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DEVELOPMENT STRATEGIES FOR TOURISM DESTINATIONS: TOURISM SOPHISTICATION VS. RESOURCE INVESTMENTS

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Development strategies for tourism destinations: tourism sophistication vs. resource investments

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Abstract

This paper investigates the effectiveness of development strategies for tourism destinations. We show that resource investments unambiguously increase tourism revenues and that increasing the degree of tourism sophistication, that is increasing the variety of tourism related goods and services, increases tourism activity and decreases the perceived quality of the destination's resource endowment, leading to an ambiguous effect on tourism revenues. We disentangle these two effects and characterize situations where increasing the degree of tourism sophistication is a viable development strategy and where it is impracticable without resource investment.

Keywords: Tourism destination; tourism sophistication; resource investments; tourism demand; development strategy.

JEL: L83; O1; D11.

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1 Introduction

Considering the worldwide distribution of tourism activity we observe regions with highly developed destinations and regions where tourism is still absent. Policy makers in these latter areas, which include many developing countries, view the promotion of tourism activity, with its inherently strong forward and backward linkages, as a leading growth and development strategy (see, for example, UNCTAD, 2007; Lee and Chang, 2008, Sequeira and Nunes, 2008). This raises the policy issue of identifying features that allow for a successful tourism take-off and of finding instruments apt to foster the transformation of a region into a flourishing tourism destination.

To address this question we investigate the characteristics of tourism demand and revenues in a destination. In our model tourists are attracted by the presence of natural and/or cultural resources (see, for example, Melian-Gonzalez and Garcia-Falcon, 2003, and Papatheodorou, 2003) and exhibit love of variety preferences for tourism related goods and services, such as restaurants, recreational facilities and so on. We show that overnight stays, which are a proxy for tourism activity, depend positively on the degree of differentiation of tourism related goods. From the policy viewpoint this opens the possibility of furthering tourism development, measured in terms of tourism revenues, by increasing the variety of tourism related goods and services, that is, by increasing the degree of sophistication of the tourism product.

We argue that while resource investments, that is, investments aimed at enriching the destination's resource endowments, unambiguously increase tourism revenues, increasing the degree of tourism sophistication has potentially an ambiguous effect on tourism revenues. On the one hand tourism sophistication affects revenues positively by increasing tourism activity (that is, overnight stays); on the other hand it may affect revenues negatively by decreasing tourism quality because of resource congestion issues. We disentangle these two effects and describe situations where the former effect dominates the latter one, so that increasing the degree of sophistication is a viable development strategy and characterize the policy trade-off between sophistication and resource investments. We find that if tourism quality strongly reacts to tourism activity, then furthering the degree of sophistication may reduce tourism revenues and that therefore sophistication as a development strategy may be constrained by the destination's resource endowment. Our analysis suggests that for such destinations tourism take-off may be unfeasible without resource investments.

In Section 2 we present the formal model and the main results. Section 3 contains some concluding remarks and all proofs are listed in the Appendix.

2 The model

We consider a continuum of measure one of identical individuals, each endowed with a constant elasticity of substitution (CES) utility function exhibiting Dixit and Stiglitz (1977) love of variety preferences for differentiated tourism related goods. The utility function of the representative consumer j is

$$U\left(y\left(j\right),h\left(j\right),x_1\left(j\right),...,x_i\left(j\right),...,x_n\left(j\right)\right)=\left\{y\left(j\right)^{\beta}+z^{\beta}\left[h\left(j\right)^{\gamma}+\left(\sum_{i=1}^{n}x_i\left(j\right)^{\alpha}\right)^{\frac{\gamma}{\alpha}}\right]^{\frac{\beta}{\gamma}}\right\}^{\frac{1}{\beta}} \tag{1}$$

where y is a composite non-touristic good[1], h are overnight stays and x_i, for $i=1$, ..., n, represent differentiated tourism related goods. We call T the tourism product, consisting of overnight stays (h) and differentiated tourism related products ($\{x_i\}_{i=1}^{n}$), i.e. $T=(h,\{x_i\}_{i=1}^{n})$. z indicates the perceived quality of the destination's resource endowment, such as beaches, mountains, museums or more in general heritages, on which tourism is based. We assume that at least one variety has to be offered such that tourism is viable, i.e. $n\geq 1$; in other words, for $n=0$, total overnight stays are nil. n is the degree of tourism product diversification and we consider it to be a proxy for the degree of tourism sophistication[2]. We neglect for simplicity the index j wherever this does not lead to confusion. Throughout the paper we assume the following.

Assumption 1 *(i)* $0<\beta<1$*, (ii)* $-\infty<\gamma<0$*, (iii)* $0<\alpha<1$.

Assumption 1 (i) implies that the non-touristic good y and the tourism product T are gross substitutes; for $\beta\rightarrow 1$ they are perfect substitutes. Assumption 1 (ii) implies that overnight stays and tourism related products are gross complements, where for $\gamma\rightarrow-\infty$ they are perfect complements. Assumption 1 (iii) implies that goods/services x_i, $i=1$,...,n, are gross substitutes.

The representative consumer faces the budget constraint

$$y+qp_hh+q\sum_{i=1}^{n}p_ix_i=I \tag{2}$$

where I is his income, p_h is the price of a single overnight stay, p_i the price of x_i and q is the quality premium of the tourism destination, that is, the premium related to the perceived quality of the destination; the price of the non-touristic good y has been normalized to 1.

[1] y could also include tourism consumption related to other destinations.

[2] See also Andergassen and Candela (2009).

We define $\lambda_\beta \equiv \frac{\beta}{1-\beta} \in (0,\infty)$, $\lambda_\gamma \equiv \frac{\gamma}{1-\gamma} \in (-1,0)$, $\lambda_\alpha \equiv \frac{1-\alpha}{\alpha} \in (0,\infty)$. We assume symmetry on the supply side where $p_i = p$ and therefore in equilibrium $x_i = x$, for $i = 1,...,n$. Let $H = \int_0^1 h(j)\,dj$ be aggregate overnight stays, $X_i = \int_0^1 x_i(j)\,dj$ aggregate consumption of each differentiated good/service and $Y = \int_0^1 y(j)\,dj$ aggregate consumption of non-touristic goods.

We assume that tourism is based on natural and/or cultural resources and that an increase in tourism activity reduces the perceived quality of the destination's resource endowment (z) because of congestion problems (i.e. common pool resources). Therefore, we conjecture that z depends negatively on total overnight stays (H), which is a proxy for the size of the tourism activity, and positively on the destination's resource endowment (R). Variations in tourism activity and resource endowments are likely to trigger price adjustments. We assume that the quality premium q depends negatively on H and positively on R and that prices p_H and p_i, $i = 1, ..., n$, remain constant.[3] Hence, price adjustments triggered by quality changes are reflected in variations in the general price level q.

Assumption 2 *(i)* $z = z(H,R)$, *where* $z_H < 0$, $z_{HH} < 0$, $0 \leq lim_{H\to\infty} z(H,R) < z(0,R)$ *and* $z_R > 0$; *(ii)* $q = q(H,R)$, *where* $q(0,R) > 0$, $q_H \leq 0$, $q_{HH} < 0$, $\frac{\partial}{\partial H} Hq \geq 0$, $lim_{H\to\infty} Hq = \infty$ *and* $q_R > 0$; *(iii)* $z_{HR} \geq 0$ *and* $q_{HR} \geq 0$; *(iv)* $\frac{q}{z} = \eta(H,R)$, *where* $\eta_H \geq 0$ *and* $\eta_R \leq 0$.

z_H is the degree of quality depreciation as a consequence of tourism activity and part (i) states that the depreciation becomes stronger the stronger tourism activity is. z_R is the degree of quality appreciation as a consequence of an increase in the destination's resource endowment. Part (ii) implies that through adjustments in the quality premium, prices adjust, at least partially, as quality changes. η is therefore a proxy for the price-quality ratio, which remains either constant or increases as tourism activity increases (part (iv)). This latter case captures situations where price decisions are decentralized and non-coordinated[4] and/or where an increase in tourism activity, i.e. overnight stays, leads to an overall increase in production costs, while in the former case quality decreases are fully compensated by a reduction in the overall price level of the tourism product. An increase in the destination's resource endowment does not lead to an increase in the price-quality ratio (part (iv)) and it reduces the degree of quality depreciation due to tourism activity and the negative impact of tourism activity on the quality premium (part (iii)).

[3] This follows from the symmetry assumption on the supply side, where firms in equilibrium set the same prices.

[4] Tourism decisions are often based on the average price level of a destination. If prices are set in an uncoordinated way, the single firm has an incentive to reduces prices less in response to a reduction in the quality of the destination, free riding on other's price reductions.

Let $\varepsilon_H^z = \frac{z_H(H,R)}{z(H,R)}H < 0$ and $\varepsilon_H^q = \frac{q_H(H,R)}{q(H,R)}H \leq 0$ be the elasticity of z and q with respect to H, respectively, where the former measures the degree of quality depreciation, and the latter captures the degree of price adjustment, as tourism activity increases. Assumption 2 (iv) implies that $|\varepsilon_H^z| \geq |\varepsilon_H^q|$, where $\varepsilon_H^q = \varepsilon_H^z$ entails that the quality premium adjusts completely to quality changes, keeping the price-quality ratio constant. Note that the assumption $\frac{\partial}{\partial H}Hq \geq 0$ implies that the absolute value of the elasticity of q is lower than one, i.e. $-\varepsilon_H^q \leq 1$, implying that tourism operators have some monopoly power[5]. This poses a limit to reductions in the quality premium (i.e. the overall price level) as the quality decreases and may therefore lead to an increase in the price-quality ratio as tourism activity increases (i.e. part (iv) of Assumption 2).

We characterize total tourism revenues as n and R vary. Tourism revenues are defined as

$$\Omega(n, R) = q(p_h H + npX)$$

Since the representative consumer's income I is constant and because of the aggregate budget constraint, characterizing Ω implies characterizing $I - Y$.

Proposition 1 *Tourism revenues are increasing in R.*

Increasing the destination's resource endowment increases consumer expenditure for overnight stays and for tourism related goods and services, thereby increasing tourism revenues.

Before characterizing the effect of n on R we show that the aggregate demand of overnight stays $H^\star$ is an increasing function of the degree of tourism sophistication (n).

Lemma 1 *$H^\star$ is increasing in n; the larger $|\varepsilon_H^z|$ and/or the lower $|\varepsilon_H^q|$ is, the lower $\frac{\partial H^\star}{\partial n}$.*

Because of the complementarity assumption between overnight stays and tourism related goods, an increase in n increases overnight stays. Note that the stronger the reduction in the quality premium is, the stronger the increase in overnight stays as n increases. The intuition for this result is the following. Increasing n increases overnight stays and, because of resource congestion issues, the quality premium; a reduction in the overall price level leads to more overnight stays. The greater $|\varepsilon_H^z|$ is, that is, the greater the negative impact of tourism activity on its quality is, the lower the positive impact of an increase in tourism sophistication on tourism activity.

We define $M(n) \equiv \varepsilon_H^z \lambda_\gamma - \varepsilon_H^q (1 + \lambda_\gamma)$.

[5] If overnight stays are supplied under monopolistic competition, then the equilibrium price is $qp_h = \frac{c}{1+\varepsilon_H^q}$, where c are marginal costs, which requires $1 + \varepsilon_H^q > 0$.

Lemma 2 *Total tourism revenues are decreasing in the degree of tourism sophistication (n) if $M(n) > 1$, while they are increasing if $M(n) < 1$.*

Tourism revenues are decreasing or increasing in the degree of product diversification, depending on the degree of complementarity between overnight stays and tourism goods/services (λ_γ), on the degree of resource depletion as tourism activity increases and on the degree of adjustment of the overall price level (q). The result is driven by the interplay between two opposing forces: a love of variety effect which positively affects tourism expenditures and a quality depreciation effect, which negatively affects tourism revenues. If aggregate demand of tourism goods and the aggregate demand for overnight stays are independent ($\lambda_\gamma = 0$), then n does not affect $H^\star$ and z. Consequently, only the love of variety effect is at work, which positively affects tourism revenues. On the other hand, if they are complements, then an increase in n leads to an increase in $H^\star$ and to a reduction of the perceived quality of tourism and to a reduction of the quality premium. Note that this effect is stronger, the stronger is the degree of complementarity and/or the larger is $|z_H|$. The feedback mechanism through price adjustments reinforces the negative effect of n on Ω. The reason for this result is that the stronger price reductions are, the stronger the positive relationship between $H^\star$ and n (see Lemma 1). Therefore, price adjustments, by increasing overnight stays and tourism activity, further reduce tourism quality and revenues (Ω). Price adjustments are able to compensate quality depreciations only if $-\varepsilon_H^z \leq 1$; if this condition holds, then an increase in the degree of tourism sophistication always leads to an increase in tourism revenues. On the other hand if $-\varepsilon_H^z > 1$, then price adjustments are not able to keep the price-quality ratio constant. Sufficient condition for tourism revenues to decrease as the degree of sophistication increases is that $\varepsilon_H^z \lambda_\gamma > 1$. The stronger the degree of complementarity (λ_γ) is, the stronger the increase in $H^\star$ as a consequence of an increase in n. It follows that, if the quality depreciation is strong enough, consumers increase their expenditure on non-touristic goods and reduce their expenses on tourism. Note also that since $H^\star$ is always increasing in n, it is $nX^\star$ that is decreasing in n for $M(n) > 1$.

Let us define $\bar{M} \equiv lim_{n \to \infty} M(n)$ .The following result holds.

Proposition 2 *If $\bar{M} > 1$, then there exists a n^* where $\Omega_n \gtrless 0$ for each $n \lesseqgtr n^*$, where n^* is increasing in R, decreasing in $|\varepsilon_H^z|$, $|\varepsilon_H^q|$ and $|\lambda_\gamma|$; if $\bar{M} < 1$ then $\Omega_n > 0$ for each n.*

If we consider n as a policy instrument for the development of a tourism destination, then n^* is an upper limit for the effectiveness of the instrument. The existence of n^* depends on the degree of resource depreciation; as stated in Proposition 2, a sufficient condition for the existence of n^* is that $lim_{n\rightarrow\infty}\varepsilon_H^z\lambda_\gamma > 1$. Tourism sophistication leads to an increase in tourism activity (Lemma 1) and therefore to a perceived quality depreciation of the destination's resource endowment. Since the quality depreciation gets the stronger the greater the degree of tourism sophistication (Assumption 2 (i)) is, it may happen that, as the process of tourism sophistication proceeds, the degree of quality depreciation becomes sufficiently strong such that a further increase in n leads to a reduction in tourism revenues. In this case there exists a degree of tourism sophistication ($n^\star$) that, for a given resource endowment, maximizes tourism revenues. Comparative statics result in the lemma show that the richer the destination's resource endowment is, the larger n^* is. In a similar vein, the less the resource is subject to congestion, that is, the lower $|\varepsilon_H^z|$ is, the larger n^* is. n^* depends also on the strength of the positive relationship between n and H: the larger $|\lambda_\gamma|$ and/or $|\varepsilon_H^q|$ is, that is, the stronger the effect of a change in n on H is, the stronger the resource depletion as a consequence of an increase in n and therefore the lower is n^*. On the other hand, if the degree of quality depreciation remains small as tourism activity increases, then tourism sophistication always increases tourism revenues. We treat the two cases in a unified way considering $n^* < \infty$ if $\bar{M} > 1$ and $n^* = \infty$ if $\bar{M} < 1$.

Corollary 1 *Let $MRS_{n,R} \equiv -\frac{\Omega_R}{\Omega_n}$ denote the marginal rate of substitution between n and R. $MRS_{n,R}$ is negative for each $n < n^*$ and is positive for each $n > n^*$.*

As long as $MRS_{n,R}$ is negative, the policy maker can use both instruments to promote tourism development and the optimal policy mix depends on the relative costs and benefits of doing so. But once $n > n^*$ tourism development via sophistication is no longer viable unless resource investments are undertaken. Note that if $n^* = \infty$, then sophistication is always a viable development strategy.

For a given resource endowment, $\Omega(n^*, R)$ is the maximum of revenues achievable through tourism sophistication. If $\Omega(n^*, R)$ is too low to guarantee tourism take-off, then resource endowments pose a binding constraint to the development process and hence resource investments are necessary. Resource investments have a direct positive effect on revenues (see Lemma 2) and moreover they increase n^* (see Proposition 2), paving the way for a further sophistication.

3 Conclusion

The main problem for policy makers of destinations is how to foster or how to kick-off the development of a tourism industry. We investigated the effectiveness of tourism sophistication and resource investments as development strategies. We showed that the success of fostering tourism development through tourism sophistication may be constrained by the destination's resource endowment. Tourism sophistication increases tourism activity, thereby affecting positively tourism revenues, but aggravating resource congestion issues. In particular, we argued that if the perceived quality depreciation of the destination's resource endowment as a consequence of tourism activity is strong enough, then engaging in a sophistication strategy may well reduce tourism revenues, obstructing the kick-off of the tourism industry. To overcome this hurdle, our analysis suggests that policy makers should engage in investments aimed at enriching the destination's natural and/or cultural resource endowment which positively affect tourism demand and revenues and lay the foundation for further tourism sophistication. Those regions where these investments are not feasible or too costly cannot become tourism destinations.

Appendix

Proof of Lemma 1. We first calculate individual demand functions, and then aggregate over individuals. Since there is a continuum of consumers, each one has a negligible effect on the perceived tourism quality z. Using Lagrange for solving the problem of maximizing (1) under the budget constraint (2), the first order conditions for the representative consumer read:

$$\left\{ y^{\beta} + z^{\beta} \left[h^{\gamma} + \left(\sum_{i=1}^{n} x_i^{\alpha} \right)^{\frac{\gamma}{\alpha}} \right]^{\frac{\beta}{\gamma}} \right\}^{\frac{1}{\beta}-1} y^{\beta-1} = \lambda \tag{3}$$

$$\left\{ y^{\beta} + z^{\beta} \left[h^{\gamma} + \left(\sum_{i=1}^{n} x_i^{\alpha} \right)^{\frac{\gamma}{\alpha}} \right]^{\frac{\beta}{\gamma}} \right\}^{\frac{1}{\beta}-1} z^{\beta} \left[h^{\gamma} + \left(\sum_{i=1}^{n} x_i^{\alpha} \right)^{\frac{\gamma}{\alpha}} \right]^{\frac{\beta}{\gamma}-1} h^{\gamma-1} = \lambda q p_h \tag{4}$$

$$\left\{ y^{\beta} + z^{\beta} \left[h^{\gamma} + \left(\sum_{i=1}^{n} x_i^{\alpha} \right)^{\frac{\gamma}{\alpha}} \right]^{\frac{\beta}{\gamma}} \right\}^{\frac{1}{\beta}-1} z^{\beta} \left[h^{\gamma} + \left(\sum_{i=1}^{n} x_i^{\alpha} \right)^{\frac{\gamma}{\alpha}} \right]^{\frac{\beta}{\gamma}-1} \left(\sum_{i=1}^{n} x_i^{\alpha} \right)^{\frac{\gamma}{\alpha}-1} x_i^{\alpha-1} = \lambda q p_i, \tag{5}$$

for $i = 1, ..., n$, where λ is the Lagrange multiplier. Using the assumption that all firms producing tourism related goods are symmetric we have $p_i = p$ and hence obtain $x_i = x$, for each $i = 1, ..., n$. From (4) and (5) we obtain

$$x = h \left(\frac{p}{p_h} n^{1-\frac{\gamma}{\alpha}} \right)^{\frac{1}{\gamma-1}} \tag{6}$$

while from (4) and (3) we obtain $qp_h = \frac{z^{\beta}\left(h^{\gamma}+n^{\frac{\gamma}{\alpha}}x^{\gamma}\right)^{\frac{\beta}{\gamma}-1}h^{\gamma-1}}{y^{\beta-1}}$ which, using (6), reads as

$$y = h\left(qp_h\right)^{\frac{1}{1-\beta}} z^{\frac{\beta}{\beta-1}} \left[1 + n^{\frac{\gamma}{1-\gamma}\frac{1-\alpha}{\alpha}} \left(\frac{p}{p_h}\right)^{\frac{\gamma}{\gamma-1}}\right]^{\left(\frac{\beta}{\gamma}-1\right)\frac{1}{\beta-1}} \tag{7}$$

Finally, we calculate h substituting (6) and (7) into the budget constraint (2) and obtain

$$h\left(n,\eta\right) = \frac{I}{qp_h\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]\left\{1+p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}}\right\}} \tag{8}$$

where $h_n > 0$. Substituting (8) back into (6) and (7) one obtains

$$x\left(n,\eta\right) = \frac{I}{qp\left[n^{-\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{\lambda_\gamma}+1\right]}\frac{1}{n+p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left[n^{-\frac{\lambda_\gamma}{\lambda_\beta}}+n^{\lambda_\gamma\lambda_\alpha-\frac{\lambda_\gamma}{\lambda_\beta}}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}}} \tag{9}$$

and

$$y\left(n,\eta\right) = I\frac{1}{1+p_h^{-\lambda_\beta}\eta^{-\lambda_\beta}\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{\frac{\lambda_\beta}{\lambda_\gamma}}}. \tag{10}$$

Since all individuals are identical, $h\left(j\right) = h$ and $x\left(j\right) = x$, and consequently $H = h$ and $X_i = X = x$. We calculate the aggregate demand function $H\left(n,R\right)$, where the consumers' choice H feeds back into the perceived tourism quality z and the quality premium q. Using (8), we have to solve the following fixed point problem:

$$qH = f\left(n,\eta\left(H,R\right)\right) \equiv \frac{I}{p_h\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]\left\{1+p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}}\right\}} \tag{11}$$

which yields the solution $H^\star = H\left(n,R\right)$. In view of Assumption 2, $f_H\left(n,\eta\left(H,R\right)\right) \leq 0$ and qH increasing in H, with $f\left(n,\eta\left(0,R\right)\right) > 0$ and $lim_{H\to\infty}qH = \infty$. Consequently, a unique $H^\star$ solving $f\left(n,\eta\left(H^\star,R\right)\right) = q\left(H^\star\right)H^\star$ exists, with $H^\star = H\left(n,R\right)$. Using the implicit function theorem one obtains $\frac{\partial H^\star}{\partial n} = \frac{f_n(n,\eta(H^\star,R))}{q+Hq_H - f_\eta(n,\eta(H^\star,R))\eta_H(H^\star,R)}$, which, after rearranging terms reads

$$\frac{\partial H^\star}{\partial n} = \frac{-H^{\star 2}\frac{qp_h}{I}\lambda_\gamma\lambda_\alpha n^{\lambda_\gamma\lambda_\alpha-1}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\left\{1+p_h^{\lambda_\beta}\eta\left(H^\star,R\right)^{\lambda_\beta}\left(1-\frac{\lambda_\beta}{\lambda_\gamma}\right)\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}}\right\}}{1+\varepsilon_H^q+H^\star\frac{qp_h}{I}\lambda_\beta p_h^{\lambda_\beta}\eta\left(H^\star,R\right)^{\lambda_\beta}\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{1-\frac{\lambda_\beta}{\lambda_\gamma}}\epsilon_H^\eta} > 0 \tag{12}$$

Using (9) and (10), one obtains that $X(n,R) = x(n,\eta(H^\star,R))$ and $Y(n,R) = y(n,\eta(H^\star,R))$. Comparative statics results directly follow from (12). ■

Proof of Proposition 1. Since $f(n,\eta(H,R))$ is increasing in R, it follows from (11) that qH is increasing in R. Furthermore, from (6) it follows that if qH is increasing in R also qX increases as R increases. ■

Proof of Lemma 2. From the aggregate budget constraint one obtains that $\Omega = I - Y$. Consequently, using (10)

$$\Omega(n,R) = \frac{I}{1+p_h^{\lambda_\beta}\eta\left(H^\star,R\right)^{\lambda_\beta}\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}}} \tag{13}$$

Taking the derivative of Ω with respect to n and using (12) we obtain, after rearranging terms,

$$\Omega_n(n,R) = -\frac{\Omega^2}{I}\frac{\lambda_\alpha\lambda_\beta p_h^{\lambda_\beta}\eta^{\lambda_\beta}n^{\lambda_\gamma\lambda_\alpha-1}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}-1}}{1+\varepsilon_H^q+H^\star\frac{qp_h}{I}p_h^{\lambda_\beta}\lambda_\beta\eta^{\lambda_\beta}\left[1+n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{1-\frac{\lambda_\beta}{\lambda_\gamma}}\epsilon_H^\eta}\left[\epsilon_H^z\lambda_\gamma-\varepsilon_H^q\left(1+\lambda_\gamma\right)-1\right] \tag{14}$$

and therefore the result follows. ■

Proof of Proposition 2. Taking the derivative of $M(n)$ with respect to n we obtain

$$M_n = H_n^\star\left[\left(z_{HH}\frac{H^\star}{z}-z_H^2\frac{H^\star}{z^2}+z_H\frac{1}{z}\right)\lambda_\gamma-\left(q_{HH}\frac{H^\star}{q}-q_H^2\frac{H^\star}{q^2}+q_H\frac{1}{q}\right)\left(1+\lambda_\gamma\right)\right]$$

which, under Assumption 2 is always positive. Moreover, since for $n=0$, $H^\star=0$ it follows that $M(0)<1$. Therefore, if $\bar{M}>1$, then there exists a n^* such that $M(n)<1$, or $\Omega_n>0$, for $n<n^*$, and $M(n)>1$, or $\Omega_n<0$, for $n>n^*$. On the other hand, if $\bar{M}<1$, then $\Omega_n>0$ for all values of n.

Finally, we derive comparative statics results for n^*. Consider first the case of a variation in R. Using the implicit function theorem one obtains that $\frac{dn^*}{dR} = -\frac{M_R}{M_n}$, where $M_n > 0$, and $M_R = \left(z_{HR}\frac{H^\star}{z} - z_H z_R \frac{H^\star}{z^2}\right)\lambda_\gamma - \left(q_{HR}\frac{H^\star}{q} - q_H q_R \frac{H^\star}{q^2}\right)(1+\lambda_\gamma) < 0$ in view of Assumption 2. We rewrite $M(n)$ as follows $M(n) = |\varepsilon_H^z| \, |\lambda_\gamma| + |\varepsilon_H^q| \, (1 - |\lambda_\gamma|)$. Since $M_{|\varepsilon_H^z|} > 0$, $M_{|\varepsilon_H^q|} > 0$ and $M_{|\lambda_\gamma|} > 0$, after using the implicit function theorem, we obtain $\frac{dn^*}{d|\varepsilon_H^z|} = -\frac{M_{|\varepsilon_H^z|}}{M_n} < 0$, $\frac{dn^*}{d|\varepsilon_H^q|} = -\frac{M_{|\varepsilon_H^q|}}{M_n} < 0$ and $\frac{dn^*}{d|\lambda_\gamma|} = -\frac{M_{|\lambda_\gamma|}}{M_n} < 0$. ■

Proof of Corollary 1. The corollary is a direct consequence of Lemma 2, Proposition 1 and Proposition 2. ■

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Appendix: Proof not to be published

In this Appendix we provide some further details on the derivation of Ω_n (proof of Lemma 2). Consider tourism revenues

$$\Omega(R,n) = \frac{I}{1 + p_h^{\lambda_\beta}\eta(H^\star,R)^{\lambda_\beta}\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}}}$$

The derivative of the denominator of Ω with respect to n is

$$p_h^{\lambda_\beta}\lambda_\beta\eta(H^\star,R)^{\lambda_\beta-1}\eta_H H_n^\star\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}} +$$

$$+p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left(-\frac{\lambda_\beta}{\lambda_\gamma}\right)\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}-1}\lambda_\gamma\lambda_\alpha n^{\lambda_\gamma\lambda_\alpha-1}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}$$

Since

$$H_n^\star = \frac{-H^{\star 2}q^2\frac{p_h}{I}\lambda_\gamma\lambda_\alpha n^{\lambda_\gamma\lambda_\alpha-1}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\left\{1 + p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left(1-\frac{\lambda_\beta}{\lambda_\gamma}\right)\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}}\right\}}{q + H^\star q_H + H^\star q^2\frac{p_h}{I}\lambda_\beta p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{1-\frac{\lambda_\beta}{\lambda_\gamma}}\epsilon_H^\eta}$$

we obtain

$$\lambda_\beta p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}-1}\lambda_\alpha n^{\lambda_\gamma\lambda_\alpha-1}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\times$$

$$\left\{\frac{-H^\star q^2\frac{p_h}{I}\left\{\lambda_\gamma\epsilon_H^\eta\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right] + \epsilon_H^\eta p_h^{\lambda_\beta}\eta^{\lambda_\beta}(\lambda_\gamma-\lambda_\beta)\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{1-\frac{\lambda_\beta}{\lambda_\gamma}}\right\}}{q + H^\star q_H + H^\star q^2\frac{p_h}{I}\lambda_\beta p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{1-\frac{\lambda_\beta}{\lambda_\gamma}}\epsilon_H^\eta} - 1\right\}$$

or

$$\lambda_\beta p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}-1}\lambda_\alpha n^{\lambda_\gamma\lambda_\alpha-1}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\times$$

$$\frac{-H^\star q^2\frac{p_h}{I}\lambda_\gamma\epsilon_H^\eta\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]\left\{1 + p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}}\right\} - q - H^\star q_H}{q + H^\star q_H + H^\star q^2\frac{p_h}{I}\lambda_\beta p_h^{\lambda_\beta}\eta^{\lambda_\beta}\left[1 + n^{\lambda_\gamma\lambda_\alpha}\left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{1-\frac{\lambda_\beta}{\lambda_\gamma}}\epsilon_H^\eta}$$

which, since

$$H^{\star} = \frac{I}{qp_h \left[1 + n^{\lambda_\gamma \lambda_\alpha} \left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right] \left\{1 + p_h^{\lambda_\beta} \eta^{\lambda_\beta} \left[1 + n^{\lambda_\gamma \lambda_\alpha} \left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma}}\right\}}$$

can be rewritten as

$$\frac{\lambda_\alpha \lambda_\beta p_h^{\lambda_\beta} \eta^{\lambda_\beta} n^{\lambda_\gamma \lambda_\alpha - 1} \left(\frac{p}{p_h}\right)^{-\lambda_\gamma} \left[1 + n^{\lambda_\gamma \lambda_\alpha} \left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma} - 1}}{1 + \varepsilon_H^q + H^{\star} q \frac{p_h}{I} p_h^{\lambda_\beta} \lambda_\beta \eta^{\lambda_\beta} \left[1 + n^{\lambda_\gamma \lambda_\alpha} \left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{1 - \frac{\lambda_\beta}{\lambda_\gamma}} \epsilon_H^\eta} \left(-\epsilon_H^\eta \lambda_\gamma - 1 - \varepsilon_H^q\right)$$

Using this result and taking into account that $\varepsilon_H^\eta = \varepsilon_H^q - \varepsilon_H^z$, the derivative of Ω with respect to n can be written as

$$\Omega_n (R, n) = -\frac{\Omega^2}{I} \frac{\lambda_\alpha \lambda_\beta p_h^{\lambda_\beta} \eta^{\lambda_\beta} n^{\lambda_\gamma \lambda_\alpha - 1} \left(\frac{p}{p_h}\right)^{-\lambda_\gamma} \left[1 + n^{\lambda_\gamma \lambda_\alpha} \left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{-\frac{\lambda_\beta}{\lambda_\gamma} - 1}}{1 + \varepsilon_H^q + H^{\star} \frac{qp_h}{I} p_h^{\lambda_\beta} \lambda_\beta \eta^{\lambda_\beta} \left[1 + n^{\lambda_\gamma \lambda_\alpha} \left(\frac{p}{p_h}\right)^{-\lambda_\gamma}\right]^{1 - \frac{\lambda_\beta}{\lambda_\gamma}} \epsilon_H^\eta} \left[\epsilon_H^z \lambda_\gamma - \varepsilon_H^q (1 + \lambda_\gamma) - 1\right]$$

which is the expression reported in the proof of Lemma 2.