TOURIST CHOICE, COMPETITIVE TOURISM MARKETS AND THE EFFECT OF A TOURIST TAX ON PRODUCERS REVENUES

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Tourist choice, competitive tourism markets and the effect of a tourist tax on producers revenues *†

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Abstract:

We propose a model for the tourism sector assuming basically two markets, one for tourist services and the other for accommodation. These sub-markets are considered as separate but interrelated. The nature of the feedback is determined by a vertical complementarity between tourist services and lodging. We obtain the optimal solution of the tourist choice problem, the primary demand for tourist services and the derived demand for overnight stays. Then, we focus on the equilibrium outcomes assuming perfectly competitive tourism markets. We don't address the externalities caused by tourism activities. Consequently, we move away from efficiency by introducing a tax on overnight stays and inspecting the consequences for the competitiveness and for producers' revenues in each market. The answer key elements are, apart from reservation prices, the direct and cross price elasticities of demand for tourist services. The study of structural parameters extends and completes our analysis of tourism.

Keywords: Complementarity, Elasticity, Preferences, Tax, Tourism.

JEL classification: D11, H2, Z3.

1 Introduction

Tourism is one of the most important sectors of economic activity in many developed and developing countries. Whereas in the 19th century and before tourism was an eccentricity that only certain elites could afford, during the 20th century it became a mass phenomenon. As a result economists have paid increasing attention to it and, in our days, it has turned into a very important subject of study. On the one hand, its quantitative relevance began to take off in the mid-1960s and did not slow down until the outbreak of the covid-19 pandemic in 2020. But, according to projections for 2022, both the number of domestic and international arrivals to tourism destinations and the percentage contribution of the tourism sector to total GDP and employment are expected to return to pre-pandemic trend values. On the other hand, the theoretical approach to the study of tourism economics started to gain importance three decades after in the mid-1990s. Factors that could explain either the growth of the industry and the expansion of the research area are discussed in Dwyer et al. (2011). The authors point out, firstly, the social, technological and economic changes experienced during the years of strong economic growth that followed World War II, and secondly, the appearance of the first academic journals dedicated to the study of tourism economics.

It is well known that both domestic and international tourism have economic, social and environmental impacts, both positive and negative, on tourism destinations. Tourism brings benefits and costs to destinations, of which only one part is reflected in market prices. Therefore, only a part of them is taken into account in decision-making. Open access to i) public facilities and amenities like cleaning and waste collection, police and transport, ii) the services of natural resources, environmental quality and landscape, and iii) the servicing of cultural heritage, is the cause of market failures that manifest themselves in congestion, infra-funding and over-exploitation. This is important because residents are responsible for all the maintenance and conservation of infrastructures, natural capital and cultural patrimony, but these assets provide non-market services that tourists directly consume without paying for them or that tourism sector uses as an input in a regime of free availability. Of course tourists and firms pay for what they buy, but they don't really pay for everything they consume or use. Moreover, the tourist activity generates negative externalities on residents who see their well-being directly reduced as the number of visitors increase, in this case connected with overcrowding, garbage accumulation and noise.

Beyond this, and even though tourism economists have been active in adopting new techniques of economic evaluation (Dwyer et al., 2004), the main issues addressed in the literature remain the traditional ones. Among others the elasticity of tourism demand, the impact of tourist activity on the economy and society as a whole, the consequences of taxation on the revenues of tourist services suppliers and accommodation providers and, more recently as a consequence of the evident climate change, also the interactions between tourist activity, the environment and sustainability.

Theoretical contributions focus on the study of tourist choice, which has traditionally been analyzed with a model based on standard consumer theory. The tourism decisions of economic agents are the result of utility maximization subject to the usual income constraint. Individual utility is obtained from tourist goods consumed and income spent on other non-tourist goods. However, tourism is not a typical product in the sense that it is not a single commodity, nor is it sold only by specialized suppliers belonging to a single industry. The tourist product is a collection of heterogeneous goods and services provided by diverse suppliers and industries which sell their products to both tourists and residents, and to tourism and non-tourism firms (Mak, 2004). Tourism is a multi-dimensional activity which encompasses very different services and activities.

There is an alternative model that studies the tourist's choice of holiday destination under the constraints of a tourist budget and time availability. This model is built on the basis of a given distribution of characteristics among the different destinations. The variables that provide utility to tourists are the quantities consumed of attributes such as security, weather conditions and landscape richness, which are essentially pure public goods. Consequently, the characteristics model is not an appropriate substitute for the traditional one when it comes to analyzing the classic issues of tourism economics.

In the travel and tourism industry, the different goods considered by the consumer-tourist (i.e. the trip, the destination's attributes, the tourist services at the destination and the accommodation) are not on an equivalent horizontal level when it comes to making decisions. On the contrary, these components of the tourist package are hierarchically ordered and the consumer decides sequentially. In situations where we might consider that the general features of destinations are given and stable and there are no major changes in the transport conditions, the main factor influencing travel decisions is the quality-price ratio of the tourist services provided by each destination. Only in a second instance would we find the economic conditions associated with lodging. Therefore, in this paper we adopt a different modeling strategy for tourist choices, which is closer to the traditional model but proposes an important structural change with respect to it: we consider that tourist services at the destination and accommodation are connected through a vertical relationship of complementarity. Let us emphasize this point. We share the idea that tourist activity involves the consumption of services that are quite heterogeneous and make up a multidimensional demand, but accommodation is nothing more than a necessary and complementary good to such services. Hence, our model assumes that the demand for overnight stays is not due to the lodging itself, but it is a demand derived from tourist services, so that a pseudo-technical relationship can easily be established between the amount of tourist services and the number of overnight stays.

The mechanics of the tourism sector is governed by the principles of market forces. Prices are determined by the interaction of supply and demand, and their shifts will lead to changes in market outcomes. The extent of the effects depends on the elasticities of supply and demand for tourist products. We consider two separate but interrelated sub-markets, one for tourist services and the other for accommodation. Empirical studies, as shown in Johnson and Thomas (1992), Song and Li (2008) or Song et al. (2010), suggest that the demand for lodging is quite inelastic with respect to price, while the supply of lodging is very elastic. Things are different in the market for tourist services, where demand is moderately elastic in response to price, but supply is not. Since our main goal in this paper is to focus on the assumption of a vertical segmentation of tourism markets, in order to highlight its analytical implications, we will ignore the aforementioned problems associated with tourist activity: the open access regime and welfare externalities, which will be left for future research. Consequently, based on the new framework for the tourist choice proposed in this paper, we get an alternative version of the model of competitive tourism markets in the absence of market failures.

It is in this new context that we undertake the theoretical study of tourism demands, we characterize the competitive equilibrium that simultaneously clears the two tourism sub-markets, and we carry out a comparative analysis of the effects caused by changes in the parameters. As there are no market failures, the competitive equilibrium is an efficient outcome and, hence, any distortionary indirect tax will cause a deadweight loss in welfare. Moreover, abstracting from statutory liability, administration and compliance costs, the implementation of a specific tax raises a number of additional issues related to the tax burden, its shifting and the final incidence. Tourism taxation in general includes value added tax, property tax, corporate tax and personal income tax, which are levied on purchases and business activity, but also covers entry and exit taxes, excise taxes on car rental, as well as fees paid by tourists during their stay. However, our comparative statics exercise will focus on a tourist tax levied on overnight stays in any type of accommodation, regardless of the level of comfort and accessory services they may include.

The exercise is relevant and clarifying because there is a controversy surrounding the application of this specific indirect tax (Bird, 1992; Blake, 2000; Forsyth and Dwyer, 2002;

Pintassilgo and Silva, 2007; Schubert, 2010). Some argue reasons of tax equity, since it is the direct consumers who bear the burden, and not the general population. Also because the tax is not paid by local residents, but by tourists, and is not a cost to the tourism entrepreneur. Others argue efficiency reasons based on the fact that the tax helps to solve the problem of real opportunity costs generated by tourism that are not fully supported by tourists. On the opposite side, those who argue against the tax on overnight stays assume the efficiency of outcomes in self-regulating competitive markets. Thus, the tax entails an allocative inefficiency, with a strong negative impact on tourist activity and competitiveness. This is because they consider that tourism demand is very elastic, which also implies that tourist services suppliers and accommodation providers will suffer significant revenue losses.

In the following pages we will shed some light on the factors underlying the controversy. The paper is organized as follows. In Section 2 we provide a detailed description of the theoretical framework in which the tourist makes decisions, and then we solve the optimization problem for the representative tourist. In Section 3 we introduce a particular form for the utility function and study the demands for tourist services and overnight stays. The section also includes a complete analysis of how the control variables depend on the structural parameters. In section 4 we consider the competitive equilibrium conditions that simultaneously clear the two interrelated and complementary tourism sub-markets. In addition, we identify the producer revenues at equilibrium in both the tourist services and the accommodation subsectors. In section 5 we propose a fiscal policy exercise that consists in implementing a tourist tax on overnight stays and studying its impact on each of the two tourism sub-markets under scrutiny. Section 6 concludes.

2 The representative tourist's choice

The traditional model of tourism choice is a multi-stage model of choice in which the consumer first decides whether to travel or not. Secondly, he makes a decision on how much of the total budget will be spent on travel. Next, the traveler determines where, when and how to go. Finally the tourist chooses between the set of tourist goods and services available at the destination (Sinclair and Stabler, 1997; Papatheodorou, 2006; Divisekera, 2013). The standard model considers a bundle of goods and services that includes transportation, food and drinks, tourism attractions and guide services, entertainment and shopping, accommodation, but also some particular attributes of the destination (facilities, public amenities, climate, political stability) with respect to other competing destinations. In general, the different components of the basket are treated horizontally in a similar way, without assuming any specific structure of interactions between them. In this paper, for the sake of simplicity and to focus on the main goal, we assume that there are fixed transport conditions and a stable distribution of particular attributes featuring destinations. Moreover, we also consider that tourist services at the destination and accommodation are strongly connected through a vertical relationship of complementarity that has been largely ignored (Divisekera, 2009a, 2009b).

On the other hand, in parallel to the classical modelization of tourist choice that is founded in the standard consumer theory, there is the characteristics model developed by Rugg (1973), Morley (1992) and Papatheodorou (2001), which is based on Lancaster's (1966) consumer theory and the developments in discrete choice analysis and hedonic pricing method. According to this, the representative tourist derives utility from destinational attributes or characteristics such as a pleasant climate or beautiful scenery, which are pure public goods and components of the natural capital. To consume and get utility the tourist must be dwelling in a particular destination for some period of time. Actually, the characteristics model is a model of choice where the tourist chooses the journey destination and the journey duration, constrained by the amount of income budgeted for travel and the availability of time, with or without the inclusion of transportation costs between alternate destinations. In our paper, however, the destination has been previously chosen and we focus on the demand that tourists from various origins carry out in a single destination. Moreover, we abstract from round-trip transportation costs. The latter is a simplifying assumption that has no relevant consequences on the results of the model, nor does it modify the lessons we draw from the fiscal policy exercise discussed below. We treat the outlay for the round-trip travel ride as a lump sum deduction or an admission fee, and we consider that the tourist does not obtain any satisfaction from the ride itself.

Then, we define a framework where the representative tourist has to choose the demand for three goods: number of tourist services x, which represents a multidimensional vector including a great variety of products and services such as recreation, leisure, gastronomy, nature, adventure, culture, sport and business; overnight stays q, which involves accommodation in different types of establishment (hotel, apartment, campsite, cottage, guesthouse, visitor flat, etc.); and income y, which is the quantity of monetary resources available to buy goods other than x and q.

The tourist preferences over these goods are assumed to be represented by a utility function $W(x, y)$ that does not depend on q, but only on the quantity of tourist services consumed and the income available to consume other non-tourist products. This is because we consider that although overnight stays are necessary to enjoy from tourist services consumption, they do not provide directly any utility or disutility.[1] The utility function is increasing in both x and y, and marginal utilities are non-increasing. Given the nature of goods x and y, the representative tourist's utility function is assumed additively separable, which implies that the corresponding marginal utilities do not depend on the consumption of the other good,

$$W(x,y) = U(x) + V(y). \tag{1}$$

Separability is a recurrent assumption in the theory of tourist choice. Assuming separability we can partition consumer spending into groups of related goods so that preferences defined on the elements of each group are represented by independent functions. That is why the assumption fits so well with the multi-stage approach. In our case, the assumption allows us to separate tourist goods from other non-tourist goods, but it is also a step further since we separate overnight stays from the multidimensional vector of tourist services.

According to the tourist's budget constraint, the total income net of the round-trip travel fare m is allocated to tourist services expenditure, where p_x is the unit price of a tourist service, to overnight stays expenditure, where p is the unit price of accommodation, and other goods expenditure, where y plays the role of *numéraire* and we normalize its price assuming $p_y = 1$. That is,

$$m = p_x x + pq + y. \tag{2}$$

With respect to the tourist accommodation demand, we consider that it is a derived demand because it is a necessary requirement to benefit from tourist services. Tourists do not demand accommodation *per se*, but only as an instrumental way of accessing the means that will provide them with greater well-being. Without accommodation is not possible to enjoy tourist services, and without tourist services demand accommodation has no sense. We can represent all this through a demand for overnight stays that depends linearly on the demand for tourist services according to a fixed proportion, a. This proportion can be read as the productivity of an overnight stay in terms of the number of tourist services that the tourist can consume throughout the day. That is,

$$q = \frac{x}{a} \geq 1 \qquad \forall p \leqslant p_R^q, \tag{3}$$

otherwise $q = 0$. Consequently p_R^q is the tourist's reservation price for accommodation. Moreover, given that q represents overnight stays, parameter a measures the number of tourist services consumed per day, and it is assumed $x \geq a$. No matter how strong the tourist's preference is for x, if the associated price exceeds the corresponding reservation

[1] In Appendix B we extend the model by assuming that the tourist's utility increases proportionally with the overnight stays q.

price p_R^x, the tourist will migrate to other destinations rendering null the demands for x and q. Given (3) we can jointly refer to the sum of expenditures on tourist services and on lodging by introducing the effective total price of every tourist service consumed, $p_x + \frac{p}{a}$. This is a way of recognizing the interdependencies between the two goods and the two markets: tourist services and overnight stays demanded by tourists are complementary and could therefore be merged making up a bundle of consumption.[2]

In this context, the static constrained optimization problem: $\max_{\{x,y\}} (1)$ $s.t.$ (2) and (3), to be solved by the representative consumer, can be transformed into the following Lagrangian problem

$$\max_{\{x,y,\lambda\}} \mathcal{L} = U(x) + V(y) + \lambda \left(m - \left(p_x + \frac{p}{a} \right) x - y \right). \tag{4}$$

The first order conditions are

$$\frac{U'(x^*)}{V'(y^*)} = p_x + \frac{p}{a}, \tag{5}$$

$$\lambda^* = V'(y^*), \tag{6}$$

$$m = \left(p_x + \frac{p}{a} \right) x^* + y^*, \tag{7}$$

$$q^* = \frac{x^*}{a}. \tag{8}$$

Equation (5) says that at equilibrium the tourist equals the marginal rate of substitution between tourist services and income to the effective total unit price of tourist services measured in income terms, whose price is equal to unity. Equation (6) means that the equilibrium value of one unit of additional revenue equals the marginal utility of income. Equation (7) is the constraint of the optimization problem. Equation (8) simply restates the demand for overnight stays as a derived demand in terms of the equilibrium values.

3 Demands characterization

From now on we will assume a particular form for the utility function,

$$W(x,y) = -\alpha\gamma^{\phi} + \alpha (x + \gamma)^{\phi} + \beta y, \tag{9}$$

[2] In the case where we had not neutralized transportation costs, assuming they were chosen at an earlier stage, following Divisekera (2016) we would have considered the demand for transport as complementary to the demand for tourist services, and it would be added to the model in parallel with the demand for overnight stays.

where $\alpha > 0$ and $\beta > 0$ are scale parameters that represent the 'efficiency' of each consumption in utility, the parameter $0 < \phi < 1$ has to do with the curvature of the utility function, $-\frac{(x+\gamma)U''}{U'} = 1 - \phi$, or intensity of preferences over x, and $\gamma > 0$ is a parameter that shapes the indifference map. Given the separable specification adopted for W in (9), parameter β is the transformation coefficient from income to utility, α determines the position of $U(x)$, and γ points to the existence of finite reservation prices for the consumer-tourist. Note that the expression for the slope of the indifference curves is $\frac{dy}{dx} = -\frac{\phi\alpha}{\beta(x+\gamma)^{1-\phi}}$, which takes the finite value $-\frac{\phi\alpha}{\beta\gamma^{1-\phi}}$ on the y-axis where $x = 0$.

Actually, factors such as the relative characteristics of destinations and transport conditions, which we are treating as fixed in this study, are latent behind the parameters α and ϕ. It is well-known that destinations compete between them by supplying differentiated tourist services. Consequently, the degree of substitutability between destinations depend on the degree of substitutability between those differentiated services. Individual preferences defined over the services supplied by different destinations rely on the above parameters that indirectly represent destination features.

This function accommodates to the general characterization because it is strictly concave in x: $U(0) = 0$, $U' = \phi\alpha(x+\gamma)^{\phi-1} > 0$, $U'' = (\phi - 1)\phi\alpha(x+\gamma)^{\phi-2} < 0$, and it is linear in y: $V(0) = 0$, $V' = \beta > 0$, $V'' = 0$. The latter implies that the marginal utility of income is constant. Such a representation of preferences leads to demands for x and q that are independent of income m.[3] This is quite realistic because, at least in the short and medium term, tourism destinations are matched with a particular class of tourists characterized by their socioeconomic status. Tourists with different income levels are associated with different types of tourism destination, and changing this order of things to attract tourists from other wealth segments requires time and active tourism policy measures.

The first order conditions may now be solved in closed-form for the endogenous variables,

$$x^*(p_x, p, \Omega) = -\gamma + \left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}} \frac{1}{\left(p_x + \frac{p}{a}\right)^{\frac{1}{1-\phi}}}, \tag{10}$$

$$\lambda^* = \beta, \tag{11}$$

$$y^*(p_x, p, m, \Omega) = m + \gamma\left(p_x + \frac{p}{a}\right) - \left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}} \frac{1}{\left(p_x + \frac{p}{a}\right)^{\frac{\phi}{1-\phi}}}, \tag{12}$$

[3] As we will see below, this is compatible with our approach to the tourist tax problem because we want to analyze the effect of price changes without the interference of any income effect.

$$q^*(p_x, p, \Omega) = \frac{x^*}{a} = -\frac{\gamma}{a} + \left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}} \frac{1}{a\left(p_x + \frac{p}{a}\right)^{\frac{1}{1-\phi}}}, \tag{13}$$

being $x^*(p_x, p, \Omega) = 0$, $y^*(p_x, p, m, \Omega) = m$ and $q^*(p_x, p, \Omega) = 0 \quad \forall p_x + \frac{p}{a} \geq \frac{\phi\alpha}{\beta\gamma^{1-\phi}}$. Here $\Omega = (\alpha, \beta, \gamma, \phi, a)$ represents the vector of structural parameters of the model. According to the assumption that the marginal utility of income is constant, here represented by a constant optimal value of the Lagrangian multiplier equal to β, the demands for tourist services x^* and overnight stays q^* do not depend on the tourist's available total net income m, but only on prices and parameters.

In order to characterize the above demand functions, consider first the reservation prices for tourist services and overnight stays. From (10) we observe that $x^* > 0$ if and only if $p_x + \frac{p}{a} < \frac{\phi\alpha}{\beta\gamma^{1-\phi}}$. From (3) and (8) we know that $q^* = \frac{x^*}{a} > 0 \; \forall p \leqslant p_R^q$, where p_R^q is the reservation price of the tourist's demand for overnight stays. But also that $q^* > 0$ and $x^* > 0$ are bi-univocally correlated. Putting the above together we have $p_x + \frac{p}{a} \leqslant p_x + \frac{p_R^q}{a} < \frac{\phi\alpha}{\beta\gamma^{1-\phi}}$, from which we get $p_x < \frac{\phi\alpha}{\beta\gamma^{1-\phi}} - \frac{p_R^q}{a}$. Finally, it is obvious that in this context there exists a reservation price of the tourist's demand for tourist services p_R^x, such that $x^* > 0$ if and only if $p_x < p_R^x$. Consequently, at the border line we will find

$$p_R^x = \frac{\phi\alpha}{\beta\gamma^{1-\phi}} - \frac{p_R^q}{a}. \tag{14}$$

On the other hand, from (10) the slope of the demand for tourist services is given by the direct price effect

$$\frac{\partial x^*}{\partial p_x} = \frac{-(x^* + \gamma)}{(1-\phi)\left(p_x + \frac{p}{a}\right)} < 0, \tag{15}$$

and the cross price effect determines the direction of shifts

$$\frac{\partial x^*}{\partial p} = \frac{-(x^* + \gamma)}{a(1-\phi)\left(p_x + \frac{p}{a}\right)} < 0. \tag{16}$$

The corresponding elasticities are

$$\left|\varepsilon_{p_x}^x\right| = \frac{p_x}{(1-\phi)\left(p_x + \frac{p}{a}\right)} \frac{x^* + \gamma}{x^*}, \tag{17}$$

$$\left|\varepsilon_p^x\right| = \frac{p}{a(1-\phi)\left(p_x + \frac{p}{a}\right)} \frac{x^* + \gamma}{x^*}. \tag{18}$$

These elasticities are related to each other in the following way

$$\left|\varepsilon_{p_x}^x\right| = \frac{ap_x}{p}\left|\varepsilon_p^x\right|, \tag{19}$$

and

$$\left|\varepsilon_{p_x}^{x}\right| + \left|\varepsilon_{p}^{x}\right| = \frac{1}{1-\phi}\frac{x^* + \gamma}{x^*}. \tag{20}$$

To complete the study of the demand functions, we must pay attention to the demand for overnight stays. This demand has been defined as complementary to the tourist services demand. At first, equation (8) seems to tell that once the tourist determines the demand for x, given the fixed coefficient a, we will have unequivocally determined the demand for q regardless of the price p. However, real things are not so simple and we find that the demand for tourist accommodation also depends on prices. Causality plays as follows: the price of overnight stays, which is mainly a supply price at equilibrium, is a determinant of the demand for tourist services, and this one contributes in the accommodation market to fix the quantity of overnight stays. Taking into account this feedback relationship, equation (13) allows us to compute the slope (direct price effect) and shift directions (cross price effect) of the overnight stays demand,

$$\frac{\partial q^*}{\partial p} = \frac{1}{a}\frac{\partial x^*}{\partial p} < 0, \tag{21}$$

$$\frac{\partial q^*}{\partial p_x} = \frac{1}{a}\frac{\partial x^*}{\partial p_x} < 0. \tag{22}$$

Finally, in Appendix A we show the partial derivatives of the two demands, x^* and q^*, and the two main elasticities, $\left|\varepsilon_{p_x}^{x}\right|$ and $\left|\varepsilon_{p}^{x}\right|$, with respect to $\Omega = (\alpha, \beta, \gamma, \phi, a)$. On the basis of these results, we can analyze the impact of at least three important elements beyond prices, which help to understand how tourism markets work. First, the relative attractiveness of competing destinations as perceived by tourists, which would depend on political considerations, transport facilities and characteristics, and qualitative aspects of the tourism supply. This element is represented in our model with the parameter α. According to $(A.1)$ and $(A.16)$, the greater the advantage of the destination over its close substitutes, or in terms of tourist beliefs the greater the value of α, the greater the demands for both tourist services and overnight stays. Second, the income level and the corresponding socioeconomic status associated with the targeted tourist segment. This element can be linked to the values of parameter β because richer people generally show lower β-values. According to $(A.2)$ and $(A.17)$, the higher the purchasing power of the class of tourists, the greater the demands for both tourist services and overnight stays. Finally, it is also important to analyze the impact of the daily intensity of services consumed by tourists, i.e., the coefficient a. According to $(A.5)$, the bigger the number of services the tourist can consume per day, the greater the demand for tourist services. The impact on demand for overnight stays is ambiguous, although as proposed in $(A.20)$, this impact is likely to be negative.

4 Competitive equilibrium in tourism markets

In the tourism sector we have identified two different but interconnected areas of activity that correspond to two tourism sub-markets: the services x that include a variety of tourist products like recreation, gastronomy, culture and so on; and tourist accommodation q that include different types of establishment like hotels, apartments, campsite, cottage, and others. Consider the equilibrium condition in the competitive sub-market of tourist services[4]

$$x^* (p_x, p) = x^s (p_x) . \tag{23}$$

By total differentiation we get

$$\frac{\partial x^*}{\partial p_x} dp_x + \frac{\partial x^*}{\partial p} dp = \frac{\partial x^s}{\partial p_x} dp_x . \tag{24}$$

We know the following about the elasticities of demand and supply of tourism services: the direct price elasticity of demand is $\varepsilon^x_{p_x} < 0$, because of the fundamental law of demand; the cross price elasticity of demand is $\varepsilon^x_p < 0$, because tourist services and overnight stays are complementary; and the price elasticity of supply is $\eta^x_{p_x} > 0$, because behind the supply are the cost of inputs involved in the production of tourist goods and services, in particular wage costs. Therefore, we can write

$$-\left|\varepsilon^x_{p_x}\right| \frac{dp_x}{p_x} - \left|\varepsilon^x_p\right| \frac{dp}{p} = \eta^x_{p_x} \frac{dp_x}{p_x} . \tag{25}$$

We get, then, a relationship between the proportional change in the price of tourist services and the proportional change in the price of overnight stays that is consistent with the equilibrium condition

$$\frac{dp_x}{p_x} = - \frac{\left|\varepsilon^x_p\right|}{\left|\varepsilon^x_{p_x}\right| + \eta^x_{p_x}} \frac{dp}{p} . \tag{26}$$

Moreover, the producers revenue at equilibrium in the tourist services sub-market is given by

$$I_T = p_x x^* = \left(\frac{\phi \alpha}{\beta}\right)^{\frac{1}{1-\phi}} \frac{p_x}{\left(p_x + \frac{p}{a}\right)^{\frac{1}{1-\phi}}} - \gamma p_x . \tag{27}$$

On the other hand, in the competitive sub-market of tourist accommodation we find a demand that is a derived demand, $q^* (p_x, p) = \frac{x^*(p_x,p)}{a}$ $\forall p \leqslant p^q_R$ and $p_x < p^x_R$, and a supply that is assumed perfectly elastic, $p = \bar{p} \leqslant p^q_R$, until it reaches the point of full capacity utilization, where it becomes completely inelastic. Empirical studies like Arbel and Ravid

[4] Under the assumptions of identical tourists and no externalities, the demand of the representative tourist can be read as an aggregate demand.

(1983), Fujii et al. (1985), Mak (1988) and Hiemstra and Ismail (1992) showed that the elasticity of lodging supply is much larger than the demand elasticity, the former tending to infinity and the latter below unity and near zero. Since then, for the sake of simplicity, the theoretical literature has assumed a horizontal accommodation supply. This implies that any change in marginal cost is fully forward shifted. Moreover, following Mak and Nishimura (1979) it is also assumed that visitors will not change the quality of lodging purchased. It seems quite obvious that these assumptions are fulfilled and that they fit well into the description of this market.

For a given equilibrium price $p^* = \bar{p}$, the equilibrium quantity q^* is determined by x^* and a, but the quantity x^* is determined according to (23) and (10) for such a value of p. Consequently, any change in p triggers a feedback adjustment process up and down between the two sub-markets. Among the changes that shift this horizontal supply are wage variations and indirect taxes implemented in the tourist accommodation subsector.[5]

Finally, the producers revenue at equilibrium in the tourist accommodation sub-market is given by

$$I_H = pq^* = p\frac{x^*}{a} = \left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}} \frac{p}{a\left(p_x + \frac{p}{a}\right)^{\frac{1}{1-\phi}}} - \frac{\gamma p}{a}. \tag{28}$$

5 Comparative statics: the consequences of a tourist tax on overnight stays

For years there has been an intense debate on the convenience of taxing tourism with a special tax. Fiscal theory advises that taxes should be justified by compelling reasons. In the particular case of tourism these reasons could be the negative externalities that open access to natural, cultural and public capital services entail. However, although these are relevant reasons that point to the correction of serious inefficiencies, the possibility of raising new public revenues cannot be disregarded in economies where tourism is a very important source of income and wealth.

In this paper, as a first step in our attempt to reformulate the theoretical modeling of the tourism sector, we have assumed perfectly competitive and self-regulated markets,

[5] Of course, the characterization of the tourist accommodation market will have important consequences on the issues of the initial tax burden, tax shift, final incidence of the tourist tax, and government additional tax receipts. Lodging firms have the statutory liability for paying the tax to the government but, given the shape of the supply curve, the price of accommodation will increase by the total of the tax. However, given the relationship between demands for tourist services and accommodation, the final results are still uncertain.

with no room for externalities and other types of imperfections. Consequently, the market outcome is itself efficient and what we will do is introduce a distortionary tax. This is a very particular and restricted context in which we will be able to analyze more accurately the incidence of the tax and the strength of the arguments against it. According to Mak (2006), travelers visiting different destinations encounter a large variety of taxes and user charges because it is generally accepted that this is the way they pay the opportunity cost of all resources employed in tourism, including the cost of public services they enjoy. Travelers may have to pay entry and departure taxes (Forsyth et al., 2014; Álvarez-Albelo et al., 2017), selective excises on accommodation and car rentals (Palmer-Tous et al., 2007), admission fees (Knapman and Stoeckl, 1995), and general taxes levied on their current purchases during the stay. Here we consider tourists visiting only one particular destination, and we assume that travel fare already includes entry and exit taxes. Moreover, we will ignore the role of those taxes that must also be paid by residents of the tourist destination when engaging in similar activities or purchases, and we will focus on a particular tax that falls largely on tourists. This is the tax on lodging or on overnight stays, most commonly known as the tourist tax.

Important sectors of the tourism industry, mainly associations of hoteliers and tourism policy makers, claim that this tax will considerably harm their level of competitiveness (Combs and Elledge, 1979; Gago et al., 2009). They argue that the tax will have a strong negative impact on tourism activity, which will result in a loss of visitors and, in addition, in a reduction of their revenues. In support of their opposition to the tax, they focus on the relative weight of the direct price elasticity of tourism demand with respect to the price elasticity of supply (Aguiló et al., 2005). We will now consider these arguments within the framework of the model outlined in the previous sections. From the point of view of the agents involved as suppliers in the two tourism sub-markets what is important is the extent of the impact of the tourist tax on their respective revenues. Given the strong complementarity between tourist services at the destination and accommodation, we show that a critical factor determining the extent of the aforementioned effects, in addition to the reservation price for lodging, is the cross price elasticity of the demand for tourist services.

By totally differentiating (27) and (28), and using the relationship (26), we get

$$dI_T = -\frac{\left(1+\eta^x_{p_x}\right)\left|\varepsilon^x_p\right|}{\left|\varepsilon^x_{p_x}\right|+\eta^x_{p_x}}\frac{p_x x^*}{p}dp \tag{29}$$

and

$$dI_H = q^* dp + \left(\frac{\left|\varepsilon^x_{p_x}\right|\left|\varepsilon^x_p\right|}{\left|\varepsilon^x_{p_x}\right|+\eta^x_{p_x}} - \left|\varepsilon^x_p\right|\right) q^* dp. \tag{30}$$

When an indirect tax is implemented in a competitive market, there are different issues that can be studied. There is the problem of administrative costs affecting agents who levy. There is also the matter of the final incidence of the tax. But due to the fact that part of the tax is usually shifted, it is important to know to what extent the tax affects the price of the product.[6] In our analysis of the impact of a tourist tax (actually an overnight stay tax) it is important to remark that a perfectly elastic supply of tourist accommodation means that the specific tax t will correspond to an equivalent increase in the market price of lodging, i.e. $t = dp$.

Then, (29) says that the revenues in the tourist services sector will not be affected by the tourist tax, $dI_T = 0$, in the cases: $i)$ $\left|\varepsilon^x_{p_x}\right| = +\infty$, and $ii)$ $\left|\varepsilon^x_p\right| = 0$. At the same time, (30) says that the revenues in the tourist accommodation sector will not be affected by the tourist tax, $dI_H - tq^* = 0$, in the cases: $i)$ $\left|\varepsilon^x_{p_x}\right| = +\infty$, $ii)$ $\left|\varepsilon^x_p\right| = 0$, and $iii)$ $\eta^x_{p_x} = 0$.

These are extreme cases because only appear when: 1) the demand for tourist services is perfectly elastic, which means that there are many close substitutes, usually in other competing destinations; 2) the demand for tourist services does not shift because it is independent of the price of overnight stays, which is determined in the complementary tourist accommodation market; or 3) the supply of tourist services is completely inelastic, which means that a tourism destination is offering services in a fixed quantity that does not respond to price changes. These results are very striking, especially points $i)$ and $iii)$, because they seem to contradict the arguments underlying the hostile reaction of hoteliers against the tourist tax. The prevailing opinion among those whose prosperity is directly linked to tourism is that tourist products are very homogeneous across destinations, therefore the demand is very elastic, but also that the supply is quite inelastic. However, the key point that elucidates the apparent contradiction is the differentiation between the two sub-markets, since the indirect tax only applies to the lodging market.

For the more usual intermediate cases in which $0 < \left|\varepsilon^x_{p_x}\right|, \left|\varepsilon^x_p\right|, \eta^x_{p_x} < +\infty$, from (19) and (8) we can establish a result that connects at equilibrium the price elasticities of the tourism demand with its corresponding expenditures in tourist services and accommodation

$$\frac{\left|\varepsilon^x_{p_x}\right|}{\left|\varepsilon^x_p\right|} = \frac{p_x x^*}{pq^*}. \tag{31}$$

Using this relationship in equations (29) and (30) we get the definitive expressions for the analysis of the tourist tax impact on the revenue of suppliers in the different subsectors

[6] Given a demand for lodging that is price inelastic and a supply of lodging that is price elastic, hotel room taxes are expected to be largely passed on to hotel guests as higher prices (Hughes, 1981; Mak, 2006).

of tourist activity

$$dI_T = -\frac{\left|\varepsilon^x_{p_x}\right|\left(1+\eta^x_{p_x}\right)}{\left|\varepsilon^x_{p_x}\right|+\eta^x_{p_x}} tq^* \leq 0, \tag{32}$$

$$dI_H - tq^* = -\frac{\eta^x_{p_x}\left|\varepsilon^x_p\right|}{\left|\varepsilon^x_{p_x}\right|+\eta^x_{p_x}} tq^* \leq 0. \tag{33}$$

These two important results allow us to obtain the following partial effects of the elasticities on the change in revenues caused by the tax. First, for suppliers of tourist services, from (32) we get

$$\frac{\partial\left|dI_T\right|}{\partial \eta^x_{p_x}} = \frac{\left|\varepsilon^x_{p_x}\right|\left(\left|\varepsilon^x_{p_x}\right|-1\right)tq^*}{\left(\left|\varepsilon^x_{p_x}\right|+\eta^x_{p_x}\right)^2} \gtreqless 0 \text{ depending on whether } \left|\varepsilon^x_{p_x}\right| \gtreqless 1, \tag{34}$$

$$\frac{\partial\left|dI_T\right|}{\partial\left|\varepsilon^x_{p_x}\right|} = \frac{\left(1+\eta^x_{p_x}\right)\eta^x_{p_x}tq^*}{\left(\left|\varepsilon^x_{p_x}\right|+\eta^x_{p_x}\right)^2} > 0. \tag{35}$$

Accordingly, when $\left|\varepsilon^x_{p_x}\right| > (<)\, 1$ a low (high) value of $\eta^x_{p_x}$ implies a low revenue distortion caused by the tourist tax. In addition, the lower the value of $\left|\varepsilon^x_{p_x}\right|$, the lower the revenue distortion in the tourist services subsector. Second, for the suppliers of accommodation, from (33) we get

$$\frac{\partial\left|dI_H - tq^*\right|}{\partial \eta^x_{p_x}} = \frac{\left|\varepsilon^x_{p_x}\right|\left|\varepsilon^x_p\right|tq^*}{\left(\left|\varepsilon^x_{p_x}\right|+\eta^x_{p_x}\right)^2} > 0, \tag{36}$$

$$\frac{\partial\left|dI_H - tq^*\right|}{\partial\left|\varepsilon^x_p\right|} = \frac{\eta^x_{p_x}tq^*}{\left|\varepsilon^x_{p_x}\right|+\eta^x_{p_x}} > 0, \tag{37}$$

$$\frac{\partial\left|dI_H - tq^*\right|}{\partial\left|\varepsilon^x_{p_x}\right|} = -\frac{\eta^x_{p_x}\left|\varepsilon^x_p\right|tq^*}{\left(\left|\varepsilon^x_{p_x}\right|+\eta^x_{p_x}\right)^2} < 0. \tag{38}$$

That is, the lower the values of $\eta^x_{p_x}$ and $\left|\varepsilon^x_p\right|$, the lower the revenue distortion caused by the tourist tax, but also that the higher the value of $\left|\varepsilon^x_{p_x}\right|$, the lower the revenue distortion in the lodging subsector. From equations (32) and (33) it is clear that the 'revenue distortion' label refers to a reduction in revenues caused by the tax.

Last but not least, we can associate the above derivatives (34)-(38), whose magnitude depends on the value of the three elasticities involved in our analysis, with the results shown in Appendix A that relate the values of both direct and cross price elasticity of demand for tourist services to the structural parameters of the model. In particular, equations $(A.6)$-$(A.10)$ pair with (35) and (38) while $(A.11)$-$(A.15)$ pair with (37). What these results reveal is that the reduction caused by the tourist tax on the revenue of tourist services providers is lower the higher α, the lower β and the lower a. In other words, the lower the perceived attractiveness of direct competing destinations, the wealthier the tourists attached to a destination, and the lower the hastiness of their stays, the lower the distortion caused by the tourist tax in a perfectly competitive tourist services market. On the other hand, the conclusion about the distortion caused by an overnight stays tax on the revenue of tourist accommodation providers is apparently more complex. In this case opposing effects caused by the same parameter, but transmitted by means of different elasticities, come together. However, from the above mentioned equations, and given that $\frac{\left|\varepsilon_{p_x}^x\right|}{\left|\varepsilon_{p_x}^x\right|+\eta_{p_x}^x} < 1$, it may be proved that the reduction caused by the tourist tax on the revenue of tourist accommodation providers is also lower the greater the attractiveness of the destination, the lower the tourists' marginal utility of income, and the smaller the number of services that they consume per day. That is, the greater α, the smaller β and the smaller a.

6 Conclusions

Tourism is an economic phenomenon related to the movement of people away from their usual place of residence, and refers to the activity of visitors whose trip includes at least an overnight stay. Tourism is a major source of economic wealth, contributing significantly to GDP and employment. It is one of the fastest growing sectors in the world economy, and despite the slowdown due to the financial crisis and the more recent pandemic, the sector's activity figures have quickly recovered long-term trends. World tourism has experienced steady growth for almost seven decades, benefiting from the growth in per capita income, the rise of globalization and technological advances that have lowered the cost of travel and improved the level of comfort associated with accommodation. In the last two decades, moreover, tourism has demonstrated significant resilience face to external shocks such as geopolitical uncertainty, terrorist attacks and natural disasters. For all these reasons, tourism is an important issue in many countries where policy makers are devoting great efforts to implement action plans for the near future.

The search for optimal tourism policies should be reflected in the formulation of joint strategies that engage the private sector in tourism governance, sharing responsibility with the different levels of government that have competencies in this area. But first, what the involved parties need is a good knowledge of the sector and an accurate theoretical representation that captures the interdependencies between the relevant variables and their relationship with the parameters, i.e., a good model to help us explain the mechanics of the tourism sector. This is very important because the use of a wrong model will lead to a misinterpretation of reality and, consequently, bad policy recommendations will be made. We have shown that by introducing a few, but crucial, structural changes into the standard model, major transformations appear and a better understanding of the tourism sector can be achieved. In order to understand and make good recommendations in a sector as strategic as tourism, it is necessary to have a complete characterization of the demand functions and to compute their elasticities.

Tourism involves a multidimensional demand of heterogeneous services. Indeed, a tourist journey also includes transportation and lodging, but the main purpose of a trip is to consume the tourist services provided at the destinations, i.e., gastronomy, a variety of attractions and guide services, entertainment, shopping, and so on. Accommodation is a necessary and complementary good for tourist services. Thus, a fixed coefficient connects the amount of tourist services and the number of overnight stays, which makes up the demand for overnights stays as a derived demand. Our model considers two distinct but vertically related markets. The primary demand for tourist services and the derived demand for overnight stays are obtained from the optimal solution of the tourist choice problem. According to the preferences, we have identified a combination of parameters that accounts for finite reservation prices in the demands for tourist services and lodging. Finally, we have studied the equilibrium outcomes assuming perfectly competitive tourism markets, which are efficient.

Within this framework we have analyzed the consequences of establishing a specific tax on visitors overnight stays, trying to see how it will affect the competitiveness of the destination that implements the tax, and what will happen to the revenues of suppliers in the tourist services and the tourist accommodation subsectors. First, given the extreme values characterizing the elasticities of accommodation demand and supply, hotel room taxes are fully passed on to hotel clients in the form of higher prices. This feature is also shared by accommodation in other types of establishments, i.e., apartment, campsite, cottage or guesthouse, so that, in general, the tourist tax is not paid by local residents, but by tourists, and is not a cost for the tourism entrepreneur as long as the final price does not exceed the reservation price. Second, our results show that the effect on destination competitiveness and the revenues of suppliers is conditioned to the values of three elasticities that are defined in the tourism services sub-market: the two direct price elasticities of demand and supply and the cross price elasticity of demand for tourism services with respect to the price of an overnight stay.

It is worth noting an important rule that characterizes the equilibrium in tourism markets: the ratio between expenditure on tourism services and expenditure on accommodation is equal to the ratio between the direct and cross price elasticities of demand for tourism services. Moreover, the model predicts that the loss of competitiveness and the revenue distortion, i.e., the reduction in revenues caused by the tax, will be smaller the lower the value of the demand cross price elasticity. To some extent, it is surprising to note that the main opposition to the tourist tax comes from associations of hoteliers, who argue that the direct price elasticity of demand is extremely high. However, the model shows that the higher the value of this elasticity, the smaller the distortion introduced by the tax in the lodging market. Finally, our model also reveals that the reduction caused by the tourist tax on hoteliers' revenues is smaller the stronger the tourists preference for the destination, the higher their purchasing power and the lower the number of services they consume per day. In short, we conclude that marginal changes in the price of overnight stays will have no impact, or at most a negligible impact on the length of stay, on the quantity of tourist services consumed, as well as on the revenues of accommodation providers.

In this paper, although not going into the details, we have mentioned the problems generated by tourism activity in destinations. Basically the open access to services provided by different capital assets and the existence of welfare externalities. First, residents are responsible for the maintenance and conservation of natural, cultural and public capital, but all of these assets provide non-market services that tourists consume directly without paying for them, or the tourism sector uses as an input free of charge. Second, tourism activity imposes external costs on residents, who see their well-being reduced as the number of vacationers increase. It is not only the amount of tourists that is a nuisance, but rather the congestion of infrastructure, amenities and facilities, the extra costs due to the intensive use of public services and the overexploitation of natural capital. Mass tourism, if not regulated, may finish by destroying the attractiveness of destinations.

Nonetheless, it may be that the characteristics of competitive tourism markets, summarized in the values of the elasticities, are such that the minimum distortion caused by the tax on overnight stays is insufficient to correct the problem of welfare externalities and their inefficiencies. In this case, we could think that leaving the tax aside and using quantitative restrictions might be a better option. However, there is still the problem of financing the growing additional costs that tourism imposes on public budgets, and the collection of the tourist tax can contribute to the solution with the extra revenue that the government raises directly from visitors. Last but not least, tourism, as a sector that makes intensive use of the services provided by natural capital and cultural patrimony, is constantly enjoying a free lunch. In such a situation, we cannot rely on the self-regulation of decentralized tourism markets, since the results recorded in official statistics can never be representative of an efficient solution.

Although in this paper we have studied tourism markets under the assumptions of perfect competition, it must be recognized that there is a fundamental market failure when tourists in their consumption and tourism firms in their supply use services of natural capital and cultural heritage that are excluded from market transactions and for which their corresponding opportunity cost is not paid. Tourists when they consume pay for what they buy, but do they really pay for everything they consume? We need to move from the well-known polluter-pays principle to the more general user-pays principle, which calls for the user of natural and cultural capital to bear the full opportunity cost. This new approach will open other avenues in tourism economics for the tourist tax on overnight stays, since it acquires another dimension and reveals itself as a complement to the market price that allows correcting fundamental inefficiencies caused by a poor market functioning. However, this issue is beyond the scope of this paper and will be left for future research.

7 Appendix A: Partial effects of parameters on demands and elasticities

From equation (10) we get

$$\frac{\partial x^*}{\partial \alpha} = \frac{\phi}{\beta} \frac{1}{1-\phi} \left(\frac{\phi\alpha}{\beta}\right)^{\frac{\phi}{1-\phi}} \frac{1}{\left(p_x + \frac{p}{a}\right)^{\frac{1}{1-\phi}}} > 0, \tag{A.1}$$

$$\frac{\partial x^*}{\partial \beta} = -\frac{\phi\alpha}{\beta^2} \frac{1}{1-\phi} \left(\frac{\phi\alpha}{\beta}\right)^{\frac{\phi}{1-\phi}} \frac{1}{\left(p_x + \frac{p}{a}\right)^{\frac{1}{1-\phi}}} < 0, \tag{A.2}$$

$$\frac{\partial x^*}{\partial \gamma} = -1, \tag{A.3}$$

$$\frac{\partial x^*}{\partial \phi} = \left(\frac{\phi\alpha}{\beta\left(p_x + \frac{p}{a}\right)}\right)^{\frac{1}{1-\phi}} \frac{\ln\left(\frac{\phi\alpha}{\beta\left(p_x+\frac{p}{a}\right)}\right)}{(1-\phi)^2} + \frac{1}{1-\phi}\left(\frac{\phi\alpha}{\beta\left(p_x + \frac{p}{a}\right)}\right)^{\frac{\phi}{1-\phi}} \frac{\alpha}{\beta\left(p_x + \frac{p}{a}\right)} > 0, \tag{A.4}$$

$$\frac{\partial x^*}{\partial a} = \frac{x^* + \gamma}{(1-\phi)\, a^2} \frac{p}{p_x + \frac{p}{a}} > 0. \tag{A.5}$$

Now remember the equation (17) and simplify by rewriting $\left|\varepsilon_{p_x}^x\right| = \Gamma(\phi, a)\, \Lambda(\gamma, x^*)$, where $\frac{\partial \Gamma}{\partial \phi} > 0$, $\frac{\partial \Gamma}{\partial a} > 0$, $\frac{\partial \Lambda}{\partial \gamma} > 0$ and $\frac{\partial \Lambda}{\partial x^*} = \frac{-\gamma}{(x^*)^2} < 0$. Then, we get the following results

$$\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial \alpha} = \Gamma(\phi, a) \frac{\partial \Lambda}{\partial x^*} \frac{\partial x^*}{\partial \alpha} < 0, \tag{A.6}$$

$$\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial \beta} = \Gamma(\phi, a) \frac{\partial \Lambda}{\partial x^*} \frac{\partial x^*}{\partial \beta} > 0, \tag{A.7}$$

$$\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial \gamma} = \Gamma(\phi, a) \left(\frac{\partial \Lambda}{\partial \gamma} + \frac{\partial \Lambda}{\partial x^*} \frac{\partial x^*}{\partial \gamma}\right) > 0, \tag{A.8}$$

$$\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial \phi} = \Lambda(\gamma, x^*) \frac{\partial \Gamma}{\partial \phi} + \Gamma(\phi, a) \frac{\partial \Lambda}{\partial x^*} \frac{\partial x^*}{\partial \phi} > 0, \tag{A.9}$$

$$\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial a} = \Lambda(\gamma, x^*) \frac{\partial \Gamma}{\partial a} + \Gamma(\phi, a) \frac{\partial \Lambda}{\partial x^*} \frac{\partial x^*}{\partial a} > 0. \tag{A.10}$$

Actually, the sign of the last two expressions is undetermined. However, given that $\lim_{\gamma \to 0} \frac{\partial \Lambda}{\partial x^*} = 0$ it is reasonable that both are positive.

Moreover, rearranging from (19) we have $\left|\varepsilon_p^x\right| = \frac{p}{ap_x}\left|\varepsilon_{p_x}^x\right|$ and the following results arise

$$\frac{\partial\left|\varepsilon_p^x\right|}{\partial\alpha} = \frac{p}{ap_x}\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial\alpha} < 0, \tag{A.11}$$

$$\frac{\partial\left|\varepsilon_p^x\right|}{\partial\beta} = \frac{p}{ap_x}\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial\beta} > 0, \tag{A.12}$$

$$\frac{\partial\left|\varepsilon_p^x\right|}{\partial\gamma} = \frac{p}{ap_x}\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial\gamma} > 0, \tag{A.13}$$

$$\frac{\partial\left|\varepsilon_p^x\right|}{\partial\phi} = \frac{p}{ap_x}\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial\phi} > 0, \tag{A.14}$$

$$\frac{\partial\left|\varepsilon_p^x\right|}{\partial a} = \frac{p}{p_x}\left(\frac{a\frac{\partial\left|\varepsilon_{p_x}^x\right|}{\partial a} - \left|\varepsilon_{p_x}^x\right|}{a^2}\right) < 0. \tag{A.15}$$

The last result can be easily checked on the basis that the function $\Gamma\left(\phi, a\right) = \frac{p_x}{(1-\phi)\left(p_x+\frac{p}{a}\right)}$ is strictly concave in a.

Finally, from equation (13) we get

$$\frac{\partial q^*}{\partial\alpha} = \frac{1}{a}\frac{\partial x^*}{\partial\alpha} > 0, \tag{A.16}$$

$$\frac{\partial q^*}{\partial\beta} = \frac{1}{a}\frac{\partial x^*}{\partial\beta} < 0, \tag{A.17}$$

$$\frac{\partial q^*}{\partial\gamma} = -\frac{1}{a} < 0, \tag{A.18}$$

$$\frac{\partial q^*}{\partial\phi} = \frac{1}{a}\frac{\partial x^*}{\partial\phi} > 0, \tag{A.19}$$

$$\frac{\partial q^*}{\partial a} = \frac{\frac{\partial x^*}{\partial a} - \frac{x^*}{a}}{a} < 0. \tag{A.20}$$

The last result holds when the function $x^*\left(a\right)$ given in (10) is strictly concave in a. But the latter occurs if and only if $\phi < \frac{2p_x}{p_x+\frac{p}{a}}$.

8 Appendix B: Utility also depends on the overnight stays

From equations (1) and (9), assuming a new term $H(q) = hq$, where $h > 0$, we get

$$W(q, x, y) = H(q) + U(x) + V(y) = hq - \alpha\gamma^{\phi} + \alpha(x+\gamma)^{\phi} + \beta y. \tag{B.1}$$

If we keep the other assumptions introduced in the main text unchanged, we can rewrite the optimization problem of equation (4) as follows

$$\max_{\{x,y,\lambda\}} \mathcal{L} = \frac{h}{a}x - \alpha\gamma^{\phi} + \alpha(x+\gamma)^{\phi} + \beta y + \lambda\left(m - \left(p_x + \frac{p}{a}\right)x - y\right). \tag{B.2}$$

Then, solving the first order conditions in closed-form for x^* and q^* we get

$$x^*(p_x, p; \alpha, \beta, \gamma, \phi, a, h) = -\gamma + \left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}} \frac{1}{\left(p_x + \frac{p}{a} - \frac{h}{\beta a}\right)^{\frac{1}{1-\phi}}}, \tag{B.3}$$

$$q^*(p_x, p; \alpha, \beta, \gamma, \phi, a, h) = \frac{x^*}{a} = -\frac{\gamma}{a} + \left(\frac{\phi\alpha}{\beta}\right)^{\frac{1}{1-\phi}} \frac{1}{a\left(p_x + \frac{p}{a} - \frac{h}{\beta a}\right)^{\frac{1}{1-\phi}}}. \tag{B.4}$$

In these equations we observe the positive effect of h on the tourist demands of services and overnight stays. Recall that both demands are directly related, but it is still interesting to see how the foreseeable increase in accommodation leads to an increase in the demand for tourist services. This is a consequence of the mutual interdependence between the two tourism sub-markets.

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