the growth of the population in a province can boost its hotel industry. The hotel industry in a province with higher transportation accessibility (TA) seems more likely to be technically efficient. The finding of a positive influence of transportation accessibility is consistent with Assaf and Cvelbar (2015), who found that the quality of the transport infrastructure has a significant positive impact on hotel performance. Hu et al. (2010) found similar evidence in the case of Taiwan. SARS broke out in 2003 in China, which no doubt was a dramatic shock to the hotel industry, with a strong significant and positive coefficient δ_9 . This result is consistent with findings from previous studies (Chien and Law, 2003; Pine and McKercher, 2004).

5.4. Robustness tests

We apply robustness tests to consolidate our results in this section. On the one hand, as there is a concern about the possible reversed relationship between TS and hotel industry efficiency, we substituted the one-year lagged TS for the current year TS in order to alleviate the reverse causality problems, based on the law that the lagged value of independent variable (TS) could affect the current value of the dependent variable (hotel industry efficiency), but not vice versa. The robustness test results for the core explanatory variables (TS, TS^2 , and $TS \times MC$) are consistent with our abovementioned findings, suggesting

that the opposing relationship is not a serious concern.

When considering the difference in region size in each province when measuring the variable of market competition, we adopted the ratio of the number of star-rated hotels over regional area as an alternative measurement of MC for a robustness test. The result confirms that no large difference was found using the two measures of MC, which again verifies that the present research is robust.

6. Conclusions

This research examined the effects of tourism specialization and market competition on hotel industry efficiency by utilizing 15 years of provincial panel data on China's hotel industry from 2001 to 2015 and adopting stochastic frontier analysis. The results show that the effect of both tourism specialization and market competition on the efficiency of the hotel industry is not mutually independent or monotonically linear. The results revealed that provincial tourism specialization and market competition exert a synergistic effect on hotel industry efficiency. As the level of tourism specialization increases, the efficiency of the hotel industry experiences progress in an inverted u-shape, and the marginal benefit of tourism specialization growth decreases as market competition becomes more intense. The influence of market competition on the operating efficiency of the hotel industry depends on the level of tourism specialization. Only when tourism specialization is below a certain threshold value does market competition generate a positive effect on hotel industry efficiency. This paper also examined the impact of other external factors situated in the Chinese context, such as foreign trade, the anti-corruption policy and SARS.

This research contributes to the existing theoretical literature on hotel industry efficiency by confirming the synergistic impact of tourism specialization and market competition. This research links a destination's level of tourism development with its hotel industry and bridges the gap between hotel performance and regional factors (Yang and Cai, 2016). Tourism specialization in a province is the key determinant of hotel industry efficiency and reflects regional factors. Market competition has been shown by research to have both positive and negative impacts on hotel industry efficiency in different cases (Assaf et al., 2017; Göcen et al., 2017; Huang et al., 2012); therefore, this research also confirms that including regional factors such as tourism specialization contributes to the in-depth and contextual understanding of this relationship.

Practically, this research contributes to policy-making for destinations when facing tourism and hotel development opportunities. The average efficiency across China is low, with large provincial differences. Meanwhile, given the current national policy on holistic tourism development ("quan yu lv you") in China, increasingly more destinations are prioritizing tourism as an economic sector, leading to improvements in tourism specialization and a promising environment for hotel investment and operation. Provinces with a low level of tourism specialization should encourage market competition in the hotel industry. While destinations expand tourism development, a more relaxed market access mechanism should be established to reduce administrative interference in market competition, eliminate corporate innovation inertia and promote healthy development of the hotel industry. Provinces with a high level of tourism specialization should focus on controlling the scale of investment in high-end hotels and market regulation.

With the emergence of nonstandard types of accommodations and their increasing popularity, as well as overinvestment in the hotel industry, competition in the hotel industry has become more fierce. The hotel industry in China faces an oversupply of high-end hotels and is at the stage of decreasing returns to scale. For the hotel industry, market competition is a double-edged sword, and hotel managers should be aware of the local and regional tourism specialization level to set appropriate strategies to compete or collaborate with fellow hotels. Under the trend of market diversification and consumption upgrading, hotels

are required to constantly innovate and improve service quality. The hotel industry should be committed to exploring and cultivating emerging market segments, actively responding to tourists' real-time and fragmented booking demand to compete with other types of accommodation and gain operational efficiency in the long run.

However, this research is not without limitations. Due to data availability, we could only use provincial panel data to examine the relationships between tourism specialization, market competition and hotel industry efficiency. Moreover, the measurements of market competition in this study could be biased if firms are forced to exit the market because of higher competition. Further considerations and comprehensive evaluations on the indicators and measurements of market competition amongst hotels are needed. There is a lack of evidence at the firm level and from other types of hotels, such as non-standard accommodations. Future studies should be conducted using different forms of data on scales other than the provincial scale to evaluate the relationships. Last but not least, the empirical results are applicable in China, and the implications may be limited to other countries with different political and social structures. It is recommended that future studies confirm and expand our research in other contexts.

Declaration of Competing Interest

None.

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