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Analysis of Hierarchical Competition Structure and Pricing Strategy in the Hotel Industry*

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Abstract

This study aims to investigate the effects of market commonality and resource similarity on price competition and the recursive consequences in the Korean lodging market. Price comparison among hotels in the same geographic market has been facilitated through the development of information technology, rendering little search cost of consumers. While the literature implies the heterogeneous price attack and response among hotels, a limited number of empirical researches focus on the asymmetric and recursive pattern in the competitive dynamics. This study empirically examines the price interactions in the Korean lodging market based on the theoretical framework of competitive price interactions and countervailing power. Demonstrating superiority to the spatial lag model and the ordinary least squares in the estimation, the results from spatial error model suggest that the hotels with longer operational history pose an asymmetric impact on the price of the newer hotels. The asymmetry is also found in chain hotels over the independent, further implying the possibility of predatory pricing. The findings of this study provide the evidence of a hierarchical structure in the price competition, with different countervailing power by the resources of the hotels. Theoretical and managerial implications are discussed, with suggestions for future study.

Keywords : Competitive Dynamics, Market Commonality, Resource Similarity, Price, Interaction, Spatial Econometrics

JEL Classification Code : D40, L11, L83, R10

1. Introduction

Strategic pricing is often considered a crucial component of a successful hotel operation. It is well-known that hotel managers face an ongoing but important problem of inventory management, that is, fixed upper limit in capacity with a perishable product (Weatherford & Bodily, 1992). Such nature of the hotel industry encourages managers to use price as a strategic lever to optimize hotel revenue in the short run. These price adjustments, also known as revenue management, has received favorable attention in the recent decade by the industry and academia alike. Revenue gains exceeding 5 percent had been suggested as the outcome of revenue management by relevant literature, while industry generally reports a 2 to 5 percent uplift in revenue attributable to this method (Jain & Bowman, 2004).

Without a good understanding of the market structure that encompasses the competitors' behavior, the industry's solution on strategic pricing can be quite far from optimal. This argument is derived from the observation that not only the revenue manager's decision, but also the competitors' decisions jointly constitute the optimality of a pricing strategy, and in turn, its success. In this vein, spatially-competing nature of hotels' room rates has become an increasingly important research topic in recent years (e.g., Lee & Jang, 2012a; Lee & Jang, 2013; Lee, 2015). Price comparison among accommodation options in the same

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geographic market has been dramatically facilitated through the internet-based online travel agencies (OTAs), travel review websites with booking/reservation services and meta-search engines rendering little to virtually no search cost of consumers (Lee, 2018; Nguyen, Jeong, & Chung, 2018).

Previous studies have attempted to offer insights into the hotels' competitive strategic interactions through prices. While they have jointly offered meaningful implications, an implicit assumption shared by most studies is that strategic price responses are symmetric among hotels. Put differently, the strategic interactions are considered non-recursive *a priori*. Though reasonable the foregoing assumption may seem, it nevertheless could be a difficult one to satisfy. For example, smaller hotels without ancillary facilities can suffer more from deep room rate discounts and therefore may not be able to match the market discount rate, while larger hotels tend to have diverse revenue streams from multiple revenue-generating departments (i.e., function space, meeting rooms, catering, restaurants, clubs, casinos). Thus, in the short run hotels with diverse revenue centers may allow room rates to be lower than the room's breakeven point, as long as the 'total' revenue from the guest is expected to cover the fixed costs. Such possibility price leadership and the consequent hierarchical structure has not been acknowledged by most empirical works, overlooking the recursive and hierarchical process of competitive pricing of hotels. This implies the existence of a theoretical gap, rendering limitation in the current understanding of strategic price reactions among hotels. Thus, investigating both recursive and non-recursive processes of strategic price competition among hotels can be considered critical in improving the understanding of the lodging market as a whole.

Therefore, the objectives of this study are 1) to deepen the understanding of competitive dynamics by examining strategic pricing interactions and the recursive hierarchy among hotels, and 2) to suggest a unique price response model using spatial econometric techniques. The current study adopts the theoretical framework of competitive price interactions suggested by Chen (1996). In Chen (1996), it is urged that firms strategically attack and respond in varying ways to competition based on their market commonality and resource similarity. He also asserts that competitive asymmetry, which leads to differences in interactive behaviors, is inevitable in the interfirm rivalry, as market commonality and resource similarity are different among rival firms, and so is countervailing power as a result (Guiltinan & Gundlach, 1996). On this theoretical foundation, the present study operationalizes market commonality of hotels on geographic boundaries (Lee & Jang, 2013; Lee, 2015), and resource similarity affecting countervailing power and thus hierarchical structure on relative sizes of the hotels, hotels' affiliation to international chain brands, and experience and/or tenure of the hotel in the market (Kim, Lee, & Roehl, 2018).

2. Theoretical Background

2.1. Competitive dynamics and countervailing power

Firms are interdependent within the boundary of a shared market, and the networks are correlated (Abrahamson & Fombrun, 1994). The border is expanded based on the distinctive features of firms and the market environment, such as suppliers and consumers. Based on the resource-based view (RBV), an organization can sustain competitive advantage for superior performance through clustering strategic resources (Grant, 1991; Peteraf, 1993; Wernerfelt, 1984). As resources themselves are not valued yet, capability how to optimally bundle and cluster available resources for the organization determines its competitive advantage (Grobler & Grubner, 2006). The market is the other significant dimension in the strategic capabilities. By jointly considering the two key dimensions of organizational competitiveness, Chen (1996) suggested market commonality and resource similarity as determinants of the firms' strategic action and response and thus triggering competitive dynamics. Market commonality refers to the degree of overlaps each firm has in its market, and resource similarity refers to the level of comparability of strategic resources each firm possesses. He asserted that the degree of market commonality and resource similarity are different among rival firms, resulting in competitive asymmetry in the interfirm rivalry. The competitive asymmetry is juxtaposed with unidentical interactive behaviors of the firms in the market. Such a notion corresponds to the concept of countervailing power. Sufficient countervailing power enables a firm to survive and competitively respond to an attack by competitors, whereas the absence of countervailing power leads the firm imperiled (Guiltinan & Gundlach, 1996). Pricing is a visible weapon reflecting the firms' strategic behavior. For instance, a below-cost price cut of a firm can make the rivals exit the market if the rivals do not have countervailing power enough to react to the aggressive and predatory pricing of the competitor.

2.2. Dynamic price interactions among hotels

Price competition of hotels has been examined in various contexts, including oligopolistic price competition (Chung, 2000), strategic price positioning (Baum & Haveman, 1997; Urtasun & Gutiérrez, 2006), competitive pricing (Enz, Canina, & van der Rest, 2015), cooperative pricing behavior (Baum & Mudambi, 1995; Gan & Hernandez, 2013), and spatial price competition (Lee, 2015). Spatial price competition herein is an evident competition driven from market commonality within the neighboring geographic boundary of hotel markets where multiple-point competition commonly occurs. Significance of spatial parameters from spatial models empirically supports the presence of competitive rivalry of hotels in a shared market (Lee & Jang, 2012a; Lee & Jang, 2013; Lee, 2015).

Table 1: Selected literature on hotel price competition

Researchers	Methods	Findings
Lee & Jang (2012a)	Spatial two-stage least squares	The centrality of the hotel location has premium in the high-demand season. Chain-affiliation, valet parking, and amenities are the factors of price premium regardless of seasonality.
Lee & Jang (2013)	Spatial two-stage least squares	Lower-quality hotels are pressured to discount deeper in the slow season than higher-quality hotels nearby.
Noone, Canina, & Enz (2013)	Multiple regressions	Hotels with higher room rates and lower price fluctuation show stronger revenue performance in the long run.
Lee (2015)	Spatial two-stage least squares	Price competition is localized in the shared market, and the geographic boundary of competition is extended among the competition of similar quality hotels.
Kim, Lee, & Roehl (2016)	Random effects spatial panel model	Price adjustment on hotel revenue affects positively in the following year but negatively when sequentially cumulated.
Kim, Lee, & Roehl (2018)	Fixed effects spatial panel model	Larger and newer hotels have an impact on their competitor prices, whereas the reverse relationship does not hold. Chain hotels cut less price than neighboring independent hotels.

An implicit assumption shared by the studies is that strategic price responses are symmetric among hotels. Gradually, the literature has begun to embrace the possibility of asymmetry in hotel competition, empirically manifesting the heterogeneous price interactions among hotels. Lee and Jang (2013) showed that the price competition is asymmetric among hotels in different quality, where lower-quality hotels provide more discount in the slow season. Lee (2015) suggested that the strategic price responses differ between low- and high-quality hotels, and found that price competition is more apparent among hotels of similar quality than among hotels of different quality. Yet, these studies have primarily focused on cross-competition (competition among hotels of similar and different quality). More recently, Kim et al. (2018) addressed asymmetric competition structure by using a U.S. lodging market data, considering the interactive process of competitive pricing of hotels. They demonstrated the size, chain-affiliation, and age of the hotel as the firm-specific attributes influencing competitive dynamics in pricing. They found that larger and newer hotels had an impact on their competitor prices, while the reverse relationship does not hold. The results can be applied to the context of countervailing power, where smaller and older hotels will inevitably follow the price leadership of larger and newer hotels (asymmetry in countervailing power). Market commonality lies in the homogeneity in a shared market, whereas resource similarity lies in the heterogeneity of each hotel. Accordingly, the following is addresses as our first research question:

RQ1. How do market commonality and resource similarity influence competitive dynamics in the hotel industry?

The recursive nature is more evidently captured by the comparison throughout a temporal span (Schwartz, Uysal, Webb, & Altin, 2016). Moreover, studies have purported that the effect of pricing strategies may be inconsistent within a different length of time. For instance, Noone, Canina, and Enz (2013) invested that the price changes for short-term revenue may impair the long-term performance in some hotels. Kim, Lee, and Roehl (2016) showed that the effect of price changes of the studied hotels is asymmetric between the short-run and the long-run. Price adjustment on hotel revenue was positively affected in the following year but negatively affected when sequentially cumulated. These results imply that hotel pricing decision should be differentiated from the tactical, short-run to the strategic, long-run. In order to robustly examine the recursive nature of price interaction, the current study traces hierarchical structures in hotel pricing for tactical (short-run) and strategic (long-run) level, respectively. Therefore, the second research question is stated as below:

RQ2. Is a hierarchical competition structure found in pricing strategy among hotels? Is it different from tactical (short-run) to strategic (long-run) level?

3. Methodology

3.1. Model and variables

Two dependent variables are constructed from collected data in order to investigate the pricing strategy of hotels. The short-term tactical pricing and long-run strategic prices are calculated as follows:

$$TP_{i,t} = Pe_{i,t} - Pl_{i,t} \quad (1)$$

$$SP_{i,t} = Pe_{i,t} - Pl_{i,t} \quad (2)$$

where TP refers to the tactical short-run price change of the hotel and SP refers to the strategic long-run price change of the hotel. Pe is the effective (transaction) price of the hotel, which Pl refers to the list price of the hotel. *i* (i=1,2,3,…,N) and t (t=1,2,3,...,T) are hotel (property) and time (day) subscripts.

The nature of the research question regarding market commonality resource similarity also requires the identification and estimation of recursive effects among the pricing strategies of hotels. To capture such effects, six types of competitors to each hotel *i* were defined: (a) competitors that have more guest rooms than hotel *i*, (b) competitors that have fewer guest rooms than hotel *i*, (c) chain-affiliated competitors of hotel *i* (when *i* is an independent hotel), (d) independent competitors of hotel *i* (when *i* is a chain hotel), (e) competitors that started operation before hotel *i*, and (f) competitors that started operation after hotel *i*.

To operationalize these six types of competitors in a data setting, a total of six NT-by-NT operator matrices were created: R1, R2, C1, C2, A1, and A2. The elements of operator matrices are defined in the equations (3)-(8) below:

R1(NTxNT) : $r1_{ij} \neq 0$ if hotel *j* has more rooms than hotel *i* (3)

R2(NTxNT) : $r2_{ij} \neq 0$ if hotel *j* has fewer rooms than hotel *i* (4)

C1(NTxNT) : $c1_{ij} \neq 0$ if hotel *j* is chain and hotel *i* is independent (5)

C2(NTxNT) : $c2_{ij} \neq 0$ if hotel *j* is independent and hotel *i* is chain (6)

A1(NTxNT) : $a1_{ij} \neq 0$ if hotel *j* started operation before hotel *i* (7)

A2(NTxNT) : $a2_{ij} \neq 0$ if hotel *j* started operation after hotel *i* (8)

where *i* and *j* denote the i^{th} column and the j^{th} row of the respective matrices. Hotel *j* is one of hotel *i*'s competitors, where hotel *i* has at least one *j* and *j*=1,2,3,…N. Since hotels cannot be their own competitors nor of hotels at a different time period, all operator matrices are defined as zeros on the diagonal elements (*i*nt=*j*nt) and also on all off-diagonals where t(*i*)≠t(*j*). It is noteworthy that any implications about room rates of other hotels are likely to weaken beyond certain geographic boundaries; therefore, the current study only considers hotel *j*'s located within a certain radius of hotel *i* (e.g., Lee & Jang, 2013). This requires all operator matrices to have nonzero elements of r1(*i*,*j*)~a2(*i*,*j*) only when hotel *i* and hotel *j* are within a certain distance range of each other, or take the value of zero otherwise. (see Figure 1 for illustration of the connectivity scheme).

The element weight for neighbor *j* has been calculated as $1/d_{ij}$, where d_{ij} is the distance between hotels *i* and *j* in kilometers. This is to ensure that the strength of market commonality decreases as the distance between the two hotels increases. The weights will be scaled by the total number of neighbors (hotel *j*'s) so that the rows of the operator matrices sum to one (Getis, 2010). As the objective of this study is to examine strategic pricing interactions among hotels, strategic price variables using the six operator matrices were generated by pre-multiplying each of operator matrix into the two price vectors (1) and (2). With this setup, the product of operator matrices and the price vectors are the distance-weighted average of competing neighbors' price changes. Therefore, when the estimated parameters are significant, it would imply the competition effect of strategic prices. Furthermore, when they are asymmetrically significant, empirical evidence for a recursive hierarchical competitive impact is obtained.

Since the hotels are spatially agglomerated with varying degrees, it was assumed that there would be the effect of autocorrelation in spatial residual despite the independent variables were not spatially interdependent from the first order, a case where the SEM (spatial error model) would appropriate to address the issues (Anselin, 1988; Kim, 2018). In order to test the superiority to competing models, we compared analytic results from three models: the ordinary least squares (OLS), the spatial lag model (SLM), and the spatial error model (SEM). Since the OLS assumes the independence among independent variables and the residual, the OLS estimator under spatial autocorrelation is considered biased. Thus the OLS estimators are estimators by not considering spatial autocorrelation (i.e., market commonality). The SLM is applied directly with spatially lagged dependent variables in the first order. The specifications of the three models can be expressed as follows:

OLS

$$Y = \alpha_1 + \beta_1 R_1 P + \beta_2 R_2 P + \beta_3 C1P + \beta_4 C2P + \beta_5 A1P + \beta_6 A2P + \Sigma\beta_7 X + \varepsilon \text{ (i.i.d.)} \quad (9)$$

SLM

$$Y = \alpha_2 + \rho W Y + \gamma_1 R_1 P + \gamma_2 R_2 P + \gamma_3 C1P + \gamma_4 C2P + \gamma_5 A1P + \gamma_6 A2P + \Sigma\gamma_7 X + \varepsilon \text{ (i.i.d.)} \quad (10)$$

SEM

$$Y = \alpha_3 + \theta_1 R_1 P + \theta_2 R_2 P + \theta_3 C1P + \theta_4 C2P + \theta_5 A1P + \theta_6 A2P + \Sigma\theta_7 X + \varepsilon \text{ (spatially interdependent error terms)} \quad (11)$$

$$\varepsilon = \lambda W \varepsilon + v \quad (12)$$

X is the matrix of control variables generated from data collected from the OTA website using a crawling technique, and the associated coefficients (β_7, γ_7, θ_7) are to be estimated on the control variables. Because of the potential spatial dependence inherent in any type of spatial data, the error terms are expected to be nonrandom. In the SLM thus, the spatial correlation was corrected using a spatial weighting matrix *W*. *W* is an NT-by-NT matrix defining the connectivity between hotel *i* and its neighbors (hotel *j*'s). The elements of *W* are zeros on diagonal and nonzeros on off-diagonal where the i^{th} row and j^{th} column denote the respective hotels in the sample. Following the above approach, w_{ij} takes a nonzero value when hotels *i* and *j* are within certain distance range from one another (share of market commonality), and the weights are calculated as the inverses of distances. After controlling for the spatial dependence, the residual in the SLM is assumed to be independently and identically distributed (i.i.d.) with means of zero (Anselin, 1988). A significant ρ or λ —spatial autocorrelation parameter—is indicative of spatial correlation in room rates among contiguous hotels by virtue of the market commonality.

3.2. Sample and data

The data was scrawled from Agoda.com, where information on price and other control variables were derived. The analyzed time reference for the price is September 2018, collected between 1st and 30th. The numbers of the data collected were 145,006 from 659 hotels in Korea for the whole month and 36,454 from 657 hotels in Korea for one week. A total of 545 hotels were analyzed as the final samples, in which no omitted information on the variables interested in this study.

The dependent variable for this study is the price of each hotel. For the long-run strategic price, the whole month data was utilized, while the data of the last one week (Monday to Friday) was used for the short-run tactical price. In order to minimize variances attributed to weekly seasonality, weekend prices were excluded in calculating the tactical price. The relatively short period of analysis could reduce the risk of bias from external influences on hotels' pricing decision, which could have been affected by unobservable time-specific factors (Schwartz et al., 2016).

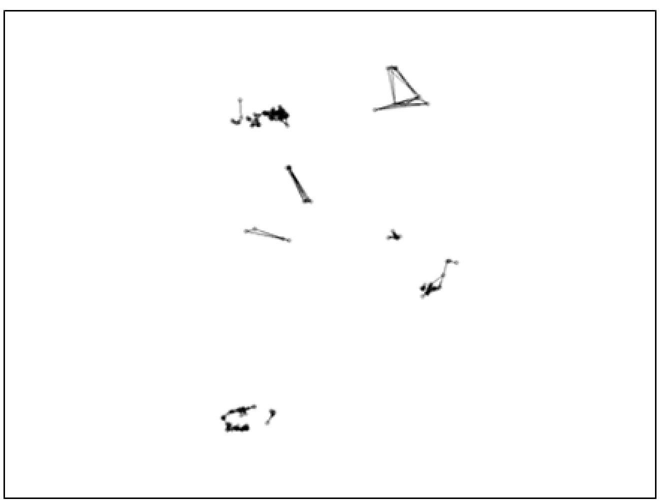

Figure 1: Connectivity Scheme of the Sample Hotels

For the first step to investigate the neighborhood boundaries among the hotels, the competitor set in the neighborhood was determined. The spatial connectivity for this study was set based on the *k*-nearest neighbors (Pinkse & Slade, 1998) considering the density and the geographic characteristics of Korea and the hotel market. Figure 1 is the geographic plots of the hotels with geographic information (longitude and latitude), and Figure 2 is the connectivity scheme drawn. The spatial weighting matrix *W* was constructed based on the connectivity with *k*=5. Competitor operator matrices were created accordingly, based on the number of rooms, affiliation type, and the operation history of the hotel. Information of room types and features was collected and dummy-coded into 11 control variables (standard, deluxe, suite, superior, dormitory, family, single, triple, double, twin, and king).

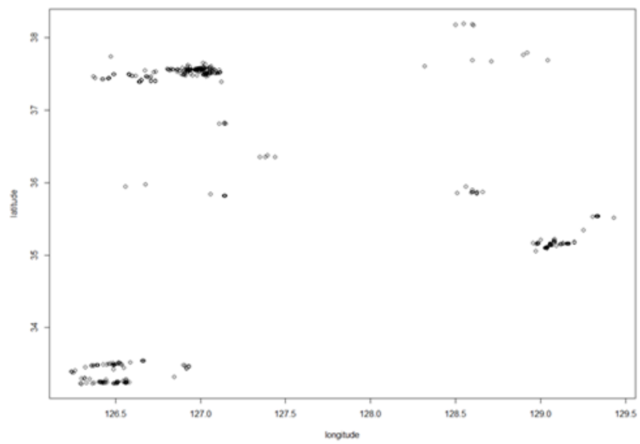

Figure 2: Locational Distribution of the Sample Hotels

4. Findings and Discussion

The equations, (9) for the OLS, (10) for the SLM, and (11) and (12) for the SEM, were respectively used to estimate the parameters in their tactical and strategic price. Table 2 presents the parameter estimates and the significance levels estimated from the OLS, the SLM, and the SEM for the tactical, short-term price effect. In order to evaluate the fit and the relative superiority of the models in response to the research questions, R-squared, Akaike Information Criterion (AIC), and Bayesian information criterion (BIC) were figured out (Burnham & Anderson, 2004). The highest R^2 and the lowest AIC and BIC, the SEM shows the superiority among the models with λ= .548 at z< .001.

Table 2: Estimated Results of the Models on Short-run Tactical Price

	Short-run					
Model	Model 1 OLS		Model 3 SAR		Model 3 SEM	
Variables	Coefficient	*t*-value	Coefficient	*z*-value	Coefficient	*z*-value
(Intercept)	-36.892	-1.463	-36.975	-1.469	4.632	0.215
r1tp	0.135*	2.078	0.137*	2.132	0.263***	4.551
r2tp	0.502***	3.847	0.505***	3.919	0.603***	5.219
c1tp	0.742***	4.143	0.743***	4.212	0.546***	3.520
c2tp	0.005	0.078	0.005	0.084	-0.083	-1.767
a1tp	0.199	1.715	0.200	1.752	0.317**	3.094
a2tp	-0.220**	-2.670	-0.219***	-2.699	0.007	0.085
standard	-17.563	-0.880	-17.570	-0.895	-15.985	-0.891
deluxe	-14.459	-0.637	-14.464	-0.648	-14.078	-0.694
suite	-158.934**	-2.807	-158.906**	-2.853	-122.259*	-2.433
superior	-23.416	-0.761	-23.406	-0.774	-16.988	-0.611
dorm	50.114	1.086	50.127	1.104	25.155	0.595
family	23.226	0.422	23.196	0.428	-10.850	-0.220
single	41.972	1.288	41.997	1.311	30.229	1.052
triple	-22.854	-0.281	-22.769	-0.284	-28.833	-0.389
double	2.021	0.090	2.076	0.094	5.778	0.278
twin	-26.594	-1.136	-26.559	-1.154	-23.163	-1.096
king	20.733	0.483	20.653	0.490	10.002	0.262
ρ			-0.006	-0.105		
λ					0.548***	-6.868
R^2	0.133		0.133		0.230	
Log-likelihood	-3578.884		-3578.882		-3567.864	
AIC	7195.769		7197.763		7175.728	
BIC	7277.483		7283.779		7261.744	

***p<0.001; **p<0.01; *p<0.05

Given the use of the SEM in improving estimating performance superior to the other models and the significance of the spatial parameter (λ), it is suggested that there is second-order spatial dependence in the tactical and strategic price competition among spatially neighboring hotels. More specifically interpreting the result from the SEM on tactical price, the parameters of both r1tp and r2tp were positive and statistically significant at z< .001, indicating the effect of price interaction in the same direction among neighboring hotels regardless of the number of rooms. On the other hand, the hierarchical price competition between chain hotels and independent hotels is evidenced. The coefficient of c1tp was positive and significant at z< .001 while c2tp was not, implying there is a hierarchical structure in the price competition between the chain-affiliated and the independent hotels in a short run. The asymmetries suggest that an independent hotel i is influenced by a chain-affiliated hotel j, while the reverse relationship does not hold. Likewise, hierarchical price competition was evidenced in the operation history with the positive coefficient a1tp with z< .01 while the coefficient a2tp was insignificant. The asymmetries indicate that older neighboring hotels affect the price of newer hotels, whereas the newer hotels have no significant impact on the pricing of the older hotels. This result is inconsistent with Kim et al. (2018), where newer hotels have shown pricing impact on older hotels while the reverse does not hold. The possible explanation is found in the differences between the context of US and Korean hotel market (e.g., Lee & Jang, 2012b). In Korea, property and interior remodeling in the hotel industry is periodically followed by changes in trends where the ebbs and flows are frequent, and thus the operational history is not necessarily the indicator of older facilities. Rather, longer operation history allows time for building reputation and reliability about the hotel to the consumers. For this reason, it is assumed that longer operational history increases countervailing power over the hotels with a shorter history.

Among the control variables, only the suite showed a significant impact on the price at z< .05. The negativity of the coefficient relates to the difference between the effective price and the list price, in the way the list price is significantly higher than the transaction price. It can be interpreted that the high price of the suite is often heavily discounted as a way of revenue management by hotels maximizing the occupancy and thus optimizing the profit.

Table 3 shows the coefficients and the t and z-values from three models for the strategic, long-term price effect. Analogous to the tactical, short-term estimations of the models, the SEM yielded the highest R^2 and the lowest AIC and BIC, supporting the superiority to the counterparts, with λ= .519 with z< .001.

Same as a result of the short-term, the parameters of both r1tp and r2tp were positive and statistically significant at z< .001. This finding supports the existence of interactive spatial price competition among various sizes of the neighboring hotels both for short-term and long-term. Notably, there has been a change in the significance of the coefficient c2tp, which was insignificant in the short-run analysis. While the coefficient c1tp has been remained as positive and significant at $z< .001$, the coefficient c2tp came to be negative and statistically significant at $z< .01$. These parameters can be again interpreted in the asymmetric price response to the competitors, conditional on the management type of the hotel. If hotel *i* is independent, its price strategy is in accordance with the upward or downward direction of the neighboring chain-affiliated hotels of the area in the long run. However, if hotel *i* is a chain-affiliated hotel, its price does not follow the price cut of independent competitors, as their demands do not suffer from the lower price of the independent. Therefore, it can be said that chain hotels have higher countervailing power over the price discount strategy of the independent competitors, and may practice predatory pricing when the independent increases their rates.

Table 3: Estimated Results of the Models on Long-run Strategic Price

	Long-run					
Model	Model 1 OLS		Model 3 SAR		Model 3 SEM	
Variables	Coefficient	*t*-value	Coefficient	*z*-value	Coefficient	*z*-value
(Intercept)	-60.576***	-4.385	-60.474***	-4.256	-27.335*	-2.362
r1tp	0.134*	2.456	0.134*	2.476	0.255***	5.160
r2tp	0.389***	4.891	0.388***	4.934	0.517***	7.420
c1tp	0.592***	5.493	0.591***	5.561	0.488***	5.332
c2tp	-0.032	-0.629	-0.032	-0.641	-0.102**	-2.717
a1tp	0.081	1.215	0.080	1.224	0.196**	3.260
a2tp	-0.100	-1.652	-0.101	-1.691	0.035	0.638
standard	-5.931	-0.547	-5.944	-0.557	-1.437	-0.152
deluxe	-5.694	-0.455	-5.700	-0.463	-4.873	-0.432
suite	-70.430**	-2.602	-70.457**	-2.646	-50.793*	-2.087
superior	-23.720	-1.416	-23.733	-1.441	-16.026	-1.091
dorm	68.302*	2.543	68.285**	2.584	49.262*	1.991
family	-0.022	-0.001	-0.063	-0.003	-0.443	-0.022
single	43.082*	2.252	43.042*	2.288	43.762*	2.572
triple	12.236	0.246	12.177	0.249	19.737	0.438
double	5.013	0.424	4.977	0.428	7.903	0.726
twin	-9.606	-0.813	-9.643	0.830	-5.037	-0.472
king	31.322	1.325	31.408	1.351	11.076	0.530
ρ			0.004	0.071		
λ					0.519***	-9.433
R^2	0.216		0.216		0.306	
Log-likelihood	-3256.185		-3256.184		-3242.291	
AIC	6550.4		6552.4		6524.4	
BIC	6632.1		6638.4		6610.6	

***p<0.001; **p<0.01; *p<0.05

The hierarchical price competition was found consistent with the tactical pricing, with the coefficient a1tp positive and significant with $z< .01$ while the coefficient a2tp was insignificant. The asymmetries keep supporting the findings that the pricing practice of older hotels affects the price of newer hotels, whereas newer hotels have no significant impact on the price of older hotels.

Among the control variables, suite (-50.793), dorm (49.262), and single (43.762) yielded statistically significant coefficients at $z< .05$. These results show the tendency of price discount of suite room, a room type which is priced much higher than non-suite rooms, and the positive coefficients of the other two indicate the tendency of significantly lower discount imposed to the dorm and single type of room. This can be explained that since they are generally the cheapest type of rooms in a hotel, their discount rates are relatively lower than those of other types. Given the coefficients from both results, the shift from the short-run price to the long-run price does not seem to change the effect sizes and the directions dramatically.

5. Conclusion

Hotels and hospitality firms can maximize profits and optimize prices through revenue management and strategic pricing. There should be key external factors considered when approaching the strategic pricing: consumer demand and competitors in the market. While studies on the consumer response to price have been amplified, competitor reaction in strategic pricing has been paid less attention from the research domain. Bridging this gap, the current study investigates the effects of market commonality and resource similarity on price competition and the recursive consequences in the Korean lodging market. This study empirically examined the evidence of a hierarchical structure which is not always homogeneous in responding to the competitor price. We compared two spatial models and a linear model, the estimators from the OLS, the SLM, and the SEM, as a treatment for the autocorrelation issue in estimating spatially interdependent properties. Supporting the notion that the errors are spatially but unsystematically autocorrelated, the SEM showed the superiority in effectively estimating price competition of neighboring hotels in Korea. Among the three competitor types, operation history was found to have an asymmetric impact in both short-run and long-run, by implying higher countervailing power of the hotels with longer operational history within the area. Management type showed that chain-affiliated hotels have higher countervailing power than the independent. It was found that chain hotels are insignificantly affected by the pricing of independent hotels tactically, and even use predatory pricing over the independent. The number of rooms was not attributed to the asymmetry of price interaction. The findings of this study provide the evidence of a hierarchical structure in the price competition, with different countervailing power by the resources of the hotels.

This study contributes to the domain of knowledge on lodging management, where relevant empirical attempts are rather scarce. First, the use of the theoretical framework of market-resource integration and countervailing power deepens the understanding of hotels' strategic price reactions. Though spatial interdependence of hotel competition is intuitive and has evidently witnessed in the previous studies, the introduction of the concept market commonalty strengthens the theoretical support on the dynamic price competition in the hotel industry where multiple-point competition is prevalent. The resource and strategy concept provides fitted theoretical ground on the firm-specific characteristics inducing heterogeneity and asymmetric rivalry, practically executed by quality differentiation. Second, the spatial econometrics models have enabled to empirically answer the theoretically driven research questions. Furthermore, the use of the objective measures of proximity from geographic data and of firm-specific characteristics from the reputable OTA website has smoothly linked the theory and the practice out of subjectivity.

The findings of this study also provide managerial implications. First, it deepens the understanding of competitive market interaction in the context of hotel pricing and Korean hotel market. The spatial competition and the strategies are considerably varied by the contingent context and conditions, a tailored investigation based on the informed judgment should be applied to better understand the situated market. While extant literature argues that price reactions of hotels are determined by their relative product quality, the current study focuses on how other firm-specific characteristics such as relative size, chain-affiliation, and operational history, influence the directions and magnitudes of strategic interactions among hotel prices in the recursive process. Second, the research outcome of the current study can be used to enhance the analytic capacity of revenue managers and industry researchers to improve precision in business decision-making. For practitioners, a lack of complete understanding of market pricing behaviors will result in the construction of suboptimal pricing strategies. To scholars and researchers, the question on the competitive structure of the market has been a longstanding one in need of additional empirical evidence, despite the lack of published works in the context of the lodging industry.

It should be noted this study is subject to some limitations. First, for distinguishing tactical and strategic pricing, one-week and four-week data were utilized, respectively. Although one week and four weeks periodically distinct, both are relatively short from a long-term perspective. Use of a longer span of data in the future studies may detect further idiosyncratic patterns in the price interactions. Furthermore, the findings of this study could be extended by future studies challenging different types of data not limited to the cross-sectional. Second, the firm-specific resource has been operationalized into hotel size, chain-affiliation, and operation history, derived from Kim et al. (2018); however, there could be many variables affecting the competitive heterogeneity of hotels. Efforts should be kept finding further attributes influencing competitive asymmetry and hierarchy in the hotel industry.

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