

Tourism Demand and Environmental Investment: A Model with Three Tourist Regions

Resumo: Neste artigo curto apresentamos um modelo simples de três regiões turísticas para estudar os incentivos dos hotéis para investir em qualidade ambiental. Em particular, mostramos que o preço de um quarto de hotel depende positivamente do nível de investimento para preservar as características naturais da região e negativamente do investimento relativo em outras regiões. Neste sentido, mostramos que para manter a demanda turística por quartos de hotel, estes devem investir continuamente em qualidade ambiental. Regiões com baixo investimento na preservação da qualidade ambiental têm alta probabilidade de desaparecer como destinos turísticos. Também mostramos que o incentivo a investir em qualidade ambiental é uma função decrescente do número de hotéis localizados numa região particular e que o incentivo de uma cadeia de hotéis a investir em qualidade ambiental é dependente de se ela é uma cadeia local ou internacional.

Palavra - chave: Investimento em meio ambiente, demanda por turismo, modelo de cidade circular.

Abstract: In this short paper we present a simple model of three tourist regions to study the incentives of hotels to invest in environmental quality. In particular, we show that the price of a hotel room depends positively on the level of investment to preserve the natural characteristics of the region and negatively on the relative investments of the other regions. In this sense, we show that to maintain the tourist demand for rooms the hotels must invest continuously in environmental quality. Regions with low investment in preserving environmental quality have a high probability of disappearing as a tourist destination. We also show that the incentive to invest in environmental quality is a decreasing function of the number of hotels located in a particular region and that the incentive of hotel chains to invest in environmental quality is dependent on whether they are local or international.

Keywords: Environmental; investment; tourism demand; circular city.

JEL classification: D43, L83, Q21, Q26.

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1 Introduction

The tourist sector is a relative new subject of study in economic theory. In the last two decades the economists started to study it as a specific activity with special characteristics. In this sense the presence of public goods and externalities among the different actors make very interesting this activity as an economic issue. The literature of application of economics models to study different problems of the sector is very recent. This paper tries to contribute in this sense.

The explosive growth of the tourist sector have increase the importance of investment in environment quality to maintain the level of demand of a region. Tourists appreciate nature resources of a region as a good bathing water, beach quality, animal protection, etc. (See for example Gios et al (2006)). This implies that a hotel must invest in preserving the natural resources in order to maintain the tourist attractions. On the other hand, the investments of an actor of the tourist sector in environmental quality has positive consequences for the rest of the actors in the area. This is an example of positive externality. Being that environment quality is a public good, cooperation must emerge between the actors of tourist region in order to share the costs of preserving the natural attractions of the region. These externalities across the different actors of a tourism region creates a commons problem and is a key factor in understanding the tourist industry.

Note that the tourist sector is characterized by an increasing presence of hotel chains. In this sense, the functions carried out by hotel chains that refer to transfer of knowledge are extremely important for environmental protection related matters. But simultaneously with the presence of hotel chains, in the recent years, there was a increase of the international expansion of some chains. In this perspective, is very important to study the different incentives that exist between a local and an international chain, to invest in environmental quality. For example, chain affiliation enables hotels access to information on environmental protection measures as well as sharing resources

and taking advantage of economies of scale. On the other hand, an international chain can move from a region to another if the environment quality decrease. These elements are very important to think about the best regulation of the tourist sector and the government policies relating to protect the quality environment of the region.

In this paper we generalize the model introduced in Calveras (2003) by introducing three tourist regions¹. We show that in the presence of more than two regions the possibility of collusion emerge implying different strategies to invest in environmental quality.

The paper is organized as follows. In the next section we introduce and solve the model. In section 3 we study the incentives that hotels have to invest in environment quality and the differences between a local and an international chain. Conclusions and future developments are in the last section.

2 The model

The model presented in this paper suppose the existence of three tourist regions (A, B and C), several hotels and one tour operator for each region. Following the original idea due to Salop (1979), the regions are positioned at equal intervals from one other in the unit circle (see Figure 1). Then we have that the distance between two regions is $\frac{2\pi}{3}$. All tourist are uniformly distributed along the unit circle and inside each region R there are n_R hotels that could be member of a chain (local or international) or not ($R \in \{A, B, C\}$). We suppose that the totality of hotels have the same capacity of k rooms that is taken as exogenous. Given the transportation cost τ per unit of distance, then an individual located at point x in the circle that goes to the region R for vacation has a transportation cost of τ times the distance between x and R.

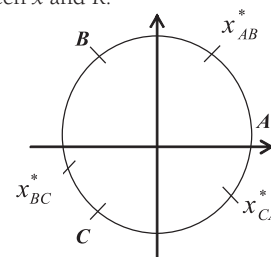


Figure 1: The unit circle

¹ See Accinelli et al (2006a) and Accinelli et al (2006b) for previous studies of the same problem.

The hotel i in the region R invest Q_R in environmental quality, with the cost $C(Q_R)$, where $C'(Q_R) > 0$, $C''(Q_R) > 0$, and $C'(0) = 0$. Note that to simplify the analysis we don't consider the possibility of economies of scale (which could be the case of a hotel chain).

Reflecting the fact that investment in environmental quality of each hotel is a public good, we define the quality of a region q_R as the average of the investment in environmental quality of each hotel correct by an idiosyncratic parameter α_R , that is:

$$q_R = \alpha_R \frac{\sum_{i=1}^{n_R} Q_{R_i}}{n_R} \quad (1)$$

The idiosyncratic parameter is representing the environment of the region or other natural attractions.

We suppose the existence of one tour operator (TO_R) in each region. This tour operator distributes the tourist flow corresponding to the hotel capacity of each region. For this action they receive a fixed portion of the profits π of tourism accommodation. In particular, we suppose that if the hotels gets $\delta\pi$ then the TO obtains $(1-\delta)\pi$. Let p_R be the price for each unit; this price is fixed by the TO_R . Given that we assume that all hotel establishments are alike, price p_R is the same for all hotels in a region R . Each TO_R set price p_R in order to maximize its profits taken as given the prices fixed by the others TO . This corresponds to a Bertrand oligopoly model (Mas-Colell (1995)) and then the Nash equilibrium of the game will be derived on prices.

Let consider a tourist located at point x going to the region R . We assume that the individual utility of this tourist is given by the following linear function:

$$U(x, R) = r + vq_R - p_R - \tau \text{dist}(x, R) \quad (2)$$

where $x \in [0, 2\pi)$, $R \in \{A, B, C\}$, $r > 0$ is the utility of going on vacation (to any region) and $v > 0$ captures the effect of the specific quality of the region. Let x_{ij}^* be the location of a tourist that is indifferent to go to region i or j . Then we have that:

$$U(x_{ij}^*, i) = U(x_{ij}^*, j) \quad (3)$$

Additionally, we suppose that transportation costs are so high such that a tourist that is indifferent between going to i and j must be located at the smaller arc of the circle determined by i and j for $i, j \in \{A, B, C\}$ ⁽²⁾.

From (2) and (3) we have that:

$$x_{AB}^* = \frac{v(q_A - q_B) - (p_A - p_B)}{2\tau} + \frac{\pi}{3} \quad (4)$$

$$x_{BC}^* = \frac{v(q_B - q_C) - (p_B - p_C)}{2\tau} + \pi \quad (5)$$

$$x_{CA}^* = \frac{v(q_C - q_A) - (p_C - p_A)}{2\tau} + \frac{5\pi}{3} \quad (6)$$

Note that, as we expected, if the price of (for example) region A increases, then the point x_{AB}^* moves counter clockwise. Similar results are valid for the other regions. Then we have that the demand faced by each region is:

$$D_A = x_{AB}^* - x_{CA}^* + 2\pi \quad (7)$$

$$D_B = x_{BC}^* - x_{AB}^* \quad (8)$$

$$D_C = x_{CA}^* - x_{BC}^* \quad (9)$$

The next step is to consider the tourist operator that maximizes its profits subject to the total hotel capacity of the region. Then by (7), (8) and (9), we have that the problem of each TO_R is:

$$\begin{cases} \max_{p_R} (1-\delta)p_R \cdot D_R \\ \text{s.t. } n_A k \geq D_R \end{cases} \quad (10)$$

where $R \in \{A, B, C\}$. We assume that k is sufficiently large that the strict restriction holds. The solution of these problems determine the equilibrium prices:

$$\begin{aligned} p_A^*(q_A, q_B, q_C) &= \frac{v(2q_A - q_B - q_C)}{5} + \frac{2\pi\tau}{3} \\ p_B^*(q_A, q_B, q_C) &= \frac{v(2q_B - q_A - q_C)}{5} + \frac{2\pi\tau}{3} \\ p_C^*(q_A, q_B, q_C) &= \frac{v(2q_C - q_A - q_B)}{5} + 2\pi\tau \end{aligned} \quad (11)$$

Note that (11) implies that an increase in the level of investment in environmental quality, produces an increase in the price that the region receives for the tourist service. On the other hand, we have that if a region R don't invest while the others do it, then

² This is a technical hypothesis. We can reproduce the analysis without this assumption but the computations are much more complicated.

the price of region R decrease. If this action continues, the price $p_R^*(q_A, q_B, q_C)$ can attain the value zero, implying that region R could disappear as a tourist destination because the owners do not have economic incentives. Note also that the speed of this process depends on the transportation cost τ . In particular, if τ is low, then the process is fast given that in this case the regions can be considered as rivals. This reflects a stylized fact that is reported in the literature.

We can also observe that an increment in q_R produces an increase in p_R^* , and a decrease in the other prices. But it is important to note that the variations are not in the same magnitude: the increment $\frac{2v\Delta q_R}{5}$ of the price p_R^* produced by an increment in investment in environmental quality Δq_R in region R is the double of the decrement $\frac{-v\Delta q_R}{5}$ in prices of hotels located in the other regions produced by Δq_R . This is a difference with the results presented in Calveras (2003), where the increment in the local region equals the decrement in the other region. Note that this effect of investment in environmental quality can produce a collusion behaviour between two regions to produce the disappearance of the third region by increasing their investments in environmental quality.

3 The incentives to investment in environmental quality

Let now express the indifferent points given by (4), (5) and (6) as a function of the environmental qualities of the regions using the prices defined in (11):

$$x_{AB}^* = \frac{v(q_A - q_B)}{5\tau} + \frac{\pi}{3} \quad (12)$$

$$x_{BC}^* = \frac{v(q_B - q_C)}{5\tau} + \pi \quad (13)$$

$$x_{CA}^* = \frac{v(q_C - q_A)}{5\tau} + \frac{5\pi}{3} \quad (14)$$

Then the problem faced by hotel i located in region A is:

$$\max_{Q_{A_i}} \pi_i(Q_{A_i}) = \max_{Q_{A_i}} \delta \cdot p_A^* \frac{D_A}{n_A} - c(Q_{A_i}) \quad (15)$$

The first order condition of this problem is:

$$\delta \left[\frac{2v\alpha_A}{5} \frac{D_A}{n_A} + \frac{p_A^*}{n_A} \frac{2v\alpha_A}{5\tau} \right] - c'(Q_{A_i}) = 0 \quad (16)$$

or equivalently:

$$4\delta \frac{v\alpha_A}{5n_A^2} (x_{AB}^* - x_{CA}^* + 2\pi) = c'(Q_{A_i}) \quad (17)$$

Then, the investment in environmental quality of hotel i produces an increase on the demand for hotels services located in region A⁽³⁾. Note also that (11) implies that an increase in the investment in environmental quality of hotel i increases the price p_A^* that the hotel receives. Similarly, if the demand faced by region A decreases, to compensate this loss the hotels located in this region must increase their investments in environmental quality. Note also that the incentive to invest in environmental quality is a decreasing function of the number n_A of hotels located in region A. That is, most hotels in the region imply less environmental quality⁽⁴⁾.

Let now considered a hotel chain formed by $\hat{n}$ hotels with $\hat{n}_A$ in region A, $\hat{n}_B$ in region B and $\hat{n}_C$ in region C. In this case, the problem faced by the chain is to decide how much to invest in environmental quality in hotel i located in region A. That is:

$$\max \pi_{\hat{n}_A \hat{n}_B \hat{n}_C} = \delta \left[\hat{n}_A p_A^* \frac{D_A}{n_A} + \hat{n}_B p_B^* \frac{D_B}{n_B} + \hat{n}_C p_C^* \frac{D_C}{n_C} \right] - \sum_{R,i} c(Q_{R_i}) \quad (18)$$

The first order condition of this problem is:

$$\frac{\delta \hat{n}_A}{n_A} \left[\frac{\partial p_A^*}{\partial Q_{A_i}} D_A + \frac{\partial D_A}{\partial Q_{A_i}} p_A^* \right] + \frac{\delta \hat{n}_B}{n_B} \left[\frac{\partial p_B^*}{\partial Q_{A_i}} D_B + \frac{\partial D_B}{\partial Q_{A_i}} p_B^* \right] + \frac{\delta \hat{n}_C}{n_C} \left[\frac{\partial p_C^*}{\partial Q_{A_i}} D_C + \frac{\partial D_C}{\partial Q_{A_i}} p_C^* \right] = c'(Q_{A_i}) \quad (19)$$

that can be written as:

$$2\delta \frac{v\alpha_A}{5\tau n_A} \left(\frac{\hat{n}_A}{n_A} p_A^* - \frac{\hat{n}_B}{n_B} p_B^* - \frac{\hat{n}_C}{n_C} p_C^* \right) = c'(Q_{A_i}) \quad (20)$$

As above, we can note that the price for the hotels services is the incentive that hotels have to invest in environmental quality. Additionally, in the case of an international chain, the new element is that when the price of a region is increased, then the chain has more incentives to increase the investment in environmental quality in that region and

³ Note that this is also a positive externality produced by hotel i in profit of the rest of the hotels located in region A. Again, the presence of this externality creates a commons problem: quality is jointly produced by all hotels in the region.

⁴ Note that an increment of one new hotel in region A produce a loose in the incentive to invest in environmental quality of the rest of the hotels located in this region of more than $\frac{1}{n_A^2}$ (this loose is of the order of $\frac{1}{n_A^2}$).



less incentives to increase the investment in environmental quality in the other regions. Being that the second term of (20) is multiplied by $\frac{\hat{n}_B}{n_B}$ (the participation of the chain in the total of hotels of region B) then if $\hat{n}_B$ increases, the incentive to invest in environmental quality of hotels located in region A decreases. Similarly for region C. Note also that if we compare (20) with (17) a local chain have more incentive to invest than an international one. Since the participation of the chain in the other regions ($\frac{\hat{n}_B}{n_B}$ and $\frac{\hat{n}_C}{n_C}$) given by (20) produces a negative effect, then an international chain has less incentives to invest in environmental quality than a local chain. This makes the difference between local and international chains.

Conclusions and further research

In this paper we present a model with three tourist regions to study the incentives of hotels to invest in environmental quality of the region where they are located. The regions are positioned at equal intervals from one other in the unit circle and all tourist are uniformly distributed along the circle. The quality of a region is defined as the average of the investment in environmental quality of each hotel corrected by a idiosyncratic parameter. Additionally we suppose that in each region there is a tourist operator that distributes the tourism flow corresponding with the hotel capacity of each region. We show that the price is an incentive to the hotels to invest in environmental quality, in the sense that a increment of this investment produce a increment in the price that each hotel located in the region receives. We also show that the best response of a region when other region increments the investment is to increment the investment too. On the other hand, this result show that two regions can collusion to decrease the interest for the tourist to go to the third region. We also noted that if transportation costs are low, the regions tend to have the same level of investment in environmental quality.

When we study the difference between a local and an international chain, the basic result is that the international chain have less incentive to invest in environmental quality, because a increment of the investment pro-

duces a decrease on the demand and price of the other regions.

This paper can be generalized by introducing more than three regions or introducing different types of hotel rooms (non homogeneity of the goods). We can also modify the mechanism of price fixation by changing the Bertrand oligopoly assumption.

Our results depend strongly on the assumption of constant returns to scale of the hotel chains. But it is well known that a characteristic element of hotel chains is the presence of economies of scale (see Alvarez et al (2001)). This can also be material of future research.



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