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# Increasing cognitive proximity investments in spatial tourism duopoly

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**As distance is often one of the main factors in a tourist's decision to visit a given location, tourism companies often attempt to lower the impact of geographic distance through promotion and related efforts. The focus of this paper is on the business strategy of tourism companies in a competitive market. We examine methods to shorten geographic distance and cognitive distance within a homogenous market consisting of two competing tourism companies. Specifically, we first deal with the question of how to shorten the cognitive distance between a tourism company and its potential tourists' psychological status. We then address the impact of geographic distance on the tourist's choice of travel destination. Through an endogenous business strategy, we discuss the differentiation strategies under the three-stage game process, acquiring a better understanding of the relationship between proximity investment sizes and pricing. The results show that spill-over effect is the decisive factor in a tourism company's investment decision. We also find that non-cooperation is a better strategy for a tourism company in a competitive market.**

**Key words:** Friction of distance, cognitive proximity, three-stage game, spill-over effect.

## INTRODUCTION

A primary issue for the management and development of tourism companies is the question of how to attract tourists. From the perspective of business management, investment is important to future enterprise development. Based on this reasoning, we are of the view that tourism companies should establish strategies and objectives to better attract tourists. In this paper, we define the business strategies made by tourism companies as to decide how much differentiation in the features of products compared with their competitors. With taking spill-over effect into account, we deal with the issue of how to increase the cognitive proximity between tourism companies and their potential tourists' psychological status that would exert an influence of reducing the impact of the effect of friction of geographic distance on the tourists' determinants in tourism destination choice.

In contrast with reviews in the fields of spatial economic analyses and leisure/tourism, this paper will modify the tourist's linear cost of transportation according to the effect of friction of distance. It presents the relations between the tourist's utility function and geographic

distance based on the tourist's perception of distance. In this paper, we build a three-stage game context where there exist differences between the two business strategies endorsed by two tourism companies. We consider increasing proximity size by investment effort with a view toward closing the cognitive gap between potential tourists and the tourism companies, thereby improving the sense of distance and engaging value competition. We then seek to contribute to tourism with respect to broadening promotion and investment perspectives as well as tourism companies' efforts to boost the effectiveness of their operating resources.

## LITERATURE REVIEW

### Cognitive proximity and the demand of tourism

There are many relevant investment approaches worthy of consideration. One major approach to attracting tourists and capitalizing on investments is to minimize the

cognitive gap between tourism companies and their potential tourists and then to increase their interaction. From the tourist's perspective, there exists an inverse relationship between one's willingness to visit a scenic spot and the geographic distance from his location to the destination. Basically, to shorten cognitive distance is to boost the degree of interaction so that there will be more tourists attracted into the tourism destination. With respect to relationship between cognition and tourism demand, Wu (2002) did a research on tourists attending Shovel-mouth-fish festival in the Ali Mountains, Central Taiwan. Wu's findings was that most tourists took a positive view toward this tourist event, Wu's held that to increase proximity would strengthen interaction in a positive manner. Those economic benefits, as Wu argued, included more job opportunity in the tribes, triggering sightseeing enterprises, and greater popularity enjoyed by the tribes. Indeed, with the government's effort to boost the local culture industry in the Ali Mountains by holding these eventful activities, the Taiwanese people have the opportunity to know the tribe deeper and are more willing to visit the tribal areas in the mountains. When the tourists are booming, the benefits as a consequence are shared by the local tourism companies. Liu (2002) when studying the cognition and need of Taiwanese people in playing golf, classified the need of people's having vacation into four elements including multiple amusements, added value service, cosmopolitan tours and professional counseling. After reporting that tourists' purpose of playing golf could be one or several elements combined as mentioned earlier, Liu argued that the higher degree of clienteles' identification of the golf sport, the more importance attached to the need for golf as a leisure sport. This is another positivist case to illustrate a relationship between identification/cognition and leisure need. In this paper, we will combine the cognitive/psychological factor with the geographical/physical factor and carry out a game-theory-based quantitative analysis that seeks to improve our understanding of tourism companies' management strategies and the relationship between investment and pricing.

### **Cognitive proximity and the spill-over effect of knowledge**

In the developing process of economic activities, two groups of people often have interaction with their personnel, materials, information and knowledge, especially if geographic proximity is allowed. This being said, frequency of interaction and its related effects, are subject to geographic distance. In an economic geographic area, co-located economic interests are an issue that cannot be underestimated. If geographic proximity, as a factor, proves insignificant in a detached context, it is argued that we can observe other proximity factors that contribute to communication, coordination and cooperation. Using the other proximity factors, we may

explore the knowledge-based spill-over effect on interaction, learning and initiative processes (Amin and Wilkinson, 1999; Boschma, 2005). Gertler (2003) called the effect of geographic proximity as "De-territorialisation of closeness." Using an umbrella as metaphor, Torre and Gilly (2000) defined the scope of "proximity" by including geography, cognition, organization and institutions.

A review of the literature on the economic utility of proximity shows that neo-classical economists consider knowledge to be a public asset within the economic system. Based on rationality, all actors in the economic system realize that it is impossible to attain an optimal choice with the maximum utilities (Simon, 1955). To reduce uncertainties, firms are often seen to build institutions. Among such institutionalizing efforts, one of the better approaches is to rationally seek closer proximity. These efforts reflect a cumulative, local and silent process to develop initiatives when a firm's unique competitiveness becomes mature. Cohen and Levinthal (1990), however, hold a different view. They believe that low-key effort and uniqueness are not sufficient to be considered valid in constituting knowledge. To transfer valid knowledge, as they argued, we need the ability to absorb and interpret knowledge so that new knowledge can be further developed. To put strategy into practice, Boschma (2005) argued that strengthening cognitive proximity helps interaction but this has to be kept within bounds. Too much cognitive proximity will be detrimental to learning and interaction, increases the likelihood of closure to the outside world and naturally causes a spill-over effect on competitors. We, consequently, need to properly manage the proximity factor without causing further harm.

Under the hypothesis of the externality of knowledge, Audretsch and Feldman (1996) explored the geographic dispersion of economic activities. A further analysis of collected data shows that the geographic amassing of tourism companies is caused by a spill-over effect from research activities such as R and D, academic effort, and related knowledge concerning technical labor. Most of literatures reflect the positive effects of knowledge-based spill-over on developing initiatives and economic growth. However, the question here is whether there are additional kinds of spill-over effects other than those that are knowledge-based. Stel and Nieuwenhuijsen (2004) have elaborated quite expansively on internet-based spill-over effects and marketing-based spill-over effects. To broaden the scope of their case studies, we consider spill-over effects due to cognitive proximity and investment effort. We also believe that our investigation is a worthwhile academic inquiry.

### **Quantitative models of spill-over effect**

It was found that, if a high-tech industry chooses a factory location that is proximate to another, it will boost its contact of talents, manufacturing skills and the R and D

information shared across firms, which, in turn, will increase benefits and decrease costs. Lang (2005) using the New Growth Theory and the Evolution Theory, validated this causal link. Another interesting point that concerns us is the following: how are those spill-over effects integrated into a quantitative analytic model? A review of literature from an economic point of view can be illustrated as described further.

Poyago-Theotoky (1995) observed that high-tech firms, when in an oligopoly, will keep their investment sizes smaller than optimal. In other words, they are not strongly motivated to invest in R and D, as the spill-over effects occur exogenously. From a strategic viewpoint, we ask what the impacts on firms' development strategy are if we control the volume of the spill-over effects. Further research by Piga and Poyago-Theotoky (2004), who took information exchange volumes as a variable and explored the optimal scale of spill-over effects, showed that under non-cooperation conditions, the index of the optimal spill-over effects approached zero as a result of fearing others' free-riding.

Another research done by Piga and Poyago-Theotoky (2005), designed a three-stage game and explored how firms decided the locating place. While admitting quality gap between products, Piga and Poyago-Theotoky argued that in duopoly, competitors would benefit as a result of a firm's proactive effort of improving products' quality, whereas the benefits reaped by the competitors depended on the distance. Piga and Poyago-Theotoky also reported that the volume of R and D investment would rise proportionately with the increase of gap between products' quality. Molto et al. (2005) touched upon decision-making in R and D cooperation using a three-stage game context in duopoly. Compared with those effort devoted to maximum social welfare, these similar acts would also lead to a smaller technical gap. Breton et al. (2004) developed a dynamic and infinite model based upon duopoly differential game to observe the spill-over effects of know-how and skills with a finding that situation like this would lead to quantitatively less products and qualitatively less complementary among the products. Breton et al. therefore, suggested that competition had to be price-oriented as the quantity-oriented competition, they argued, suited for the condition when there are more products in the market and these products are complementary. Firms need to present a positive impression on the potential customers' understanding through efforts to provide information with respect to business content. One possible approach is to strengthen cognitive proximity, thereby initiating a process of pass information, social learning and interaction. Bearing in mind this characteristic factor, we first clarify the need to strengthen interactions between the tourism companies and their potential tourists through proper investment effort. We then address the question of whether the accompanied spill-over effects will hinder the investment motivation and whether or not this will impact tourism companies' overall management strategy.

## THE MODEL

To explore how the tourism companies compete in the domestic market, we first integrate the effect of friction of distance as well as tourists' cognition about the features of the products developed by tourism companies and construct a theoretical model concerning the interactions between the two competitors when they make investment and pricing decisions.

Consider a domestic tourism market comprising two tourism companies. Suppose the market is shaped like a line segment from 0 to 1 and that tourists are distributed evenly on it with the density of 1, the tourism companies  $i, i \in \{A, B\}$  lie on both ends of the segment, respectively. First of all, we suppose that tourism companies  $i, i \in \{A, B\}$  have to create their own business tactics  $M_i$ , which could be marked on the line segment  $[0,1]$ .  $\delta = |M_i - M_j|$ ,  $i, j \in \{A, B\}, i \neq j$ , represents the degree of featured products differentiation. Based on its business strategy, the tourism company  $i$  then determines to invest in increasing the quantity  $z_i$  of cognitive proximity between it and its potential tourists. For reasons of convenience, we set the unit investment cost to 1. Then, we follow the assumptions made by Molto et al. (2005). Suppose that the business strategy differentiation between tourism companies is the decision variable. Thus, the spill-over effect will be endogenous. Because of the spill-over effect, the size of the cognitive proximity between tourism company  $j$  and its potential tourists increases as a result of the other tourism company's investment effort; that is  $x_i = z_i + \alpha(\delta)z_j$ .  $x_i$  represents the essential quantity of cognitive proximity after taking the spill-over effect into account. Furthermore, we establish a spill-over effect function  $\alpha(\delta) = (1 - \delta)s$ .  $s \in (0,1]$  is the maximum potential influence by the other tourism company's cognitive proximity investment. It implies that the larger the differences between the business tactics made by the two tourism companies, the less the spill-over effects. Besides the decision-making mentioned above, pricing should be considered when the tourism companies compete in the market. Let  $p_i$  be the price of tourism company  $i$ .

Second, when a tourist travels to a tourism destination, he can obtain the utility  $\beta > 0$ . Let  $t$  be the unit transportation cost. In addition, as stated in Boschma (2005), it is easier to encourage interactions when the cognitive proximity is higher. That means that more tourists are willing to travel to this location, and, of course, it benefits the tourism companies. But too much proximity will induce a lock-in effect which is harmful to interaction. The utility functions are given by:

$$u_A = \beta - p_A - \theta ty^2 + \gamma x_A(1 - x_A) \quad (1)$$

$$u_B = \beta - p_B - \theta t(1 - y)^2 + \gamma x_B(1 - x_B) \tag{2}$$

In this market, there exists a point  $y_0$  such that there is no difference in the value of the utility.

$$y_0 = \frac{1}{2} - \frac{1}{2t\theta}(p_A - p_B + \gamma(x_B(1 - x_B) - x_A(1 - x_A))) \tag{3}$$

Then we construct tourism companys' profit functions as follows:

$$\begin{aligned} \pi_A &= \int_0^{y_0} (p_A - ty) dy - \frac{1}{2} \phi z_A^2 \\ &= \left(\frac{1}{2} - \frac{1}{2t\theta}\right) \left(p_A - \frac{t}{2} \left(\frac{1}{2} - \frac{1}{2t\theta}(p_A - p_B + \gamma(x_B(1 - x_B) - x_A(1 - x_A)))\right)\right) - \frac{1}{2} \phi z_A^2 \end{aligned} \tag{4}$$

$$\begin{aligned} \pi_B &= \int_{y_0}^1 (p_B - t(1 - y)) dy - \frac{1}{2} \phi z_B^2 \\ &= p_B \left(\frac{1}{2} + \frac{1}{2t\theta}(p_A - p_B + \gamma(x_B(1 - x_B) - x_A(1 - x_A)))\right) \end{aligned}$$

$$\hat{p}_A = \frac{2\theta + 1}{2(3\theta + 1)} (\gamma(x_A(1 - x_A) - x_B(1 - x_B)) + t(3\theta + 1)) \tag{6}$$

$$\hat{p}_B = \frac{2\theta + 1}{2(3\theta + 1)} (\gamma(x_B(1 - x_B) - x_A(1 - x_A)) + t(3\theta + 1)) \tag{7}$$

We now turn to the second-stage. Substitution of Equations (6) and (7) into (4) and (5). Then taking the first derivatives of the resulting profit function with respect to  $z_i$ ,  $i = A, B$ , and setting them equal to 0, by solving the equations we obtain:

$$z^* = z_i^* = \frac{1}{2(\alpha + 1)} + \frac{2\phi(3\theta + 1)}{\gamma(4\theta\alpha^2 - 4\theta + \alpha^2 - 1)} \tag{8}$$

Substituting Equation (8) into profit functions, we have:

$$\pi_i^* = \frac{t}{8}(4\theta + 1) - \frac{\phi}{2(\alpha + 1)} - \frac{2\phi^2(3\phi + 1)}{\gamma(4\theta\alpha^2 - 4\theta + \alpha^2 - 1)} \tag{9}$$

$$\begin{aligned} &-\frac{t}{2} \left(\frac{7}{4} + \frac{3}{2t\theta}(p_A - p_B + \gamma(x_B(1 - x_B) - x_A(1 - x_A)))\right) \\ &-\left(\frac{1}{2t\theta}(p_A - p_B + \gamma(x_B(1 - x_B) - x_A(1 - x_A)))\right)^2 - \frac{1}{2} \phi z_B^2 \end{aligned} \tag{5}$$

where  $\phi_i$  shows the efficiency of the investment of tourism company  $i$ .

### NON-COOPERATION GAME

We suppose that the tourism companies have to consider their own future development and make the decisions by themselves, without cooperation with each other. A three-stage game is employed. At the first stage, tourism companies make decisions about business tactics. Then, to shorten the cognitive distance, investments have to be made at the second stage. At the last stage, they proceed to Bertrand-Nash competition. The backward induction method is used. Finally, we obtain the subgame-perfect equilibrium.

We start with the third-stage subgame. First-order condition yields:

$$p^* = p_i^* = \frac{t}{2}(2\theta + 1) \tag{10}$$

Observing Equation (10), the optimal price is not related to the tourism companies' management tactics; rather, it relates positive to the unit transportation cost. This might be caused by the requirement that tourism companies take responsibility for the transportation cost. Interestingly, the optimal price is negatively related to transportation type. Generally, more abominable traffic conditions and higher prices will prevent tourists from traveling to the tourism destination. In our analysis, however, tourism companies intend to raise prices even if the traffic conditions are not convenient for tourists.

To examine the relationship between the optimal investment level and the spill-over effects, we take the derivative of Equation (8) with respect to  $\alpha$  :

$$\frac{\partial z^*}{\partial \alpha} = \frac{\gamma(4\theta + 1)}{2(4\theta\gamma\alpha^2 - 6\phi\theta - 4\theta\gamma + \gamma\alpha^2 - \gamma - 2\phi)} * \left( 1 - \frac{2\gamma\alpha(4\theta + 1)(\alpha - 1)}{4\theta\gamma\alpha^2 - 6\phi\theta - 4\theta\gamma + \gamma\alpha^2 - \gamma - 2\phi} \right) \quad (11)$$

Suppose

$$\phi > \frac{\gamma(4\theta + 1)(\alpha^2 - 1)}{2(3\theta + 1)} \quad (12)$$

Under the assumption of Equation (12), we obtain  $\frac{\partial z^*}{\partial \alpha} < 0$ .

**Remark 1**

The quantity of cognitive proximity investments decreases when the spill-over effect rises.

There often exists a psychology of speculation regarding a free-rider between tourism companies. Therefore, reducing the investment could be the better option to a tourism company since the investment might otherwise benefit its rival. This result coincides with those of Molto et al. (2005) and Poyago-Theotoky (1995). We now run the first stage. Taking a derivative of Equation (9) with respect to  $\delta$  and setting the resulting function equal to 0, we solve the equation. We obtain:

$$\delta^* = \frac{s - 1}{s} \quad (13)$$

Since  $s \in (0,1]$  and Equation (13) should not be negative, we set  $s = 1$ , i.e.  $\delta^* = 0$ .

**Remark 2**

If the effect of the difference between tourism companies' tactics can totally reflect on the spill-over effects that are caused by cognitive proximity investments, under the condition of pursuing maximum profit, tourism companies will reduce the featured products differentiation as much as possible.

**COLLUSION BETWEEN TWO COMPETITORS**

To pursue the larger profits and avoid price competition, tourism companies will often adopt a means to collude with each other. However, if they collude in price, they might offend the Fair Trade Act in Taiwan. Further, we investigate the case where tourism companies do not cooperate at the first and the second stages but set a uniform price at the third stage of the game. Thus, they exhibit semi-collusion behavior.

Assuming that  $\bar{p} = p_A = p_B$  and substitute it into Equation (3), we obtain:

$$\bar{y}_0 = \frac{1}{2} - \frac{1}{2\theta t} (\gamma(x_B(1 - x_B) - x_A(1 - x_A))) \quad (14)$$

Using Equation (14), we develop new tourism companies' profit functions:

$$\bar{\pi}_A = \int_0^{\bar{y}_0} (\bar{p} - ty) dy - \frac{1}{2} \phi z_A^2 \quad (15)$$

$$\bar{\pi}_B = \int_{\bar{y}_0}^1 (\bar{p} - t(1 - y)) dy - \frac{1}{2} \phi z_B^2 \quad (16)$$

As usual, we use the first order condition. We have the investment level:

$$\bar{z}' = z_i = \frac{\gamma(1 - \alpha)(2\bar{p} - t)}{2(2\theta\phi - \gamma + \gamma\alpha^2 + 2\bar{p}\gamma - 2\bar{p}\gamma\alpha^2)} \quad (17)$$

Since investments could not be less than 0 in our model, we suppose  $\bar{p} \geq \frac{t}{2}$ . The assumption also provides the lower bound on the common price. Taking the first derivative of Equation (17) with respect to  $\bar{p}$  gives:

$$\frac{\partial \bar{z}'}{\partial \bar{p}} = \frac{\gamma(1 - \alpha)}{2\theta t\phi - \gamma + \gamma\alpha^2 + 2\bar{p}\gamma - 2\bar{p}\gamma\alpha^2} * \left( 1 - \frac{\gamma(1 - \alpha^2)(2\bar{p} - t)}{2\theta t\phi - \gamma + \gamma\alpha^2 + 2\bar{p}\gamma - 2\bar{p}\gamma\alpha^2} \right) \quad (18)$$

Using the conditions of  $\alpha \in [0,1]$  and  $\bar{p} \geq \frac{t}{2}$ , we find

that  $\frac{\partial \bar{z}'}{\partial \bar{p}} > 0$ .

**Remark 3:** The quantity of cognitive proximity investments increases as a function of the common price. Using Equations (8) and (17), we have the optimal common price:

$$\bar{p}^* = \frac{t(2\theta + 1)^2}{2(3\theta + 1)} \quad (19)$$

At the first stage, the optimal difference of tourism companies' business strategy can be found:

$$\delta^* = \frac{s - 1}{s} \tag{20}$$

Obviously, we have  $s = 1$ ,  $\delta^* = 0$ ,  $\alpha^* = 1$  and  $z^* = z_i^* = 0$ . By using the results, we have the optimal profit function:

$$\pi^* = \frac{\varpi}{4} - \frac{t}{8} \tag{21}$$

where  $\varpi = \frac{(2\theta + 1)^2 t}{3\theta + 1}$

We compare the optimal prices and profit functions we obtain in previous sections:

$$p^* - p^* = -\frac{t\theta(2\theta + 1)}{2(3\theta + 1)} < 0 \tag{22}$$

$$\pi^* - \pi^* = -\frac{t\theta(2\theta + 1)}{4(3\theta + 1)} < 0 \tag{23}$$

We establish the following.

**Remark 4:** According to Equations (22) and (23), tourism companies have no inducement to exhibit collusion behavior.

When tourism companies work together to set a common price, this result in a lower price compared to those obtained under competitive market. In the meantime, tourism companies can gain a lower total profit than if they will cooperate with each other.

Therefore, we do not have to worry that the Fair Trade Act will be violated.

**CONCLUDING REMARKS**

Cognitive distance is the key factor that decides how much interaction can be produced. In the course of development of a tourism destination, a tourism company invests not only on the building facility to meet the leisure need of tourists but also on shortening the cognitive distance between tourists and itself. In this paper, we take tourists' consciousness of geographic distance and cognitive difference into account. Our analysis and deduction have led to the further elaborated results.

Under situations of non-cooperation, because of the spill-over effects, one tourism company can take advantage of another one's investment effort. Thus, there might exist a free-rider condition when making investment decisions. While the tourism company anticipates what actions that its competitor will take, reducing its own investments could be the most probable decision that they

would make. That is, the greater the spillover effects, the fewer investments tourism companies will make. Once we take the spill-over effects by cognitive proximity investment into account, we find that shrinking the differences between tourism companies' business tactics leads to overall gains.

For the sake of avoiding price competition, tourism companies may decide to work together to set a common price. We show that to solicit more tourists, the higher the common prices the stronger the will to invest by tourism companies. However, under such conditions of collusion, both the prices and the gains are less than those obtained if they do not cooperate together. Ultimately, as we show earlier, because of spill-over effects, less differentiation in the features of tourism products will be welcomed by tourism companies in a competitive environment. This result seems to be the counterevidence of the growth of Taiwan tourism industry. Actually, it will be a common outcome if the tourism market is limited within the islands. The finding implies that attracting foreign tourists to visit Taiwan may be the possible way to keep the industry growing.

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