

## Article

# Competitive Structure of Accommodations in a Traditional Japanese Hot Springs Tourism Area

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**Abstract:** This paper investigates the competitive structure of prices in a traditional hot springs resort area in Japan from a spatial econometric perspective. This perspective has not been addressed in hot springs—or “onsen” in Japanese—tourism areas, which have been gradually losing momentum due to the ageing of operators and diversification of leisure activities. The study area is one of the three oldest hot springs in Japan, the Dogo Onsen area in Matsuyama, where hotels and ryokans are clustered. First, we present a conceptual framework that characterizes two strategies, namely, differentiation and partnership strategies. Then, spatial error models are employed to test the hypothesis that spatial closeness intensifies price competition, while social closeness mitigates price competition. The estimation results reveal that our hypothesis was verified, in that the social network which has been nurtured for generations in the study hot spring area mitigates price competition, in comparison with the non-hot spring area in Matsuyama. Thus, good partnerships among local operators based on social networks should be more closely scrutinized for the revitalization of traditional hot springs areas.

**Keywords:** onsen tourism; hot springs resort; competitive structure; ryokan; Japanese accommodations; spatial econometrics

## 1. Introduction

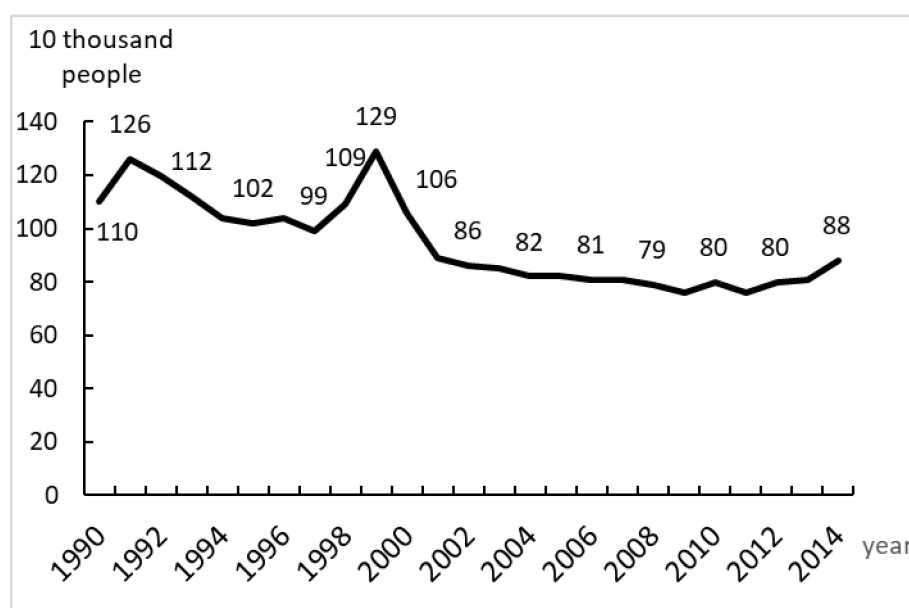
Hot springs —“onsen” in Japanese—tourism in the Japanese style is a traditional pastime for people in Japan. Nevertheless, a long-standing structural change in demand by group tourists, as well as smaller tourism units, such as families, couples, and individuals, has imposed the need for adjustments by the operators of facilities in hot springs areas. Due to the difficulty of making structural adjustments in traditional accommodation facilities, many of which are Japanese-style accommodation facilities called ryokans, numerous operations have had to close amid the ageing of operators without successors. Thus, the number of ryokans has been decreasing, due to an inability to cope with the demand structure [1]. To counter this negative trend, effective promotional measures must be designed. For this purpose, it is essential to explore the structure of competition and co-operation among accommodation operators in hot springs areas. Although community-based rural tourism has been promoted in rural Japan [2], local communal relationships have been sparsely taken into account in hot springs tourism, despite its importance in the evolution of tourism services differing from the traditional means of renovating such services. This paper, thus, investigates these issues from a spatial econometric perspective, by focusing on the Dogo Onsen area in Matsuyama city, a city in the Ehime prefecture in Western Japan, which is one of the oldest and most well-established hot springs resort areas in Japan. As the Dogo Onsen area is considered to have both competitive and co-operative characteristics among its accommodation facilities, it was considered suitable as a study area where partnerships

among stakeholders are undertaken under competitive circumstances. Generally, such partnerships are necessary for the revitalization of hot springs areas, which is a basic hypothesis of our study. Despite the rapid increase in tourism studies, the spatial econometric approach has not been undertaken fully, especially in the area of spa and hot springs tourism or rural tourism. Furthermore, no study has focused on one municipality. Thus, this paper first presents a conceptual framework that enables us to characterize the differentiation and partnership strategies that lead to the following empirical evaluation. Secondly, the authors empirically conduct an investigation of the structure of price competition, as well as taking into account the co-operative relationships within one municipality: the Dogo Onsen area in Matsuyama. Finally, the authors present policy recommendations to promote new developments in hot springs tourism.

## 2. Literature Review and Hypotheses

First, the authors review the managerial issues of hot spring areas in Japan and the situation of the study areas. Secondly, the issues of competition in connection with product differentiation are addressed. Thirdly, price competition in connection with spatial factors is discussed.

As for the first item, measures to revitalize hot spring areas have been explored by Japanese researchers but were published in Japanese, which greatly reduces their availability to readers abroad. This is one reason for conducting this research, in order to let international readers share the issues. Among these reports, [3] evaluated the managerial factors regarding ryokans in hot spring areas and mentioned that two factors, hospitality and financial capability, are important. In another study [4], it has been pointed out that a common factor in cases in which the revitalization of a hot springs area was successful was the existence of social capital in that area and an extensive human network with experts outside of the local community. In fact, in the Dogo Onsen area, community-based revitalization efforts have been made. The most successful was “Dogo Onsenart”, held in 2014, which was an art event organized by a partnership between the municipality of Matsuyama and ryokan co-operatives in Dogo. “Onsenart” means the combination of onsen and art. For the event, art works were displayed in hotels and ryokans. Consequently, overnight stays that year reached 880 thousand in the Dogo Onsen area, which was the highest of the previous ten years, as shown in Figure 1.



**Figure 1.** Trend of number of stays (Dogo Onsen hot springs). Source: Dogo Onsen Ryokan Cooperatives.  
Note: The numbers on the graph correspond to the years on the horizontal axis.

Turning to the topic of ryokan management, various studies and proposals have been described in Japanese. For instance, [5] proposed that the pre-modern situation, whereby ownership and management are not separated, should be modernized to separate the financial and labour management entities. The importance of target marketing, which focuses on a certain range of demands and provides services aiming to meet those demands, has been pointed out ([6]). Thus, renovation in ryokan management has been urged, in order to enable ryokans to keep up with modern demands. In this respect, Onsenart in Dogo Onsen is considered as a typical case of this trial, under the circumstances of competition and partnerships among ryokan operators.

Secondly, we consider the issue of competition in relation to product differentiation. One of the product attributes that most highly influences the choice of an accommodation facility is location, as tourists put a high priority on the location of accommodation, being suitable to their tourism destination ([7]). Other attributes also influence tourist behaviours, such as the price of an accommodation service, service quality, reputation, cleanliness, and so on ([8]). In the short-term, accommodation operators can change prices to implement a product differential strategy under the condition of a fixed facility and equipment, while location and other attributes are considered as differential factors over the long-term ([9]). The Hotelling model [10], based on the classical theory of competition on spatial differentiation by firms, is a conceptual model that explains that two firms that do not have price competition, but which have competition on spatial differentiation to maximize profit, reach a competitive equilibrium at the middle of the spatial distance between the two firms (i.e., the duopoly state). Then, by easing the assumption to allow price competition after the location is fixed, Hotelling [10] has been utilised to indicate that Bertrand-type price competition occurs. To summarize, when we see the issue of competition, spatial factors should be considered.

Studies derived from this model have been extensively conducted and various outputs with different assumptions and factors taken into the models have been generated. Among them, many studies have expanded the Hotelling model to models that deal with competition based on the positioning of product differentiation, as location is considered as a horizontal attribute. For instance, [11] shed light on competitive equilibrium by considering multiple product attributes as spatial factors. They concluded that firms will reach equilibrium when they maximize differentiation in the attribute that consumers like the most and minimize differentiation in all other attributes. In [12], it was confirmed that vertical product differentiation mitigates price competition. Thus, we need to consider horizontal and vertical differentiations in the empirical evaluation of price competition.

In connection with spatial factors, we can expect that differentiation in spatial attributes—that is, vertical attributes such as quality of the facility or horizontal attributes such as the diversity of the facility—will reduce price competition. Nevertheless, the above discussion has a limitation from the viewpoint that competition in product differentiation has been discussed only under the duopoly market, as many firms exert an influence over each other in reality. Thus, the authors looked into studies on the choice of location of accommodation facilities in areas with an accumulation of accommodation facilities. In [13] and [14], the externality of accumulation has been explained from supply and demand perspectives. For externalities in the supply side, exclusive access to resources, diffusion and sharing of technical information, and access to good suppliers were listed, while reduction in the retrieval cost for consumers and demand increase due to diversified options for consumers were externalities in the demand side. In [15], the competitive structure of hotels in Manhattan was investigated and it was concluded that hotels maximize differentiation in terms of business size while minimizing price differentiation to take advantage of the accumulation effect of hotels there. On the other hand, [16] expanded the three-dimensional model initially presented by [15] by adding the service attributes of hotels in Madrid and verified that hotels tended to decide on location to maximize price differentiation while minimizing differentiation in terms of service and business size. These results are consistent with the product-differentiation strategies of firms discussed in [11], in which firms try to ease price competition by maximizing differentiation in one product attribute while minimizing other attributes.

Thus, we can say that operators of accommodation facilities demonstrate strategic behaviours that lead to product differentiation over the long term to ease short-term price competition. Put differently, we can examine how product differentiation affects price competition when we consider the situation of price competition. In short, it is expected that differentiation in vertical or horizontal attributes will mitigate price competition in a spatially close area of accumulation.

Thirdly, regarding empirical studies on price competition taking into account spatial factors, [17] pointed out that Airbnb pricing positively depends on characteristics of points of interest within a 650 m radius from an investigation of Airbnb pricing in Tallinn, Estonia, using spatial econometric models. From the results of spatial econometric models in Hong Kong, [18] stated that the magnitude of price dispersion is not only influenced by demand, but also by the pricing of neighbouring hotels and hotel attributes such as scale, star rating, and chain affiliation. However, these studies did not consider social closeness among accommodations. In [19], the influence of spatial and vertical attributes of lodging facilities on price competition was empirically investigated in the state of Texas in the U.S.A. It was indicated that, when vertical differentiation was small, price competition was also small among spatially close lodging facilities. This result, however, does not follow the above expectation that vertical differentiation will reduce price competition. The reason for this contradiction can be explained by the influence of social networking among operators, independent of product attributes. In [20], it was pointed out that it is quite often observed that operators in the lodging industry share information on price and room occupancy with each other. In [21], it was empirically revealed, by focusing on hotels in Texas, that collusion is highly possible among operators to maintain high prices in an accumulated area. Thus, these results indicate that social closeness among managers will generate strategic co-operative behaviour to reduce price competition. On the other hand, [22] clarified, from empirical research on hotels in Sydney, that personal friendships of general managers with rivals had a positive effect on increasing revenue in operating a facility. This study verified that social relationships have a positive influence on economic behaviour through the exchange of useful information, which is an effect of social relationships generated differently from strategic co-operation. Consequently, we can assume that social closeness will mitigate price competition in two different ways: strategic co-operation and personal friendships. From an empirical viewpoint, social closeness among operators in Dogo Onsen area should contain these two factors, as there are long historical relationships among ryokan operators.

Based on the above literature review, the authors set empirical hypotheses for a model specification, as follows. First, accommodation services have three attributes: spatial attributes, vertical attributes, and horizontal attributes. Second, if vertical differentiation is not made among accommodation facilities, the closer the facilities are located to each other (i.e., the more similar their spatial attributes), the fiercer the price competition is. Third, social relationships, as a managerial attribute, mitigate price competition. Nevertheless, there is no appropriate conceptual microeconomic framework which enables us to investigate the issues of strategic behaviour of ryokan operators in connection with the perspective of community development. Thus, before empirical evaluation, the authors present a conceptual framework which characterizes the two strategies, regarding competitive differentiation and partnership strategies, which lead to subjective price determination.

### 3. Conceptual Framework

Figure 2 depicts a microeconomic operator's subjective equilibrium framework, which characterizes the price strategies and measures tourism activity horizontally and values vertically. A price strategy is determined by cost and revenue. Suppose an operator of a ryokan has a marginal revenue line, illustrated as  $MR$ , and a marginal cost line, represented as  $MC$ , ceteris paribus. This ryokan has a certain level of tourist loyalty and an ordinally decreasing marginal revenue when tourism activity increases. Thus, the  $MR$  lines are illustrated as right downward. Likewise, the  $MC$  lines are demonstrated as ordinally right-upward. A subjective equilibrium on the price is realized where the  $MR$  and  $MC$  lines meet (e.g., the initial optimal point  $e_0$  where  $MR_0$  meets  $MC_0$ ). At this point, the operator does not implement any strategic behavior. When the operator undertakes a differentiation strategy

(either horizontal or vertical), this strategy usually entails facility and software investment to generate the upward shift of  $MR$ . Vertical differentiation generally requires more investment than horizontal differentiation. These differentiations, therefore, cause an upward shift of the  $MC$  lines (i.e., from  $MC_0$  to  $MC_1$  in Figure 2). Then,  $MR_1$  meets  $MC_1$  at  $e_1$ , which is the new subjective optimal point with a higher accommodation price,  $P_1$ , than the initial one,  $P_0$ . This higher price, however, does not always mean a higher operator's surplus than the initial one if the upward shift of  $MC$  becomes large enough to cancel out the increase in the operator's surplus caused by the rise in price. Specifically, the operator's surplus of the differentiation strategy becomes the triangle  $P_1e_1k$ , which is (not so obviously) larger than the initial one  $P_0e_0j$ , despite the upward shift of the  $MR$  lines. Thus, we have to be careful not to overestimate the price-increase effect of differentiation when we evaluate the price-increase effect of the differentiation strategy empirically [23].

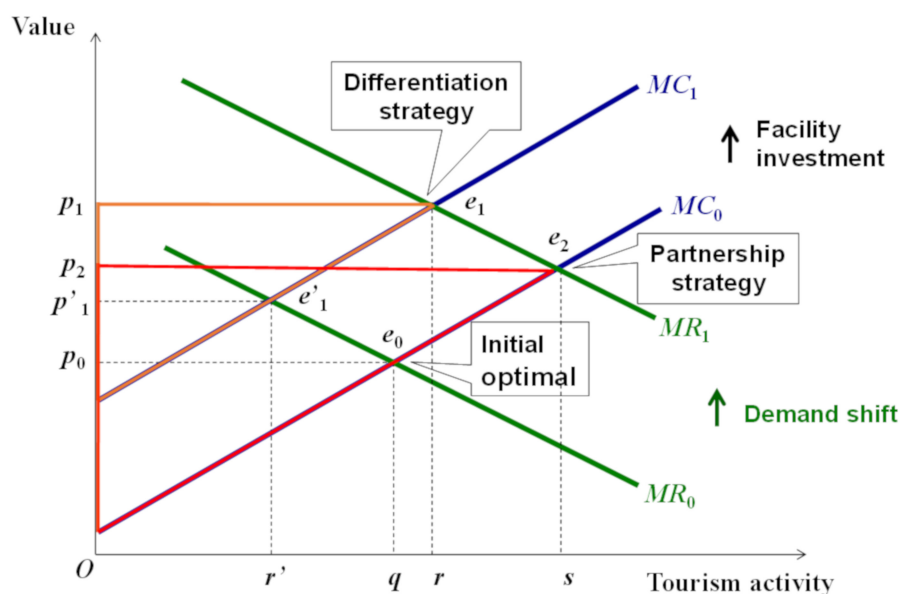


Figure 2. Operator's subjective equilibrium between differentiation and partnership strategies.

Now, the authors consider the partnership strategy, which is comprised of two perspectives: one seeks the operator's individual benefit, and the other seeks community benefit. Let us explain in the figure: The partnership strategy is generally based on the social capital in the community, rather than facility differentiation. In this case, it is supposed that the investment cost for each operator, such as an event or destination marketing organized by the local community, is much smaller than that of a differentiation strategy. To simplify the discussion here, no investment cost is assumed for this strategy, which means no upward shift of the  $MC$  line. Under this circumstance, the optimal point of this strategy is achieved at  $e_2$  (where  $MR_1$  meets  $MC_0$ ), as the collaborative action creates an increased demand for accommodation, demonstrated by the shift from  $MR_0$  to  $MR_1$ . Consequently, the operator's surplus,  $P_2e_2j$ , will be larger than that of the former competitive differentiation strategy and also that of the initial point. From this consideration, we can say that the partnership strategy will be less costly in facility investment than the differentiation strategy. Put differently, the operator will have a larger surplus than in the case of the differentiation strategy if the investment cost is identical. However, it should be said that this strategy is only possible in a community where well-functioned social capital which nurtures community-based activities has been established. Otherwise, significant upward shifts of  $MC$  will occur for the establishment of social capital, which requires long-term endeavours for the people concerned in the community.

The above two strategies are not likely to be exclusive to each other, in reality, and a mixed strategy will likely be undertaken. This is an empirical question to be investigated in the subsequent section.

#### 4. Outline of the Dogo Onsen Area

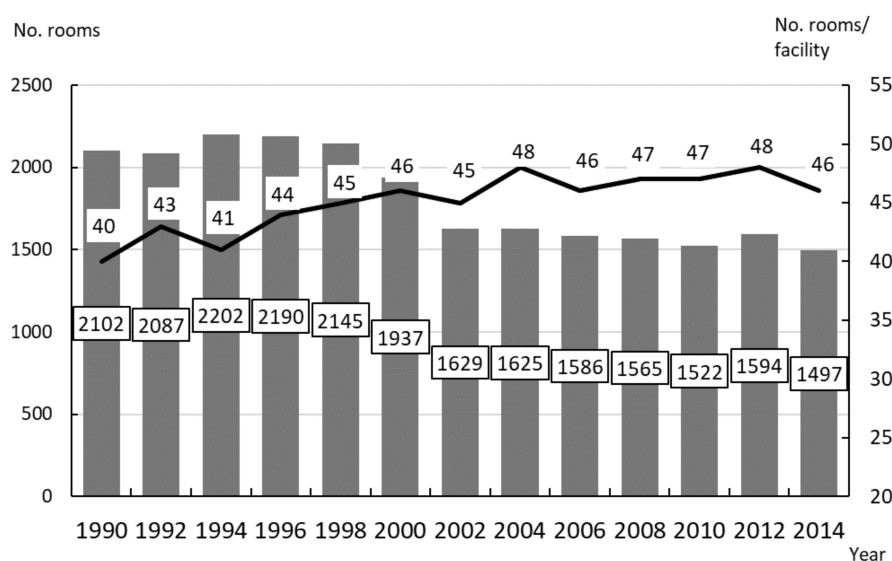
As mentioned earlier, Dogo Onsen is one of Japan's three oldest hot springs areas, located in the city of Matsuyama, and is an "onsen town" that was formed with ryokan accommodation and hotels. It is symbolized by a Japanese hot spring architectural treasure, the "Dogo Onsen Main Building", which is used as a public hot springs bath. As indicated in Table 1, Dogo Onsen is one of the most popular hot spring areas in Japan.

In the past 25 years, the number of incoming tourists to Dogo Onsen has been decreasing, dropping from 1.1 million tourists in 1990 to 0.89 million in 2014 (Figure 1). From an interview in the study area, it was revealed that the number of accommodation facilities has decreased from 56 to 35, including five that temporarily suspended operation during the same period. Although this decrease was initially among the small ryokans, large ryokans started to halt operations around 2000. There are hardly any new entries into this area. Figure 3 confirms the decreasing trend in the number of rooms in accommodation facilities in Dogo Onsen and that the average facility size has increased to counter this decreasing trend in the number of rooms there. Therefore, ryokans with a long history have played an important role in tourism activity in Matsuyama.

**Table 1.** 100 highly selected Japanese onsens (2014): Total ranking.

Rank	Name	Place
1	Kusatsu	Gumma
2	Yuhuin	Oita
3	Gero	Gifu
4	Beppuhachiyu	Oita
5	Arima	Hyogo
6	Noboribetu	Hokkaido
7	Dogo	Ehime
8	Kurokawa	Kumamoto
9	Ibusuki	Kagoshima
10	Kinosaki	Hyogo

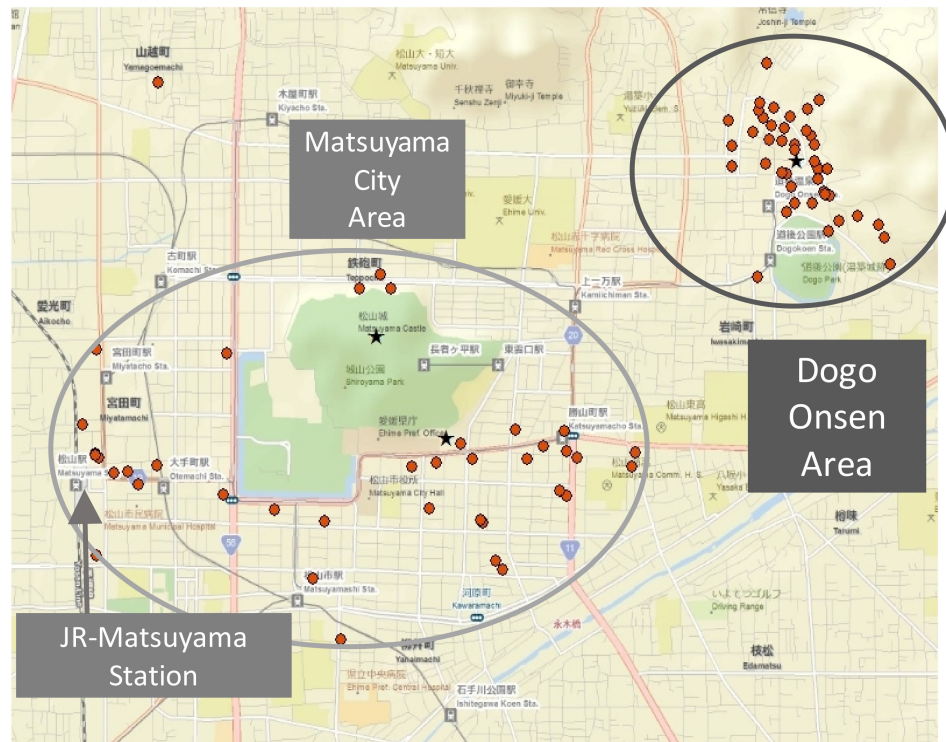
Source: Kankokeizai News Corporation (2015).



**Figure 3.** Trend of number of rooms in accommodation facility in Dogo Onsen. Source: Same as Figure 1.



Figure 4 illustrates the spatial distribution of accommodation facilities in the Dogo Onsen area and of business hotels in other areas of Matsuyama. Business hotels are in a category of hotels that focuses on business tourists and normally specializes in providing bed and breakfast services.



**Figure 4.** Distribution of accommodation facilities in Matsuyama. Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), MapmyIndia, © OpenStreetMap contributors, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community.

## 5. Data and Methodology

### 5.1. Data

We focused on accommodation facilities within a 3 km radius around Matsuyama Castle, the symbol of local identity and a major tourist attraction in addition to Dogo Onsen. While 88 accommodation facilities were located in the study area, data were available from only 77 facilities. This study area included Dogo Onsen, the JR railway station, and a shopping area, which meant that this area was where most of the economic activities were undertaken. Names and addresses of facilities were collected from the “i town page” and the Internet telephone directory. More detailed information, such as prices and number and types of rooms, was obtained from the Internet hotel and ryokan booking site in Japan (i.e., an online travel agency) named “Jalan net”. If data were not available from this site, the authors directly contacted the facilities by telephone to obtain this information. As the authors studied the prices of accommodation facilities, we could collect that data directly from the website of the individual facility. Many facilities, however, did not have a web booking system that enabled them to reflect price changes on the site instantly. For this reason, the authors used price data from Jalan net, which reflected price changes immediately. Data collection was carried out during the first ten days of October 2015, except for the weekend (when prices go up). During this period, the authors also conducted an interview with an official of the local tourism association to obtain an overview of trends in tourism in this area. Spatial distances between accommodation facilities were measured using the ArcGIS software.

Regarding the data, as of 2020, the number of tourists from abroad who travel to Matsuyama has increased, compared with data from our survey in 2015. There was an increase from 133,800 arrivals in 2014 to 217,400 arrivals in 2018, due to the national inbound-promotion policy and also a policy by the local municipality of Matsuyama, such as a cultural exchange agreement between Matsuyama and Taipei municipalities ([24]). Thus, it is considered that tourism in this area has entered a new stage. Although this trend is favourable for the accommodation sector in this area, operators are now facing other problems, such as a labour shortage due to the intensive input of labour for the implementation of Japanese-style hospitality ([25]). The authors think that an investigation of how this new trend has influenced pricing strategies is a separate topic. This is the reason why the authors focused on the time before that trend emerged for this investigation.

## 5.2. Taking into Account Spatial Dependence and Model Building

To identify the influence of spatial factors on price competition, it is necessary to take spatial factors as variables in an estimation model. However, it is often difficult to form an explanatory variable that represents a spatial relationship with other facilities. Thus, this paper uses an empirical methodology, in order to not use explanatory variables in a spatial relationship. Specifically, the authors constructed a model in which the spatial dependence in an explained variable is introduced and the result is compared with the result of the ordinary least squares (OLS) estimation. If an omitted variable has a spatial correlation, then it is highly expected that prices of accommodation facilities that are located close to each other have a spatial dependence on each other. For the empirical evaluation of this case, spatial econometric models are useful ([26]). The authors also applied the same methodology to social relationships. In spatial econometrics, the spatial dependence among variables is structured in a model as a spatial weight matrix  $W$ .

Before spatial econometric modelling, the authors tested whether the prices had a spatial correlation. To test this issue, the authors formed spatial weight matrices and calculated the Moran's  $I$  for prices from these matrices (Table 2). The authors tested for spatial autocorrelation and the null hypothesis with the assumption that no spatial autocorrelation was rejected in every Moran's  $I$ . From these results, the authors can say that the introduction of spatial dependence into a model is appropriate.

**Table 2.** Moran's  $I$  of price by different weight matrices.

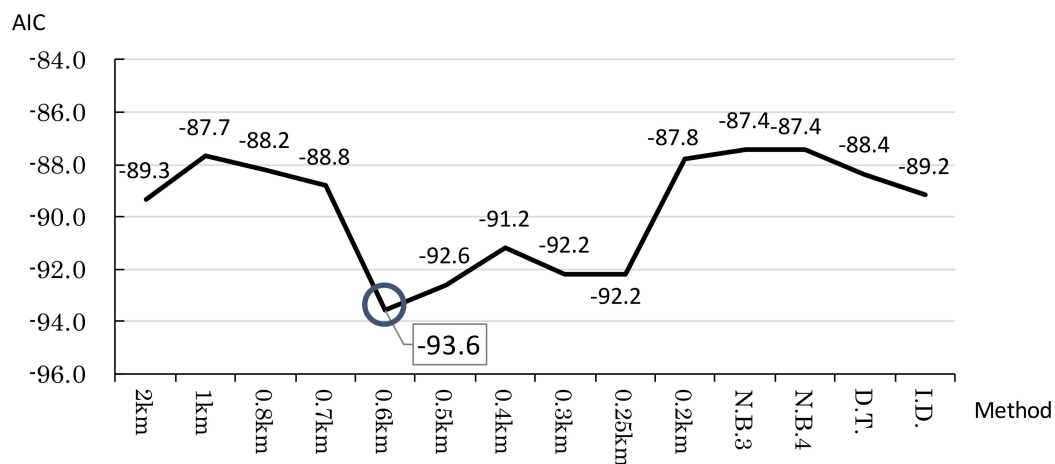
Method of Weight Matrix		Moran's $I$	z Value	Test Result
Spatial contiguity weights	Threshold: 2km	0.129	9.6783	***
	Threshold: 1km	0.275	10.472	***
	Threshold: 0.8km	0.279	9.4375	***
	Threshold: 0.7km	0.276	8.0255	***
	Threshold: 0.6km	0.283	7.0308	***
	Threshold: 0.5km	0.291	6.5598	***
	Threshold: 0.4km	0.284	5.7927	***
	Threshold: 0.3km	0.301	5.1400	***
	Threshold: 0.25km	0.297	4.4684	***
	Threshold: 0.2km	0.320	4.3124	**
K nearest neighbours	k: 3	0.320	4.0868	**
	k: 4	0.290	4.3330	**
Delaunay triangulation		0.269	4.3417	**
Inverse distance		0.241	7.6048	***

Notes: \*\*\*, \*\*, \* means that z value is 1%, 5%, 10% statistically significant, respectively.

Next, the authors determined which spatial weight matrix is appropriate to use for the model by the Akaike Information Criterion (AIC; Figure 5). Figure 5 indicates that the spatial weight matrix that is defined as closeness within a 600 m range had the lowest AIC; therefore, this weight matrix is most appropriate for the empirical model. It takes about ten minutes to walk a distance of 600 m. This result



is similar to results of a study on pricing behaviour of Airbnb accommodation ([17]), which pointed out that a 650 m radius is an influential distance for pricing behaviour.



**Figure 5.** Comparison of Akaike Information Criterion (AIC) in models by different spatial weight matrices. Notes: N.B. = nearest neighbours, D.T. = Delaunay triangulation, I.D. = inverse distance.

To simplify our estimation model, the authors assumed two different kinds of spatial autocorrelation, depending on how the spatial autocorrelation exists: either in the explained variable or error terms. In one, it is assumed that autocorrelation exists in the explained variable controlled for the spatial correlation in the covariates, which is termed as the spatial autoregressive model (SAM). Initially, autocorrelation among the explained variable  $\rho$  is assumed to be zero. In the other type, autocorrelation is assumed in the error terms, which is called the spatial error model (SEM). Initially, autocorrelation in the error  $\lambda$  is assumed to be zero. Then, the authors determined which model was suitable, depending on the result of the Lagrange multiplier test, with  $\rho = 0$ ,  $\lambda = 0$  as the null hypothesis in the SAM and SEM models, respectively. The results demonstrated that the null hypothesis  $\lambda = 0$  was rejected, which means that autocorrelation existed in the SEM. Further, to clarify that an omitted variable has a correlation with explanatory variables, the authors tested the null hypothesis that the OLS estimate and SEM estimate were identical by the Hausman test [26] (pp. 61–63). The results of this test did not allow a rejection of the null hypothesis and showed that there was no statistically significant correlation between the omitted and explanatory variables. If this correlation between omitted and explanatory variables exist, we should use the spatial Durbin model, which introduces the spatial autocorrelation into explained variables as well. This was not, however, the case. Consequently, the authors used the SEM for empirical models.

Details of the model are explained as follows. First, the authors constructed an OLS model that did not consider autocorrelation of an explained variable. Then, the authors made two spatial econometric models by using two types of weight matrix. Finally, the authors compared the results of these three estimation models using the AIC, taking into account the number of parameters.

### 5.3. Forming the Spatial Weight Matrix

The spatial weight matrix  $W$  uses the spatial variable dependence as components: if points  $s_1$  and  $s_2$  are spatially close, then  $w_{ij} \neq 0$ ; while, if not,  $w_{ij} = 0$ . Generally, to make interpretation easier, the value of each component is divided by the sum of row values to standardize (i.e., such that  $\sum w_{ij} = 1$ ) [27]. Thus, the selection of the spatial weight matrix influences the parameter estimation. Nevertheless, there is hardly an effective guideline for adequate selection of the spatial weight matrix and, so, forming this matrix actually depends on the researcher's choice ([28]). Thus, firstly, based on our two hypotheses, the authors assumed that prices are either influenced solely by spatial relationships or by both spatial and social relationships. Secondly, the authors set two types of  $W$  and empirically

tested them through model estimations. The approach taken in this paper, treating a social relationship as a spatial correlation among data rather than as the introduction of an explanatory variable in a regression model, has been observed in the field of social network research [29].

Next, the authors describe how the spatial matrices were formed for the current purpose. First, when the distance between observed points  $s_i$  and  $s_j$  was less than 600 m, these two points were considered as spatially close and  $w_{ij} = 1$  was set. When the distance was greater than 600 m,  $w_{ij} = 0$  was used. The authors denote this weight matrix by  $W_1$ . This was used to express the correlation among error terms when two points were close spatially, while showing no correlation when they were spatially distant. For the second matrix, when the observed two points were located in the Dogo Onsen area, the authors considered that the two points were socially close and set  $w_{ij} = 0$ . Otherwise, the two points were considered not socially close and we set  $w_{ij} = 1$ . Then, the authors standardized the rows based on the sum of the weight matrix before row standardization. The authors denote this standardized matrix as  $W_2$ . This assumption was based on results of our interview with the Ryokan Association, which revealed that social relationships are closer in the Dogo Onsen area than in other areas in Matsuyama. Thus, the authors characterized the weight matrices such that the less close the social relationship was, the less autocorrelation there was among error terms. Whether autocorrelation of spatial and/or social relationships was observed or not is an empirical question, and the Moran's I obtained from the weight matrices can provide empirical answers.

#### 5.4. Estimation Models

Based on the consideration above, the authors set up three kinds of estimation models, as follows: the OLS model; SEM 1, which considered only the spatial relationship; and SEM 2, which considered both spatial and social relationships:

$$\text{The OLS model, } y = X\beta + u, u \sim N(0, \sigma^2 I) \quad (1)$$

$$\text{Spatial Error Model 1, } y = X\beta + u, u = \lambda W_1 u + \varepsilon, \varepsilon \sim N(0, \sigma^2 I), \quad (2)$$

Considers only spatial relationship; and Spatial Error Model 2I,

$$y = X\beta + u, u = \lambda W_2 u + \varepsilon, \varepsilon \sim N(0, \sigma^2 I), \quad (3)$$

Considers spatial and social relationships; where,  $y$  = price vector,  $X$  = vector of explanatory variables,  $\beta$  = vector of parameters,  $W_1$  = spatial weight matrix considering only spatial relationship,  $W_2$  = spatial weight matrix considering spatial and social relationships, and  $u, \varepsilon$  = error terms.

For the explained variable, the authors took the natural logarithm of prices of rooms (in consideration of the normality of the error term), available on 28 October 2015, from the least expensive price plan available at each accommodation facility. The explained variable was the same in all three models. The prices of accommodation facilities are influenced by external and internal factors ([30]). As external factors, the demand and supply situation in the market, state of competition, and environmental factors were considered; and, as internal factors, business goals, strategy, and managerial factors such as cost and technology were considered. In general, external factors work over the short term, while internal factors work over the long term ([31]). In this study, due to data constraints, the researchers considered facility- and service-related factors as internal factors and the spatial autocorrelation of the error term (which represents competition among accommodation facilities) as an external factor.

As explanatory variables—more specifically, regarding internal factors—the authors considered vertical- and horizontal-differentiation factors. The vertical variables considered were: first, the four-stage grade of the facility (four-stage grade), as the grade of a facility is tightly connected with room price ([32]) and it is quite normal that there is a positive correlation between price and the quality of the facility ([33]). Second, from a service perspective, a dinner-service dummy variable (yes = 1,

no = 0). Third, a breakfast-service dummy variable (yes = 1, no = 0). These were considered as meal service, especially dinner service, has been considered a crucial element of enjoyment for Japanese tourists. Thus, the availability of meal services was supposed as a component of vertical differentiation. Fourth, from a facilities perspective, size of rooms (m<sup>2</sup>). Fifth, a dummy variable on the availability of a hot springs bath facility (yes = 1, no = 0). These were considered as the size of a room is an easily observable indicator of vertical differentiation and a hot springs bath is one of the most crucial facilities for hot springs tourism.

The horizontal variables considered were a ryokan dummy variable (yes = 1, no = 0) and the number of rooms. The number of rooms was obtained from the summation of Japanese-style rooms, Japanese rooms to share by several people, rooms mixed with Japanese and western styles, and western-style rooms. Shared Japanese-style rooms used to be quite common for group tourists, such as groups of company employees or various club members, in the high economic period until the early 1970s. With respect to types of rooms, it is now not uncommon in famous hot springs areas that hotels have a certain number of Japanese-style rooms and that ryokans also have western-style rooms. As tourists stay in hotels or ryokans depending on their preferences, the ryokan dummy variable is to show a horizontal difference between ryokans and hotels. The number of Japanese-style rooms and that of shared, e.g., dormitory, rooms were used as size variables in different categories of accommodation.

In short, if these parameters are positive with statistical significance, the differentiation strategy is effective for raising the price under the spatial competitive and partnership conditions. If the model that considers social closeness demonstrates a good estimation result, the partnership strategy works.

## 6. Results and Discussion

The estimation results of the three models are shown in Table 3. Details of the estimation results are interpreted below. Parameters were all significant and stable among the three models. Results of the vertical factors, grades of the facility (1%), dinner dummy variable (1%), and size of rooms (1%) were all positive with statistical significance. As for horizontal parameters, the ryokan dummy variable (1% or 5%) was positive, and the number of Japanese style rooms (5% or 10%), and number of shared rooms (5%) were negative with statistical significance.

**Table 3.** Estimation results of OLS and spatial error models (SEM).

Attributes	Explained Variable Price (Log Transformed) Explanatory Variable	OLS Model (1)		SEM (2)		SEM (3)	
		Parameter		Parameter		Parameter	
Vertical attributes	Grade of accommodation facility	0.3944	***	0.4044	***	0.3941	***
	Dinner service dummy variable (yes=1, no=0)	0.2136	***	0.1984	***	0.2120	***
	Largeness of rooms (square meters)	0.0153	***	0.0155	***	0.0162	***
Horizontal attributes	Ryokan dummy variable (yes=1, no=0)	0.1670	**	0.1640	***	0.1787	***
	No. Japanese style rooms	−0.0015	*	−0.0015	**	−0.0014	*
	No. shared rooms	−0.0746	**	−0.0706	**	−0.0779	**
	Constant	8.1463	***	8.1279	***	8.1290	***
	Weight coefficient	−		$\lambda = -0.8565$	**	$\lambda = -4.2800$	***
	Moran's I	−		0.2827	***	0.2981	***
	Model fitness	F test	***	LR test	**	LR test	***
	Sample size	77		77		77	
	AIC	−89.421		−93.566		−96.163	

Source: Data obtained by authors. Note: \*\*\*, \*\*, \* mean 1%, 5% and 10% significance, respectively.

Now, let us interpret these parameters. Table 3 shows the final estimation results that used only variables with statistical significance. It was revealed that grades, dinner service and sizes of rooms worked positively toward vertical differentiation, while the number of hot spring bath facilities was not significant. A peculiar traditional local custom, whereby people leave houses and ryokans to take a public hot springs bath, may partially explain this result.

As for horizontal factors, the parameter of ryokan worked positively, while the number of Japanese-style rooms and shared rooms worked negatively. The result for the parameter of shared

rooms is reasonable, as it is an economical category of accommodation and is suitable for the changing tourism trend from groups to small units, such as couples, families, and a small number of friends. The reason why the number of Japanese-style rooms worked negatively was probably due to the labour-intensive service provided in small-sized ryokans and partly because some hotels have ryokan-style rooms, which has a favourable influence on prices. On the other hand, these small-sized accommodations are more likely to be less price-competitive with larger ryokans and hotels, which was in agreement with a previous study (Ohe and Peypoch [1]). This is also one reason why many small ryokans have gone out of business.

(1) OLS model:

There was no multicollinearity, no heteroscedasticity, and no non-normal distribution of error terms, which enabled us to use the parameters of the OLS estimation without bias (Table 3). The adjusted  $R$  square value was 0.95 and the AIC, which indicated fitness of the model, was  $-89.421$ .

(2) Spatial econometric models:

First, let us look at the result of a spatial economic error model which used  $W_1$ , wherein Moran's  $I$  was 0.2827 and a statistically significant spatial autocorrelation (1% significance) was observed. The hypothesis  $\lambda = 0$  was rejected by the log-likelihood test with 5% significance, which indicated that this spatial error model was not erroneous. As an indicator of goodness of model fit, the AIC of the model was  $-93.566$ .

Second, for the result of estimation by the spatial error model using  $W_2$ , the Moran's  $I$  was 0.2981 and spatial and social autocorrelation was observed with 1% significance. The hypothesis  $\lambda = 0$  was rejected by the log-likelihood test with 1% significance, which indicated that this spatial error model was not erroneous. The AIC of this model was  $-96.163$ , which was the best among the three models, followed by the  $W_1$  and OLS models.

To summarize, the vertical product differentiation strategy worked positively on the price, which suggests that a competitive situation exists in this area. On the other hand, we can say that the model which considered both spatial and social relationships performed the best, in terms of the AIC criterion. This means that spatial closeness makes price competition more intensive, while social closeness makes it less intensive. Put differently, these results imply that partnerships among operators exist under the competitive circumstances. Thus, the actual behaviour of operators is likely to contain these two strategies. This behaviour is illustrated as an optimal point (located on  $MR_1$  between  $e_1$  and  $e_2$  in Figure 2) and, at this optimal point, the operator's surplus will be larger than the initial point, due to the milder upward shift of  $MC$  than that of the differentiation strategy solely. Thus, it is rational for an operator to undertake this mixed strategy. It should be also be noted that this behaviour attains incentive compatibility between individual and community development.

In reality, this is one of the reasons behind the launching of the art event "Onsenart", and why it attained a certain level of success in this study area, where the local social capital has been nurtured in a long historical evolution. This human network with mutual trust is not possible to establish in a day or so. In this sense, local social capital is a crucial aspect of heritage of the local community.

Consequently, this empirical result supports our basic hypothesis that co-operation among stakeholders is a necessary condition for the revitalization of hot springs areas. This result is consistent with a previous study of successful hot springs areas [4]. Thus, it is safe to say that operators of hot springs areas must keep a balance of incentive compatibility between individual and local community issues. In this context, it is expected that a community-based approach should be explicitly considered as a component of policy design for the renovative development of hot springs areas.

## 7. Conclusions

In this study, the authors conceptually and empirically investigated, with consideration of spatial competitive and partnership strategies, how accommodation prices are determined by not only vertical and horizontal competitive factors, but also spatial and social closeness factors, by focusing on one of

the oldest hot springs resorts in Japan, the Dogo Onsen area. The main points clarified in this study are as follows.

First, the authors presented a conceptual framework to characterize the two strategies that influence accommodation prices by causing an upward shift in the marginal revenue (i.e., competitive differentiation and partnership strategies). The differentiation strategy needs substantial investment for the marginal cost to shift upward, while the partnership strategy requires the existence of local social capital, which does not entail a shift of marginal cost or only a minor shift, even if that shift occurs. Thus, although the differentiation strategy enables the operator to increase the price level, it does not always increase the operator's surplus. On the other hand, the partnership strategy can realize an increase in the operator's surplus with less investment cost by taking advantage of local social capital. This demonstrates rationality for ryokan operators to undertake the partnership strategy, if local social capital has been well established.

The empirical results indicate that factors of vertical differentiation, such as high-grade accommodation facilities, dinner service, and large rooms, have price-raising effects. This suggests that competitive circumstances exist in this area. At the same time, the empirical model considering social closeness, which represented the partnership strategy in addition to spatial closeness, showed better performance. Thus, it is considered that the partnership strategy has also been confirmed. Consequently, a mixed strategy must practically be undertaken. This is because, in the study area, many ryokans have lasted for generations; this has nurtured a local-based social network among the operators of these ryokans. This behaviour realizes an incentive-compatible situation between the operator's individual rationality to reduce their investment cost for facility differentiation and the rationality for local communal development.

Thus, our results suggest that, for the renovative development of hot springs areas, it is necessary to take not only price-competitive strategies, but also community-based approaches, into consideration; this will effectively increase the importance of the area. As a policy implication, promotion measures to nurture local networks and partnerships among operators will be effective, while keeping the competitive structure to attain both holding down the burden of investment for operators and the promotion of local tourism development.

This study had some limitations: First, it was based on the assumption that vertical attributes are identical among accommodation facilities. Nevertheless, the authors were not able to exclude the influence of vertical differentiation from spatial and social relationships in the model estimation. As a result, the authors cannot deny the possibility of over-evaluation of spatial and social relationships. This issue should be tested by other types of spatial econometric models in the future.

Second, this study focused only on the competitive price structure in a hot springs area, which is a very narrow topic among a wide range of topics related to hot springs promotion with a naive spatial econometric model. Thus, the scope of competitive relationships should be expanded to inter-regional competitive relationships, and wider partnerships with stakeholders in other local sectors under the circumstances of increases in inbound tourism should be investigated in the future. In this respect, more sophisticated spatial econometric models, such as a mixed-W model, should be tested [34].

Third, the effectiveness of a community-based approach in hot springs areas should be fully investigated with case study approaches. Therefore, the roles of partnerships among operators based on this social network should be further securitized toward the revitalization of hot springs areas. It is also worthwhile to investigate the role of such partnerships in clustered accommodation areas generally composed of small and medium-sized operators.

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